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(72) Inventors:

- **CHIDA, Masahiro**
Tokyo 130-8603 (JP)
- **UMETSU, Toshitaka**
Tokyo 130-8603 (JP)
- **MURAKOSHI, Katsunori**
Tokyo 130-8603 (JP)

(71) Applicant: **Japan Tobacco, Inc.**

Tokyo, 105-6927 (JP)

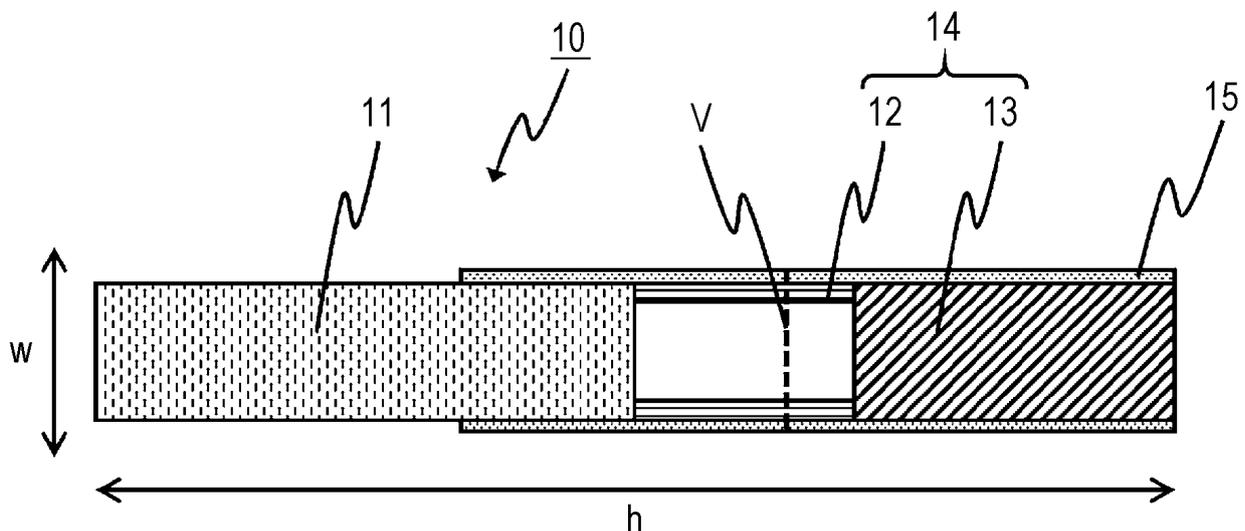
(74) Representative: **Hoffmann Eitle**

Patent- und Rechtsanwälte PartmbB
Arabellastraße 30
81925 München (DE)

(54) **COOLANT FOR HEAT-NOT-BURN TOBACCO, HEAT-NOT-BURN TOBACCO, AND ELECTRICALLY HEATED TOBACCO PRODUCT**

(57) Provided is a coolant for heat-not-burn tobacco, which comprises a polyhydric alcohol and a porous granular base material, wherein the polyhydric alcohol is impregnated into the granular base material.

FIG. 1



EP 4 321 039 A1

Description

Technical Field

5 **[0001]** The present invention relates to a coolant for a non-combustion-heating-type tobacco, a non-combustion-heating-type tobacco, and an electric heating tobacco product.

Background Art

10 **[0002]** Non-combustion-heating-type tobaccos which are inserted into an electric heating device when used have been developed as an alternative to cigarettes (paper-wrapped tobaccos) (Patent Document 1). Non-combustion-heating-type tobaccos commonly include a tobacco rod portion formed by a composition including an inhaling flavor component, such as a shredded tobacco, an aerosol-source material, and the like being wrapped with a wrapping paper, a mouthpiece portion used for inhaling components generated from the tobacco rod portion by heating, and a tipping paper with which the above members are wrapped. When a non-combustion-heating-type tobacco is used, the non-combustion-heating-type tobacco is inserted into or placed in the electric heating device. As a result of at least a part of the tobacco rod portion being heated with the heat source included in the electric heating device instead of combustion, volatile substances are generated from the composition included in the tobacco rod portion. While the volatile substances are delivered from the tobacco rod portion-side to the mouthpiece portion-side by the inhalation of the user, they are cooled in the cooling segment included in the mouthpiece portion to form an aerosol.

15 **[0003]** For example, Patent Document 1 discloses an aerosol-cooling element that includes a plurality of channels extending in the longitudinal direction, the aerosol-cooling element having a porosity of 50% to 90% in the longitudinal direction.

25 Citation List

Patent Documents

30 **[0004]** Patent Document 1: Japanese Unexamined Patent Application Publication (Translation of PCT Application) No. 2015-508676

Summary of Invention

Technical Problem

35 **[0005]** The temperature of smoke generated by a cigarette (paper-wrapped tobacco) may reach 800°C or more. At such high temperatures, the moisture content in smoke is considerably low and it may be difficult for the user to perceive that the smoke has a high temperature.

40 **[0006]** In contrast, the aerosol generated by a non-combustion-heating-type tobacco contains a relatively large amount of moisture. Therefore, it is easy for the user to perceive the temperature of the aerosol compared with cigarettes, although the aerosol has a low temperature than cigarettes.

[0007] For reducing the temperature of the aerosol, for example, a method of reducing the temperature at which heating during use and a method of increasing the length of the path along which the aerosol flows have been conventionally used.

45 **[0008]** The method for reducing the temperature of the aerosol is required to have the following characteristics: the method enables the cooling to be performed in an efficient and safe manner, the method is consistent throughout the period of time from the production of the non-combustion-heating-type tobacco to the termination of use of the non-combustion-heating-type tobacco by the user, the method does not adversely affect the flavor of the aerosol; and the impacts of the method on the production costs are limited. However, it has been difficult to achieve all the above characteristics by the methods known in the related art. There has been room for the improvement of the method.

50 **[0009]** Accordingly, it is an object of the present invention to provide a coolant for a non-combustion-heating-type tobacco which is excellent in terms of efficiency, safety, and stability and which reduces the temperature of the aerosol without adversely affecting the flavor of the aerosol nor increasing the production costs, and a non-combustion-heating-type tobacco and an electric heating tobacco product that include the coolant.

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Solution to Problem

[0010] The inventors of the present invention conducted extensive studies, consequently found that the above object

may be achieved by using a granular base material impregnated with a polyhydric alcohol, and conceived the present invention. The summary of the present invention is as follows.

[0011]

- 5 [1] A coolant for a non-combustion-heating-type tobacco,
- wherein the coolant includes a polyhydric alcohol and a porous granular base material,
the granular base material being impregnated with the polyhydric alcohol.
- 10 [2] The coolant for a non-combustion-heating-type tobacco according to [1], wherein a content of the polyhydric alcohol in the coolant for a non-combustion-heating-type tobacco is 3% by weight or more and 39% by weight or less.
- [3] The coolant for a non-combustion-heating-type tobacco according to [1] or [2], wherein the porous granular base material is one or more selected from the group consisting of charcoal, calcium carbonate, cellulose, acetate, sugar, starch, and chitin.
- 15 [4] The coolant for a non-combustion-heating-type tobacco according to any one of [1] to [3], wherein a volume of pores included in the porous granular base material is 0.3 mL/g or more and 0.8 mL/g or less.
- [5] The coolant for a non-combustion-heating-type tobacco according to any one of [1] to [4], wherein the coolant has an average particle size of 212 μm or more and 600 μm or less.
- [6] The coolant for a non-combustion-heating-type tobacco according to any one of [1] to [5], wherein the coolant has a bulk density of 0.55 g/cm^3 or more and 0.80 g/cm^3 or less.
- 20 [7] A non-combustion-heating-type tobacco including a mouthpiece member including the coolant for a non-combustion-heating-type tobacco according to any one of [1] to [6].
- [8] The non-combustion-heating-type tobacco according to [7], wherein the mouthpiece portion includes a cooling segment, and at least the cooling segment includes the coolant for a non-combustion-heating-type tobacco.
- 25 [9] An electric heating tobacco product including an electric heating device including a heater member, a battery unit serving as a power source for the heater member, and a control unit for controlling the heater member, and the non-combustion-heating-type tobacco according to [7] or [8], the non-combustion-heating-type tobacco being inserted in the electric heating device so as to come into contact with the heater member
- [10] A method for producing a coolant for a non-combustion-heating-type tobacco, the method including:
- 30 a step A of spraying a solution including a polyhydric alcohol to a porous granular base material or adding the solution dropwise to the porous granular base material to prepare granules; and
a step B of drying the granules.
- [11] The method for producing a coolant for a non-combustion-heating-type tobacco according to [10], wherein, in the step A, the solution is sprayed or added dropwise to the porous granular base material to prepare granules while the porous granular base material is caused to flow.

Advantageous Effects of Invention

40 **[0012]** According to the present invention, a coolant for a non-combustion-heating-type tobacco which is excellent in terms of efficiency, safety, and stability and which reduces the temperature of the aerosol without adversely affecting the flavor of the aerosol nor increasing the production costs, and a non-combustion-heating-type tobacco and an electric heating tobacco product that include the coolant can be provided.

Brief Description of Drawings

[0013]

- 50 [Fig. 1] Fig. 1 is a schematic diagram illustrating a non-combustion-heating-type tobacco according to an embodiment of the present invention.
- [Fig. 2] Fig. 2 is a schematic diagram illustrating an electric heating tobacco product according to an embodiment of the present invention.
- [Fig. 3] Fig. 3 is a schematic diagram illustrating an electric heating tobacco product according to an embodiment of the present invention.
- 55 [Fig. 4] Fig. 4 is a diagram illustrating an inhalation port-side end of a region of a cooling segment which is in contact with an electric heating device.
- [Fig. 5] Fig. 5 is a diagram illustrating an inhalation port-side end of a region of a cooling segment which is in contact

with an electric heating device.

[Fig. 6] Fig. 6 is a schematic diagram illustrating a system used for evaluating the cooling effect in Examples.

[Fig. 7] Fig. 7 is a graph illustrating the results of evaluation of the cooling effect in Examples.

5 Description of Embodiments

[0014] Details of embodiments of the present invention are described below. Note that the following description is merely an example (typical example) of the embodiments of the present invention and the present invention is not limited by the contents thereof without departing from the summary thereof.

10 [0015] In the present specification, in the case where a range is expressed using "to" and values or physical properties described before and after "to", it is considered that the range includes the values described before and after "to".

[0016] In the present specification, the term "a plurality of" refers to "two or more" unless otherwise specified.

<Coolant for Non-Combustion-Heating-Type Tobacco>

15 [0017] A coolant for a non-combustion-heating-type tobacco according to an embodiment of the present invention is a coolant for a non-combustion-heating-type tobacco which includes a polyhydric alcohol and a porous granular base material, the granular base material being impregnated with the polyhydric alcohol (hereinafter, this coolant is also referred to simply as "coolant").

20 [0018] A polyhydric alcohol, which is included in the coolant, is a material usually used as a cooling medium for brine freezers in the food manufacture industry. The reasons for which a polyhydric alcohol is used as a cooling medium are that polyhydric alcohols are capable of efficient cooling and excellent in terms of safety because they are substances the toxicity of which is markedly low. Furthermore, polyhydric alcohols have low melting points and commonly exist, in a stable manner, as a liquid consistently at the temperatures at which heating is performed during the use of a non-combustion-heating-type tobacco. Accordingly, the polyhydric alcohol can be held in a stable state throughout the period of time from the production of the non-combustion-heating-type tobacco to the termination of use of the non-combustion-heating-type tobacco by the user. Moreover, since polyhydric alcohols have been used as a humectant for a non-combustion-heating-type tobacco, they do not adversely affect flavor and are not particularly expensive materials. In addition, while a mouthpiece member of the non-combustion-heating-type tobacco which partially includes a hollow cavity or a PLA sheet is likely to have insufficient hardness, the addition of the polyhydric alcohol to the granular base material addresses the hardness issue and consequently improves the feeling of holding the tobacco with which the tobacco is handled during smoking. In addition to the above advantages, in the case where the polyhydric alcohol is added to the granular base material, the methods and facilities for handling granules, such as granular active carbon, which have been nurtured in the development of the non-combustion-heating-type tobacco in the related art can be directly used. This limits an increase in the production costs.

35 [0019] In the method known in the related art in which the temperature at which heating is performed during use is reduced, the consistency with which an aerosol is generated is highly likely to be reduced. In another method known in the related art in which ventilation air is taken in, an inhaling flavor may become weak. In contrast, in the above-described method in which a coolant is used, the above issues do not occur. Thus, the method in which a coolant is used is excellent in terms of cooling efficiency and stability also in this regard. In the method known in the related art in which the length of the path along which the aerosol flows is increased, the costs of production of the non-combustion-heating-type tobacco are increased. In addition, the freedom of design of the non-combustion-heating-type tobacco may be limited disadvantageously. In contrast, in the method in which a coolant is used, the above issues do not occur. Thus, the method in which a coolant is used can limit an increase in the production costs also in this regard.

45 [0020] The coolant includes a polyhydric alcohol and a porous granular base material. The polyhydric alcohol is not limited and may be any alcohol having two or more hydroxyl groups. Any polyhydric alcohols that can be used as a safe food additive may be used. Polyhydric alcohols that do not adversely affect the flavor of the non-combustion-heating-type tobacco are preferable. Specific examples of such polyhydric alcohols include propylene glycol and glycerine.

50 [0021] The boiling point of the polyhydric alcohol is usually, but not limited to, 100°C or more, is preferably 130°C or more, and is more preferably 160°C or more at atmospheric pressure, because the polyhydric alcohol is preferably liquid at 20°C and atmospheric pressure. The above boiling point is usually 340°C or less, is preferably 290°C or less, and is more preferably 240°C or less.

[0022] The content of the polyhydric alcohol in the coolant is usually, but not limited to, 3% by weight or more, is preferably 8% by weight or more, is more preferably 13% by weight or more, and is further preferably 18% by weight or more. The above content is usually 39% by weight or less, is preferably 34% by weight or less, is more preferably 31% by weight or less, and is further preferably 29% by weight or less.

[0023] Bringing the aerosol into contact with the coolant reduces the temperature of the aerosol inhaled by the user by, for example, 4°C or more. In another aspect, the above temperature can be reduced by 9°C or more.

[0024] Moreover, the inhaling flavor may be improved as a result of some of the components included in the aerosol being adsorbed thereon.

[0025] Examples of the porous granular base material include charcoal, calcium carbonate, cellulose, acetate, sugar, starch, and chitin. Charcoal is particularly preferable. Active carbon is further preferable.

[0026] Examples of the active carbon include active carbon materials produced from wood, bamboo, coconut shell, walnut shell, coal, or the like.

[0027] The BET specific surface area of the porous granular base material is usually, but not limited to, 1100 m²/g or more and 1600 m²/g or less, is preferably 1200 m²/g or more and 1500 m²/g or less, and is further preferably 1250 m²/g or more and 1380 m²/g or less. The above BET specific surface area can be determined by a nitrogen adsorption method (multipoint BET method).

[0028] The pore volume of the porous granular base material is usually, but not limited to, 0.3 mL/g or more and 0.8 mL/g or less, is more preferably 0.5 mL/g or more and 0.75 mL/g or less, and is further preferably 0.6 mL/g or more and 0.7 mL/g or less. When the pore volume of the porous granular base material falls within the above range, the intended cooling effect may be readily produced. The above pore volume can be calculated on the basis of the maximum amount of adsorption which is determined by a nitrogen adsorption method.

[0029] The average particle size of the porous granular base material is usually, but not limited to, 200 μm or more and 600 μm or less, is preferably 212 μm or more and 600 μm or less, is more preferably 250 μm or more and 600 μm or less, is further preferably 250 μm or more and 500 μm or less, and is particularly preferably 300 μm or more and 450 μm or less in order to readily produce the intended cooling effect. In the present specification, average particle size is determined by dry sieving (JIS Z 8815-1994). In the present specification, the term "average particle size" refers to the particle size (D50) at which a cumulative volume reaches 50% in a particle size distribution unless otherwise specified.

[0030] The bulk density of the porous granular base material is usually, but not limited to, 0.30 g/cm³ or more and 0.35 g/cm³ or less, is preferably 0.40 g/cm³ or more and 0.70 g/cm³ or less, and is more preferably 0.65 g/cm³ or less and 0.60 g/cm³ or less in order to readily produce the intended cooling effect. The above bulk density can be determined using a powder characteristics tester (e.g., Powder Tester PT-X produced by Hosokawa Micron Corporation).

[0031] The tap density of the porous granular base material is usually, but not limited to, 0.35 g/cm³ or more, 0.40 g/cm³ or more, or 0.45 g/cm³ or more. The above tap density is preferably 0.75 g/cm³ or less and is more preferably 0.70 g/cm³ or less or 0.65 g/cm³ or less in order to readily produce the intended cooling effect. The above tap density can be determined using a powder characteristics tester (e.g., Powder Tester PT-X produced by Hosokawa Micron Corporation).

[0032] The compression rate of the porous granular base material is usually, but not limited to, 1.0% or more and 10.0% or less, is preferably 2.0% or more and 9.0% or less, and is more preferably 3.0% or more and 8.0% or less in order to maintain the intended stability. The above compression rate can be determined using a powder characteristics tester (e.g., Powder Tester PT-X produced by Hosokawa Micron Corporation).

[0033] The angle of repose of the porous granular base material is usually, but not limited to, 20.0° or more and 50.0° or less, is preferably 25.0° or more and 45.0° or less, and is more preferably 30.0° or more and 40.0° or less in order to maintain the intended stability. The above angle of repose can be determined in conformity with the method described in JIS 9301-2-2 using a sample stored at a temperature of 22°C and a relative humidity of 60% for 12 to 24 hours with a repose angle tester (e.g., Powder Tester PT-X produced by Hosokawa Micron Corporation).

[0034] The angle of rupture of the porous granular base material is usually, but not limited to, 5.0° or more and 30.0° or less, is preferably 8.0° or more and 28.0° or less, and is more preferably 10.0° or more and 25.0° or less in order to maintain the intended stability. The above angle of rupture can be determined using a powder characteristics tester (e.g., Powder Tester PT-X produced by Hosokawa Micron Corporation) under the same conditions as in the measurement of the angle of repose.

[0035] The angle of difference of the porous granular base material is usually, but not limited to, 8.0° or more and 30.0° or less, is preferably 10.0° or more and 28.0° or less, and is more preferably 12.0° or more and 25.0° or less in order to maintain the intended stability. The angle of difference can be calculated by subtracting the angle of rupture from the angle of repose.

[0036] The angle of spatula of the porous granular base material is usually, but not limited to, 25.0° or more and 50.0° or less, is preferably 28.0° or more and 48.0° or less, and is more preferably 30.0° or more and 45.0° or less in order to maintain the intended stability. The angle of spatula can be determined using a powder characteristics tester (e.g., Powder Tester PT-X produced by Hosokawa Micron Corporation).

[0037] The uniformity of the porous granular base material is usually, but not limited to, 1.0 or more and 2.0 or less, is preferably 1.1 or more and 1.9 or less, and is more preferably 1.2 or more and 1.8 or less in order to maintain the intended stability. The above uniformity can be determined using a powder characteristics tester (e.g., Powder Tester PT-X produced by Hosokawa Micron Corporation).

[0038] The airflowability index of the porous granular base material is usually, but not limited to, 75.0 or more and 98.0 or less, is preferably 78.0 or more and 95.0 or less, and is more preferably 80.0 or more and 93.0 or less in order to

maintain the intended airflow resistance. The above airflowability index can be determined using a powder characteristics tester (e.g., Powder Tester PT-X produced by Hosokawa Micron Corporation).

5 [0039] The dispersibility of the porous granular base material is usually, but not limited to, 13.0% or more and 30.0% or less, is preferably 15.0% or more and 28.0% or less, and is more preferably 18.0% or more and 25.0% or less in order to maintain the intended stability. The above dispersibility can be determined using a powder characteristics tester (e.g., Powder Tester PT-X produced by Hosokawa Micron Corporation).

10 [0040] The floodability index of the porous granular base material is usually, but not limited to, 65.0 or more and 95.0 or less, is preferably 70.0 or more and 90.0 or less, and is more preferably 75.0 or more and 85.0 or less in order to maintain the intended stability. The above floodability index can be determined using a powder characteristics tester (e.g., Powder Tester PT-X produced by Hosokawa Micron Corporation).

15 [0041] The hardness of the porous granular base material is usually, but not limited to, 95.0% or more and 100.0% or less and is preferably 97.0% or more and 100.0% or less in order to maintain the intended stability. The above hardness can be determined by performing shaking using a shaker (e.g., a rotating and tapping shaker produced by Kyoeisha Chemical Co., Ltd.) in conformity with the method described in JIS K 1474 7.6, with the upper and lower limits of the sieves being 0.500 and 0.250, respectively.

[0042] The coolant may further include water and the like in addition to the polyhydric alcohol and the porous granular base material. The moisture content in the coolant is usually, but not limited to, 18% by weight or less, is preferably 15% by weight or less, and is more preferably 12% by weight or less. It is not necessary to set the lower limit for the above moisture content; the above moisture content may be 0% by weight or more or 0.5% by weight or more.

20 [0043] The average particle size of the coolant is usually, but not limited to, 200 μm or more and 600 μm or less, is preferably 212 μm or more and 600 μm or less, is more preferably 250 μm or more and 600 μm or less, is further preferably 250 μm or more and 500 μm or less, and is particularly preferably 300 μm or more and 450 μm or less in order to readily produce the intended cooling effect. The average particle size of the coolant can be measured as in the measurement of the average particle size of the porous granular base material.

25 [0044] The bulk density of the coolant is usually, but not limited to, 0.55 g/cm^3 or more and 0.80 g/cm^3 or less, is preferably 0.62 g/cm^3 or more and 0.78 g/cm^3 or less, and is further preferably 0.7 g/cm^3 or more and 0.76 g/cm^3 or less in order to readily produce the intended cooling effect. The bulk density of the coolant can be measured as in the measurement of that of the porous granular base material.

30 [0045] The tap density of the coolant is usually, but not limited to, 0.65 g/cm^3 or more and 0.88 g/cm^3 or less, is preferably 0.70 g/cm^3 or more and 0.85 g/cm^3 or less, and is more preferably 0.73 g/cm^3 or more and 0.82 g/cm^3 or less in order to readily produce the intended cooling effect. The tap density of the coolant can be measured as in the measurement of that of the porous granular base material.

35 [0046] The compression rate of the coolant is usually, but not limited to, 1.0% or more and 10.0% or less, is preferably 2.0% or more and 9.0% or less, and is more preferably 3.0% or more and 8.0% or less in order to maintain the intended stability. The compression rate of the coolant can be measured as in the measurement of that of the porous granular base material.

40 [0047] The angle of repose of the coolant is usually, but not limited to, 20.0° or more and 50.0° or less, is preferably 25.0° or more and 45.0° or less, and is more preferably 30.0° or more and 40.0° or less in order to maintain the intended stability. The angle of repose of the coolant can be measured as in the measurement of that of the porous granular base material.

[0048] The angle of rupture of the coolant is usually, but not limited to, 10.0° or more and 35.0° or less, is preferably 13.0° or more and 33.0° or less, and is more preferably 15.0° or more and 30.0° or less in order to maintain the intended stability. The angle of rupture of the coolant can be measured as in the measurement of that of the porous granular base material.

45 [0049] The angle of difference of the coolant is usually, but not limited to, 8.0° or more and 55.0° or less, is preferably 10.0° or more and 53.0° or less, and is more preferably 12.0° or more and 50.0° or less in order to maintain the intended stability. The angle of difference of the coolant can be measured as in the measurement of that of the porous granular base material.

50 [0050] The angle of spatula of the coolant is usually, but not limited to, 25.0° or more and 65.0° or less, is preferably 28.0° or more and 60.0° or less, and is more preferably 30.0° or more and 55.0° or less in order to maintain the intended stability. The angle of spatula of the coolant can be measured as in the measurement of that of the porous granular base material.

55 [0051] The uniformity of the coolant is usually, but not limited to, 1.0 or more and 2.0 or less, is preferably 1.1 or more and 1.9 or less, and is more preferably 1.2 or more and 1.8 or less in order to maintain the intended stability. The uniformity of the coolant can be measured as in the measurement of that of the porous granular base material.

[0052] The airflowability index of the coolant is usually, but not limited to, 75.0 or more and 98.0 or less, is preferably 78.0 or more and 95.0 or less, and is more preferably 80.0 or more and 93.0 or less in order to maintain the intended airflow resistance. The airflowability index of the coolant can be measured as in the measurement of that of the porous

granular base material.

5 **[0053]** The dispersibility of the coolant is usually, but not limited to, 13.0% or more and 30.0% or less, is preferably 15.0% or more and 28.0% or less, and is more preferably 18.0% or more and 25.0% or less in order to maintain the intended stability. The dispersibility of the coolant can be measured as in the measurement of that of the porous granular base material.

[0054] The floodability index of the coolant is usually, but not limited to, 65.0 or more and 95.0 or less, is preferably 70.0 or more and 90.0 or less, and is more preferably 73.0 or more and 83.0 or less in order to maintain the intended stability. The floodability index of the coolant can be measured as in the measurement of that of the porous granular base material.

10 **[0055]** The hardness of the coolant is usually, but not limited to, 95.0% or more and 100.0% or less and is preferably 97.0% or more and 100.0% or less in order to maintain the intended stability. The hardness of the coolant can be measured as in the measurement of that of the porous granular base material.

15 **[0056]** In this embodiment, the granular base material is impregnated with the polyhydric alcohol. In the present specification, the term "impregnate" means that at least part of the polyhydric alcohol is held in pores formed in the porous granular base material. The pores of the porous granular base material, which hold the polyhydric alcohol, may be exposed at the surface of the base material or may be present inside the base material.

20 **[0057]** A method for producing the coolant is not limited and may be a production method including a step A of spraying a solution including the above-described polyhydric alcohol to a porous granular base material or adding the solution dropwise to a porous granular base material to prepare granules and a step B of drying the granules. While the steps A and B may be conducted successively, it is preferable to alternately conduct the step A and the drying step a plurality of times so as to prevent the moisture content in the granules from being increased to an excessive degree. The number of times the steps A and B are conducted is not limited; the steps A and B may be conducted only once and may be repeated until the content of the polyhydric alcohol in the granules reaches an intended value. The method for producing the coolant may further include a production step other than the step A or B.

25 **[0058]** It is preferable that, in the step A, the above solution be sprayed or added dropwise to the porous granular base material to prepare granules while the porous granular base material is caused to flow. A coolant produced by immersing the porous granular base material in the solution and subsequently removing the solution may disadvantageously include lumps having a large particle size. On the other hand, a coolant produced by the above-described steps is unlikely to include lumps having a large particle size, and a coolant the average particle size of which falls within the above range is likely to be produced.

30 **[0059]** The content of the polyhydric alcohol in the solution used in the step A is preferably 25% by weight or more and is more preferably 40% by weight or more; and is usually 75% by weight or less and is preferably 60% by weight or less. The above solution may further include another solvent. Examples of the other solvent include water.

35 **[0060]** The viscosity of the solution is usually, but not limited to, 1.0 mPa·s or more and 9.0 mPa·s or less, is preferably 1.5 mPa·s or more and 6.0 mPa·s or less, and is more preferably 2.5 mPa·s or more and 4.0 mPa·s or less. The viscosity of the solution can be adjusted to fall within the above range by diluting the polyhydric alcohol with the solvent in accordance with the temperature and pressure at which the step A is conducted.

40 **[0061]** The temperature at which the step A is conducted is, for example, room temperature of about 20°C. The above temperature is not limited to this; the step A may be conducted at temperatures at which the polyhydric alcohol and the solvent do not solidify or evaporate. As for pressure, the step A may be conducted at atmospheric pressure. The pressure is not limited to this; the step A may be conducted at pressures at which the polyhydric alcohol and the solvent do not solidify or evaporate.

45 **[0062]** A method for performing drying in the step B is not limited. Examples of the drying method include vacuum drying and hot-air drying. In the case where hot-air drying is prepared, for example, hot air may be blown on the granules prepared in the step A until the moisture content in the granules falls within the above-described range of the moisture content in the coolant.

50 **[0063]** The temperature at which the drying is performed is usually, but not limited to, 30°C or more, is preferably 35°C or more, and is more preferably 40°C or more; and is usually 90°C or less, is preferably 80°C or less, and is more preferably 70°C or less. When the drying is performed, it is preferable to remove the solvent (water) while keeping the polyhydric alcohol in consideration of production consistency. The conditions under which the drying is performed are set appropriately in accordance with the type of the polyhydric alcohol.

55 **[0064]** The drying step is preferably conducted while the granules are caused to flow, in order to perform the drying treatment homogeneously among the granules and all over the surfaces of the granules. In particular, in the case where the steps A and B are alternately conducted, it is preferable to cause the granules to continuously flow while these steps are repeated.

<Non-Combustion-Heating-Type Tobacco>

[0065] Another embodiment of the present invention relates to a non-combustion-heating-type tobacco that includes a mouthpiece portion including the above-described coolant for a non-combustion-heating-type tobacco.

[0066] Fig. 1 illustrates an example of the non-combustion-heating-type tobacco according to the embodiment. The non-combustion-heating-type tobacco is described below with reference to Fig. 1.

[0067] The non-combustion-heating-type tobacco 10 illustrated in Fig. 1 is a rod-shaped non-combustion-heating-type tobacco that includes a tobacco rod portion 11, a mouthpiece portion 14, and a tipping paper 15 wrapped around the above members. The mouthpiece portion 14 includes a cooling segment 12 and a filter segment 13 including a filter element. At least one of the cooling segment 12 and the filter segment 13 includes the coolant according to an embodiment of the present invention. The cooling segment 12 is arranged adjacent to the tobacco rod portion 11 and the filter segment 13 and sandwiched therebetween in the axial direction (also referred to as "longitudinal direction") of the non-combustion-heating-type tobacco 10. Perforations V may be formed concentrically in the cooling segment 12 in the circumferential direction.

[0068] The perforations V, which are formed in the cooling segment 12 of the non-combustion-heating-type tobacco 10 illustrated in Fig. 1, are usually perforations that facilitate the entry of outside air by the inhalation of the user. The entry of air reduces the temperature of the components and air taken in from the tobacco rod portion 11.

[0069] The perforations V, which may be formed in this embodiment, are present at, for example, a position 4 mm or more from the boundary between the cooling segment 12 and the filter segment 13 toward the cooling segment. In such a case, the cooling capacity with which the temperature of the components generated by heating and the air is reduced can be enhanced. In addition, the retention of the above components and the air in the cooling segment can be reduced and, consequently, the amount of the components delivered can be increased.

[0070] Examples of the components generated by heating include a flavor component derived from a flavoring agent, nicotine and tar derived from tobacco leaves, and an aerosol component derived from an aerosol-source material.

[0071] The rod-shaped non-combustion-heating-type tobacco 10 preferably has a pillar-like shape that is a shape having an aspect ratio of 1 or more, the aspect ratio being defined as described below.

$$\text{Aspect ratio} = h/w$$

where w represents the width of the bottom of the pillar-shaped body (in the present specification, the width of the tobacco rod portion-side bottom), and h represents the height of the pillar-shaped body. It is preferable that $h \geq w$. In the present specification, the longitudinal direction is defined as the direction represented by h. Thus, even if $w \geq h$, the direction represented by h is referred to as "longitudinal direction" for the sake of simplicity. The shape of the bottom may be, but not limited to, a polygonal shape, a polygonal shape having rounded corners, a circular shape, an oval shape, or the like. When the bottom has a circular shape, the width w is the diameter of the circle. When the bottom has an oval shape, the width w is the major-axis length of the oval. When the bottom has a polygonal shape or a polygonal shape having rounded corners, the width w is the diameter of the circle circumscribing the polygon or the major-axis length of the oval circumscribing the polygon.

[0072] The length h of the non-combustion-heating-type tobacco 10 in the longitudinal direction is not limited. The length h is, for example, usually 40 mm or more, is preferably 45 mm or more, and is more preferably 50 mm or more. The length h is usually 100 mm or less, is preferably 90 mm or less, and is more preferably 80 mm or less.

[0073] The width w of the bottom of the pillar-shaped body of the non-combustion-heating-type tobacco 10 is not limited. The width w is, for example, usually 5 mm or more and is preferably 5.5 mm or more. The width w is usually 10 mm or less, is preferably 9 mm or less, and is more preferably 8 mm or less.

[0074] The airflow resistance of the non-combustion-heating-type tobacco 10 per stick in the longitudinal direction is not limited. In consideration of ease of smoking, the above airflow resistance is usually 8 mmH₂O or more, is preferably 10 mmH₂O or more, and is more preferably 12 mmH₂O or more, and is usually 100 mmH₂O or less, is preferably 80 mmH₂O or less, and is more preferably 60 mmH₂O or less.

[0075] The above airflow resistance is measured in conformity with an ISO standard method (ISO6565:2015) using, for example, a filter airflow resistance gage produced by Cerulean. The airflow resistance is the difference in the air pressure between one of the edge surfaces (first edge surface) of the non-combustion-heating-type tobacco 10 and the other edge surface (second edge surface) which occurs when air is passed through the non-combustion-heating-type tobacco 10 in the direction from the first to second edge surface at a predetermined air flow rate (17.5 cc/min) while the permeation of air through the side surfaces of the non-combustion-heating-type tobacco 10 is blocked. The airflow resistance is commonly expressed in units of mmH₂O. It is known that the airflow resistance is proportional to the length of the non-combustion-heating-type tobacco when the length of the non-combustion-heating-type tobacco falls within a common range (length: 5 to 200 mm); if the length of the non-combustion-heating-type tobacco doubles, the airflow

resistance of the non-combustion-heating-type tobacco doubles.

[Mouthpiece Portion]

5 **[0076]** The structure of the mouthpiece portion 14 is not limited and may be any structure that includes the filter segment 13 including a filter element. The mouthpiece portion 14 may be composed only of the filter segment 13. The mouthpiece portion 14 may include the cooling segment 12 and the filter segment 13 including a filter element such that the cooling segment 12 is arranged adjacent to the tobacco rod portion 11 and the filter segment 13 and sandwiched therebetween in the axial direction of the non-combustion-heating-type tobacco 10. In the case where the mouthpiece portion 14 is constituted only by the filter segment 13, the coolant is included in the filter segment 13. In the case where the mouthpiece portion 14 is constituted by the filter segment 13 and the cooling segment 12, the coolant may be included at least one of the filter segment 13 and the cooling segment 12. In particular, in order to enhance the cooling effect, it is preferable that the mouthpiece portion 14 include the cooling segment 12 and at least the cooling segment 12 include the coolant, and it is more preferable that both filter segment 13 and cooling segment 12 include the coolant.

15 **[0077]** The proportions of the lengths of the cooling segment 12 and the filter segment 13 to the length of the mouthpiece portion 14 in the longitudinal direction (cooling segment filter segment) are usually, but not limited to, 0.60 to 1.40:0.60 to 1.40, are preferably 0.80 to 1.20:0.80 to 1.20, are more preferably 0.85 to 1.15:0.85 to 1.15, are further preferably 0.90 to 1.10:0.90 to 1.10, and are particularly preferably 0.95 to 1.05:0.95 to 1.05 in consideration of the amount of the flavoring agent delivered and an adequate aerosol concentration. In particular, when the length of the cooling segment 20 12 is increased, the formation of aerosol particles and the like is facilitated and, consequently, a suitable flavor can be achieved. However, if the length of the cooling segment 12 is excessively increased, the substance that passes there-through may adhere on the inner wall disadvantageously.

[0078] When the above ratio between the lengths of the cooling segment 12 and the filter segment 13 falls within the above range, the cooling effect, the effect of reducing loss due to the adhesion of the generated vapor and aerosol on the inner wall of the cooling segment 12, and the function of the filter to adjust the amounts of air and flavor can be all 25 achieved in a balanced manner and a suitable flavor can be achieved.

[0079] Details of the filter segment and the cooling segment are described below.

(Filter Segment)

30 **[0080]** The filter segment 13 is not limited and may be any filter segment that has common filter functions. For example, a tow formed of synthetic fibers (also referred to simply as "tow") and a material such as paper which is formed in a cylindrical shape can be used. Examples of the common filter functions include a function of adjusting the amount of air that enters upon the inhalation of an aerosol or the like, a function of reducing a flavor, and a function of reducing nicotine and tar. However, the filter segment does not necessarily have all of the above functions. Furthermore, for electric heating tobacco products, which generate a smaller amount of components than paper-wrapped tobacco products and the filling ratio of a tobacco filler is low compared with paper-wrapped tobacco products, a function of suppressing the filtration function and preventing detachment of the tobacco filler is one of the important functions.

35 **[0081]** In this embodiment, the filter segment may include the coolant according to an embodiment of the present invention.

[0082] The proportion of the coolant in the entire filter segment is usually, but not limited to, 5% by volume or more, is preferably 10% by volume or more, and is more preferably 15% by volume or more; and is usually 100% by volume or less and is preferably 90% by volume or less.

40 **[0083]** A method for adding the cooling material according to an embodiment of the present invention to the filter segment 13 is not limited. For example, the coolant may be dispersed in the material, such as tow or paper made of a synthetic fiber, before the material is formed into a cylindrical body. Alternatively, subsequent to the treatment in which the material is formed into a cylindrical body and prior to the wrapping treatment, the coolant may be added to the inside of the cylinder composed of tow, paper, or the like. In another case, the coolant may be held inside the cylinder.

[0084] The shape of the filter segment 13 is not limited; publicly known shapes may be used. The filter segment 13 usually has a cylindrical shape. The filter segment 13 may have the following structure.

45 **[0085]** The filter segment 13 may have a section in which a cavity (e.g., center hole) is formed such that a cross section of the filter segment 13 which is taken in the circumferential direction is hollow or in which a recess or the like is formed.

[0086] The shape of cross section of the filter segment 13 which is taken in the circumferential direction is substantially circular. The diameter of the circle can be changed appropriately in accordance with the size of the product. The diameter of the circle is usually 4.0 mm or more and 9.0 mm or less, is preferably 4.5 mm or more and 8.5 mm or less, and is more preferably 5.0 mm or more and 8.0 mm or less. In the case where the above cross section is not circular, the above diameter is the diameter of a virtual circle having the same area as the cross section.

50 **[0087]** The perimeter of the shape of a cross section of the filter segment 13 which is taken in the circumferential

direction can be changed appropriately in accordance with the size of the product. The above perimeter is usually 14.0 mm or more and 27.0 mm or less, is preferably 15.0 mm or more and 26.0 mm or less, and is more preferably 16.0 mm or more and 25.0 mm or less.

5 **[0088]** The length of the filter segment 13 in the axial direction can be changed appropriately in accordance with the size of the product. The above length is usually 15 mm or more and 35 mm or less, is preferably 17.5 mm or more and 32.5 mm or less, and is more preferably 20.0 mm or more and 30.0 mm or less.

[0089] The airflow resistance of the filter segment 13 in the axial direction per length of 120 mm is not limited. The above airflow resistance is usually 40 mmH₂O or more and 300 mmH₂O or less, is preferably 70 mmH₂O or more and 280 mmH₂O or less, and is more preferably 90 mmH₂O or more and 260 mmH₂O or less.

10 **[0090]** The above airflow resistance is measured in conformity with an ISO standard method (ISO6565) using, for example, a filter airflow resistance gage produced by Cerulean. The airflow resistance of the filter segment 13 is the difference in the air pressure between one of the edge surfaces (first edge surface) of the filter segment 13 and the other edge surface (second edge surface) which occurs when air is passed through the filter segment 13 in the direction from the first to second edge surface at a predetermined air flow rate (17.5 cc/min) while the permeation of air through the side surfaces of the filter segment 13 is blocked. The airflow resistance is commonly expressed in units of mmH₂O. It is known that the airflow resistance of the filter segment 13 is proportional to the length of the filter segment 13 when the length of the filter segment 13 falls within a common range (length: 5 to 200 mm); if the length of the filter segment 13 doubles, the airflow resistance of the filter segment 13 doubles.

15 **[0091]** The structure of the filter segment 13 is not limited. The filter segment 13 may be, for example, a plain filter including a single filter segment or a multi-segment filter including a plurality of filter segments, such as a dual filter or a triple filter. In the case where the filter segment 13 is a multi-segment filter, the filter segment 13 may include a filter segment that includes the coolant according to an embodiment of the present invention and a filter segment that does not include the coolant. In such a case, the filter segment including the coolant may be interposed between the filter segment that does not include the coolant and the cooling segment. Alternatively, the filter segment that does not include the coolant may be interposed between the filter segment including the coolant and the cooling segment. It is preferable that the filter segment including the coolant be interposed between the filter segment that does not include the coolant and the cooling segment in order to readily adjust the cooling effect of the coolant.

20 **[0092]** The density of the filter element constituting the filter segment 13 is usually, but not limited to, 0.10 g/cm³ or more and 0.25 g/cm³ or less, is preferably 0.11 g/cm³ or more and 0.24 g/cm³ or less, and is more preferably 0.12 g/cm³ or more and 0.23 g/cm³ or less.

25 **[0093]** The filter element included in the filter segment 13 is not limited; publicly known filter elements may be used. Examples thereof include a filter element produced by forming cellulose acetate tow into a cylindrical shape. The filament denier and total denier of the cellulose acetate tow are not limited. In the case where the mouthpiece member has a perimeter of 22 mm, it is preferable that the filament denier be 5 g/9000 m or more and 12 g/9000 m or less and the total denier be 12000 g/9000 m or more and 35000 g/9000 m or less. Examples of the cross-sectional shape of fibers of the cellulose acetate tow include circular, oval, Y-shaped, 1-shaped, and R-shaped. In the case where the filter is filled with cellulose acetate tow, triacetin may be added to the filter in an amount that is 5% by weight or more and 10% by weight or less of the weight of the cellulose acetate tow, in order to increase the hardness of the filter. Instead of the above acetate filter, a paper filter filled with sheet-like pulp paper may also be used.

30 **[0094]** The filter segment 13 can be produced by a publicly known method. For example, in the case where a synthetic fiber, such as cellulose acetate tow, is used as a material for the filter element, the filter segment 13 can be produced by spinning a polymer solution including a polymer and a solvent into thread and crimping the thread. Examples of the above method include the method described in International Publication No. 2013/067511.

35 **[0095]** The filter element may include a crushable additive release container (e.g., a capsule) that includes a crushable shell composed of gelatin or the like. The capsule (also referred to as "additive release container" in the technical field) is not limited; publicly known capsules may be employed. For example, the capsule may be a crushable additive release container that includes a crushable shell composed of gelatin or the like. In such a case, when the capsule is broken before, while, or after the user uses the tobacco product, the capsule releases a liquid or substance (usually, a flavor agent) included in the capsule. The liquid or substance is transferred to tobacco smoke during the use of the tobacco product and then transferred to the ambient environment after the use.

40 **[0096]** The form of the capsule is not limited. The capsule may be, for example, an easy-to-crush capsule. The shape of the capsule is preferably spherical. The capsule may include the optional additives described above and particularly preferably include a flavor agent and active carbon. One or more materials that assist the filtration of smoke may be used as an additive. The form of the additive is usually, but not limited to, liquid or solid Note that the use of a capsule including an additive is known in the technical field. An easy-to-crush capsule and the method for producing such a capsule are known in the technical field.

45 **[0097]** Examples of the flavor agent include menthol, spearmint, peppermint, fenugreek, clove, and medium-chain triglyceride (MCT). The flavor agent is menthol or may be menthol or the like or a combination thereof.

[0098] In order to increase strength and structural stiffness, the filter segment 13 may include a filter wrapper (filter plug wrapper) with which the above-described materials constituting the filter are wrapped. The filter wrapper is not limited and may include one or more seams including an adhesive. The adhesive may include a hot-melt adhesive. The hot-melt adhesive may include polyvinyl alcohol. In the case where the filter is constituted by two or more segments, it is preferable that the two or more segments be collectively wrapped with the filter wrapper.

[0099] The material constituting the filter wrapper is not limited; publicly known materials may be used. The filter wrapper may include a filler, such as calcium carbonate.

[0100] The thickness of the filter wrapper is usually, but not limited to, 20 μm or more and 140 μm or less, is preferably 30 μm or more and 130 μm or less, and is more preferably 30 μm or more and 120 μm or less.

[0101] The basis weight of the filter wrapper is usually, but not limited to, 20 gsm or more and 100 gsm or less, is preferably 22 gsm or more and 95 gsm or less, and is more preferably 23 gsm or more and 90 gsm or less.

[0102] The filter wrapper may be coated and is not necessarily coated. In order to impart functions other than strength or structural stiffness, it is preferable to coat the filter wrapper with an intended material.

[0103] The filter segment 13 may further include a center hole segment having one or a plurality of hollow portions. The center hole segment is usually arranged closer to the cooling segment than the filter element and is preferably arranged adjacent to the cooling segment.

[0104] The center hole segment is constituted by a packed layer having one or a plurality of hollow portions and an inner plug wrapper (inner wrapping paper) wrapped around the packed layer. For example, the center hole segment is constituted by a packed layer having a hollow portion and an inner plug wrapper wrapped around the packed layer. The center hole segment increases the strength of the mouthpiece portion. The packed layer is, for example, a rod having an inside diameter ϕ of 1.0 mm or more and 5.0 mm or less which is filled with cellulose acetate fibers at a high density and cured with a plasticizer including triacetin, the plasticizer being added in an amount that is 6% by mass or more and 20% by mass or less of the mass of the cellulose acetate. Since the pack density of fibers in the packed layer is high, during inhalation, air and aerosols flow only through the hollow portion and hardly flow inside the packed layer. Since the packed layer present inside the center hole segment is a fiber-packed layer, the user seldom feel a sense of incongruity when touching the outside of the product during use. The center hole segment does not necessarily include the inner plug wrapper. In such a case, the shape of the product may be maintained by thermoforming.

[0105] The center hole segment and the filter element may be connected to each other with an outer plug wrapper (outer wrapping paper) or the like. The outer plug wrapper can be, for example, a cylindrical paper. The tobacco rod portion 11, the cooling segment 12, and the center hole segment and the filter element connected to each other may be connected to one another with, for example, a mouthpiece lining paper. The above connection can be achieved by, for example, applying a vinyl acetate-based paste or the like onto the inner surface of the mouthpiece lining paper, placing the tobacco rod portion 11, the cooling segment 12, and the center hole segment and the filter element connected to each other on the mouthpiece lining paper, and rolling the mouthpiece lining paper. Note that the above members may be connected to one another using a plurality of lining papers in a plurality of stages.

(Cooling Segment)

[0106] The cooling segment 12 is arranged adjacent to the tobacco rod portion and the filter segment and sandwiched therebetween. The cooling segment 12 is typically a rod-shaped member having a cavity formed therein such that a cross section taken in the circumferential direction is hollow, such as a cylinder.

[0107] The cooling segment according to this embodiment may be a cooling segment that includes the coolant according to an embodiment of the present invention which is charged in the cavity.

[0108] In this embodiment, the method for charging the coolant into the cooling segment is not limited. For example, the coolant formed into the intended shape may be directly used as a cooling segment. In another case, the coolant wrapped with a filter wrapper or the like that can be used for filter segments may be used as a cooling segment. The coolant according to an embodiment of the present invention may be present homogeneously all over the entire cooling segment or accumulated at a part of the cooling segment. Specific examples of the mode in which the coolant is accumulated at a part of the cooling segment include a mode in which the coolant is accumulated at the tobacco rod portion-side or filter segment-side part of the cooling segment and a mode in which the coolant is accumulated at a peripheral part of a cross section of the cooling segment which is perpendicular to the longitudinal direction. It is preferable that no gap be present between the coolant and the other material, such as a filter wrapper, in the cross section of the cooling segment which is perpendicular to the longitudinal direction.

[0109] The proportion of the coolant in the entire cooling segment is usually, but not limited to, 5% by volume or more, is preferably 10% by volume or more, and is more preferably 15% by volume or more in order to enhance the cooling efficiency. The above proportion is usually 100% by volume or less and is preferably 90% by volume or less.

[0110] The cooling segment 12 may have perforations V (in the technical field, also referred to as "ventilation filter (Vf)") formed concentrically therein in the circumferential direction as illustrated in Fig. 1. The number of the perforations

V may be, for example, but not limited to, eight. The perforations may be present at a position 4 mm or more from the boundary between the cooling segment and the filter segment toward the cooling segment.

[0111] The presence of the perforations V allows outside air to enter the inside of the cooling portion during use and thereby reduces the temperature of components and air that enter from the tobacco rod portion. Furthermore, arranging the cooling segment at a position 4 mm or more from the boundary between the cooling segment and the filter segment toward the cooling segment enhances the cooling capacity and also reduces the likelihood of the components generated by heating being retained inside the cooling segment.

This increases the amount of the components delivered

[0112] In the case where the tobacco rod portion includes an aerosol-source material, a vapor containing an aerosol-source material and a tobacco flavor component which are generated upon heating of the tobacco rod portion comes into contact with outside air and the temperature of the vapor is reduced. Thus, the vapor becomes liquefied and the generation of aerosol can be facilitated.

[0113] In the case where the perforations V arranged concentrically are considered as one perforation group, the number of the perforation groups may be one or two or more. In the case where two or more perforation groups are present, it is preferable that the perforation groups be not arranged at a position less than 4 mm from the boundary between the cooling segment and the filter segment toward the cooling segment in order to increase the amount of the delivered components generated by heating.

[0114] In the case where the non-combustion-heating-type tobacco 10 includes the tobacco rod portion 11, the cooling segment 12, the filter segment 13, and the tipping paper 15 wrapped around the above members, it is preferable that the tipping paper 15 have perforations formed therein at positions directly above the perforations V formed in the cooling segment 12. In the case where such a non-combustion-heating-type tobacco 10 is prepared, wrapping may be performed using a tipping paper 15 having perforations arranged to overlap the perforations V. However, in consideration of ease of production, it is preferable to form perforations that penetrate both cooling segment 12 and tipping paper 15 after the non-combustion-heating-type tobacco 10 has been prepared using a cooling segment 12 that does not have the perforations V.

[0115] The region in which the perforations V are present is not limited. In order to enhance the delivery of the components generated by heating, the perforations V are formed at a position 2 mm or more from the boundary between the cooling segment 12 and the filter segment 13 toward the cooling segment. In order to further enhance the delivery of the above components, the above distance is preferably 3 mm or more, is preferably 4 mm or more, is more preferably 5 mm or more, and is further preferably 5.5 mm or more. In order to maintain the cooling function, the above distance is preferably 15 mm or less, is more preferably 10 mm or less, and is further preferably 6 mm or less.

[0116] In order to enhance the delivery of the components generated by heating, the perforations V are preferably present at a position 22 mm or more from the inhalation end of the non-combustion-heating-type tobacco toward the cooling segment. The above distance is preferably 23 mm or more, is preferably 24 mm or more, is more preferably 25 mm or more, and is further preferably 25.5 mm or more. In order to maintain the cooling function, the above distance is preferably 35 mm or less, is more preferably 30 mm or less, and is further preferably 26 mm or less.

[0117] When the boundary between the cooling segment 12 and the tobacco rod portion 11 is used as a reference, in the case where the length of the cooling segment 12 in the axial direction is 20 mm or more, in order to maintain the cooling function, the perforations V are preferably present at a position 2 mm or more from the boundary between the cooling segment 12 and the tobacco rod portion 11 toward the cooling segment. The above distance is more preferably 5 mm or more, is further preferably 10 mm or more, and is particularly preferably 14.5 mm or more. In order to enhance the delivery of the components generated by heating, the above distance is preferably 18 mm or less, is more preferably 16 mm or less, and is further preferably 14.5 mm or less.

[0118] The diameter of the perforations V is preferably, but not limited to, 100 μm or more and 1000 μm or less and is more preferably 300 μm or more and 800 μm or less. The perforations are preferably substantially circular or substantially oval. In the case where the perforations are substantially oval, the major-axis length of the perforations is considered as diameter of the perforations.

[0119] The length of the cooling segment in the longitudinal direction may be changed appropriately in accordance with the size of the product. The above length is usually 4 mm or more, is preferably 5 mm or more, and is more preferably 26 mm or more. The above length is usually 31 mm or less, is preferably 26 mm or less, and is more preferably 21 mm or less. Setting the length of the cooling segment in the longitudinal direction to be equal to or more than the above lower limit enables a sufficiently high cooling effect to be maintained and allows a suitable flavor to be produced. Setting the above length to be equal to or less than the above upper limit reduces the loss of the generated vapor and aerosol which may be caused as a result of the vapor and aerosol adhering on the inner wall of the cooling segment.

[Tobacco Rod Portion]

[0120] The structure of the tobacco rod portion 11 is not limited and may be any publicly known structure. The tobacco rod portion 11 usually includes a tobacco filler and a wrapping paper with which the tobacco filler is wrapped. The tobacco filler is not limited; publicly known tobacco fillers, such as shredded tobacco and reconstructed tobacco sheets, may be used. The tobacco filler may include an aerosol-source material. An aerosol-source material is a material that generates an aerosol upon being heated. Examples of the aerosol-source material include glycerine, propylene glycol, triacetin, 1,3-butanediol, and mixtures thereof.

[0121] The content of the aerosol-source material in the tobacco filler is not limited. In order to generate aerosol in a sufficient manner and impart a good flavor, the above content is usually 5% by weight or more and is preferably 10% by weight or more; and is usually 50% by weight or less and is preferably 15% by weight or more and 25% by weight or less of the total amount of the tobacco filler.

[0122] The tobacco rod portion 11 may have a fitting portion to which, for example, a heater member used for heating the non-combustion-heating-type tobacco can be fit.

[0123] The tobacco rod portion 11, which includes a tobacco filler and a wrapping paper with which the tobacco filler is wrapped, preferably has a pillar-like shape. In this case, the aspect ratio that is the ratio of the height of the tobacco rod portion 11 in the longitudinal direction to the width of the bottom of the tobacco rod portion 11 is preferably 1 or more.

[0124] The shape of the bottom may be, but not limited to, a polygonal shape, a polygonal shape having rounded corners, a circular shape, or an oval shape. When the bottom has a circular shape, the above width is the diameter of the circle. When the bottom has an oval shape, the width is the major-axis length of the oval. When the bottom has a polygonal shape or a polygonal shape having rounded corners, the width is the diameter of the circle circumscribing the polygon or the major-axis length of the oval circumscribing the polygon. The height of the tobacco filler constituting the tobacco rod portion 11 is preferably about 10 to 70 mm. The width of the tobacco filler is preferably about 4 to 9 mm.

[0125] The length of the tobacco rod portion 11 in the longitudinal direction may be changed appropriately in accordance with the size of the product. The above length is usually 10 mm or more, is preferably 12 mm or more, is more preferably 15 mm or more, and is further preferably 18 mm or more. The above length is usually 70 mm or less, is preferably 50 mm or less, is more preferably 30 mm or less, and is further preferably 25 mm or less. In consideration of the balance between the amount of delivery and aerosol temperature, the proportion of the length of the tobacco rod portion 11 to the length h of the non-combustion-heating-type tobacco 10 in the longitudinal direction is usually 10% or more, is preferably 20% or more, is more preferably 25% or more, and is further preferably 30% or more. The above proportion is usually 60% or less, is preferably 50% or less, is more preferably 45% or less, and is further preferably 40% or less.

(Wrapping Paper)

[0126] The wrapping paper is not limited, and a common wrapping paper may be employed. Examples of the wrapping paper include a wrapping paper that includes pulp as a principal component. The wrapping paper may be a wrapping paper made of a wood pulp, such as a conifer wood pulp or a broadleaf wood pulp, or a wrapping paper made of pulp mixture further including a nonwood pulp commonly used for producing wrapping paper for tobacco products, such as a flax pulp, a cannabis pulp, a sisal hemp pulp, or an esparto pulp.

[0127] Examples of the pulp that can be used include a chemical pulp, a ground pulp, a chemiground pulp, or a thermomechanical pulp, which are produced by kraft cooking, acidic, neutral, or alkaline sulfite cooking, sodium salt cooking, or the like.

[0128] A wrapping paper is produced with a fourdrinier paper machine, a cylinder paper machine, a cylinder-tanmo hybrid paper machine, or the like using the pulp. In the papermaking step, the formation is arranged and homogenization is performed. As needed, a wet strength agent may be added to impart water resistance to the wrapping paper. In another case, a sizing agent may be added to adjust the manner in which printing is performed on the wrapping paper. Furthermore, aluminum sulfate, various anionic, cationic, nonionic, and zwitterionic internal agents for papermaking, such as a yield improver, a freeness improver, and a strength agent, and papermaking additives, such as a dye, a pH-controlling agent, an antifoaming agent, a pitch-controlling agent, and a slime-controlling agent, can also be added.

[0129] The basis weight of the base paper for the wrapping paper is, for example, usually 20 gsm or more and is preferably 25 gsm or more. The above basis weight is usually 65 gsm or less, is preferably 50 gsm or less, and is further preferably 45 gsm or less.

[0130] The thickness of the wrapping paper having the above properties is not limited. In consideration of stiffness, air permeability, and ease of control during papermaking, the above thickness is usually 10 μm or more, is preferably 20 μm or more, and is more preferably 30 μm or more. The above thickness is usually 100 μm or less, is preferably 75 μm or less, and is more preferably 50 μm or less.

[0131] Examples of the shape of the wrapping paper included in the non-combustion-heating-type tobacco include square and rectangular.

[0132] In the case where the wrapping paper is used for wrapping the tobacco filler (for preparing the tobacco rod portion), the length of a side of the wrapping paper is, for example, about 12 to 70 mm. The length of the other side is, for example, 15 to 28 mm, is preferably 22 to 24 mm, and is further preferably about 23 mm. When the tobacco filler is wrapped with the wrapping paper to form a pillar-shaped body, for example, an edge portion of the wrapping paper which extends about 2 mm from one of the edges of the wrapping paper in the w-direction is bonded to the other edge portion with a glue such that they overlap each other. As a result, the wrapping paper is formed into a pillar-shaped paper tube, in which the tobacco filler is filled. The size of the rectangular wrapping paper can be determined in accordance with the size of the final tobacco rod portion 11.

[0133] In the case where the wrapping paper is wrapped around the tobacco rod portion 11 and another member arranged adjacent to the tobacco rod portion 11 such that they are connected to each other like a tipping paper, the length of a side of the wrapping paper is, for example, 20 to 60 mm. The length of the other side is, for example, 15 to 28 mm.

[0134] The wrapping paper may include a filler in addition to the above pulp. The content of the filler is, for example, 10% by weight or more and less than 60% by weight and is preferably 15% by weight or more and 45% by weight or less of the total weight of the wrapping paper.

[0135] The content of the filler in the wrapping paper is preferably 15% by weight or more and 45% by weight or less when the basis weight falls within the preferable range (25 gsm or more and 45 gsm or less).

[0136] When the basis weight is 25 gsm or more and 35 gsm or less, the above filler content is preferably 15% by weight or more and 45% by weight or less. When the basis weight is more than 35 gsm and 45 gsm or less, the above filler content is preferably 25% by weight or more and 45% by weight or less.

[0137] Examples of the filler include calcium carbonate, titanium dioxide, and kaolin. For example, in order to enhance a flavor and brightness, calcium carbonate is preferably used.

[0138] Various agents may be added to the wrapping paper in addition to the base paper and the filler. For example, a water resistance improver may be added in order to enhance water resistance. Examples of the water resistance improver include a wet strength agent (WS agent) and a sizing agent. Examples of the wet strength agent include a urea formaldehyde resin, a melamine formaldehyde resin, and polyamide epichlorohydrin (PAE). Examples of the sizing agent include a rosin soap, alkyl ketene dimer (AKD), alkenylsuccinic anhydride (ASA), and highly saponified polyvinyl alcohol having a degree of saponification of 90% or more.

[0139] A strength agent may be added as an agent. Examples of the strength agent include polyacrylamide, a cationic starch, an oxidized starch, CMC, a polyamide epichlorohydrin resin, and polyvinyl alcohol. In particular, it is known that the use of a trace amount of oxidized starch enhances air permeability (Japanese Unexamined Patent Application Publication No. 2017-218699).

[0140] The wrapping paper may be coated as needed.

[0141] A coating agent may be applied onto at least one of the two surfaces, that is, the front and rear surfaces, of the wrapping paper. The coating agent is not limited. It is preferable to use a coating agent capable of forming a film on the surface of the paper and thereby reducing the permeability of the paper to liquids. Examples thereof include alginic acid and salts thereof (e.g., sodium salt), polysaccharides, such as pectin, cellulose derivatives, such as ethyl cellulose, methyl cellulose, carboxymethyl cellulose, and nitro cellulose, and starch and derivatives thereof (e.g., ether derivatives, such as a carboxymethyl starch, a hydroxyalkyl starch, and a cationic starch, and ester derivatives, such as starch acetate, starch phosphate, and starch octenylsuccinate).

[Tipping Paper]

[0142] The tipping paper 15 is not limited and may be a common one, such as paper including pulp as a principal component. The paper may be paper made of a wood pulp, such as a conifer wood pulp or a broadleaf wood pulp, or paper made of pulp mixture further including nonwood pulp commonly used for producing wrapping paper for tobacco items, such as a flax pulp, a cannabis pulp, a sisal hemp pulp, or an esparto pulp. The above pulp materials may be used alone. Alternatively, a plurality of types of pulp materials may be used in combination at any ratio.

[0143] The tipping paper 15 may be constituted by one sheet or a plurality of sheets.

[0144] Examples of the pulp materials that can be used include a chemical pulp, a ground pulp, a chemiground pulp, and a thermomechanical pulp, which are produced by kraft cooking, acidic, neutral, or alkaline sulfite cooking, sodium salt cooking, or the like.

[0145] The tipping paper 15 may be either a tipping paper produced by the production method described below or a commercial tipping paper.

[0146] The shape of the tipping paper 15 is not limited. The tipping paper 15 may be, for example, square or rectangle.

[0147] The basis weight of the tipping paper 15 is usually, but not limited to, 32 gsm or more and 40 gsm or less, is preferably 33 gsm or more and 39 gsm or less, and is more preferably 34 gsm or more and 38 gsm or less.

[0148] The thickness of the tipping paper 15 is usually, but not limited to, 20 μm or more and 140 μm or less, is preferably 30 μm or more and 130 μm or less, and is more preferably 30 μm or more and 120 μm or less.

[0149] The air permeability of the tipping paper 15 is usually, but not limited to, 0 CORESTA unit or more and 30000 CORESTA unit or less and is preferably more than 0 CORESTA unit and 10000 CORESTA unit or less. In the present specification, the term "air permeability" refers to a value measured in conformity with ISO 2965:2009. Air permeability is expressed as an amount (cm³) of gas that passes through an area of 1 cm² per minute when a pressure difference between the surfaces of the paper is 1 kPa. Note that 1 CORESTA unit (1 C.U.) is cm³/(min·cm²) at 1 kPa.

[0150] The tipping paper 15 may contain a filler in addition to the above pulp. Examples thereof 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, quartz, kaolin, talc, diatomaceous earth, and gypsum. In order to enhance brightness and opacity and increase heating rate, it is particularly preferable that tipping paper 15 include calcium carbonate. The above fillers may be used alone or in combination of two or more.

[0151] Various agents may be added to the tipping paper 15 in addition to the above pulp and the above filler. For example, the tipping paper 15 may include a water resistance improver in order to enhance. Examples of the water resistance improver include a wet strength agent (WS agent) and a sizing agent. Examples of the wet strength agent include a urea formaldehyde resin, a melamine formaldehyde resin, and polyamide epichlorohydrin (PAE). Examples of the sizing agent include a rosin soap, an alkyl ketene dimer (AKD), alkenylsuccinic anhydride (ASA), and highly saponified polyvinyl alcohol having a degree of saponification of 90% or more.

[0152] A coating agent may be added onto at least one of the front and rear surfaces of the tipping paper 15. The coating agent is not limited and is preferably a coating agent with which a film can be formed on the surface of the paper and which thereby reduces liquid permeability.

[Method for Producing Non-Combustion-Heating-Type Tobacco]

[0153] The method for producing the above-described non-combustion-heating-type tobacco is not limited; publicly known methods may be used. For example, the non-combustion-heating-type tobacco can be produced by wrapping the tipping paper around the tobacco rod portion and the mouthpiece portion.

<Electric Heating Tobacco Product>

[0154] An electric heating tobacco product according to another embodiment of the present invention (also referred to simply as "electric heating tobacco product") is an electric heating tobacco product constituted by an electric heating device including a heater member, a battery unit that serves as a power source for the heater member, and a control unit that controls the heater member and the above-described non-combustion-heating-type tobacco inserted in the electric heating device so as to come into contact with the heater member.

[0155] The electric heating tobacco product may be an electric heating tobacco product that heats the outer circumferential surface of the non-combustion-heating-type tobacco 10 as illustrated in Fig. 2 or an electric heating tobacco product that heats the inside of the tobacco rod portion 11 of the non-combustion-heating-type tobacco 10 as illustrated in Fig. 3. Note that, although air introduction holes are formed in the electric heating devices 20 illustrated in Figs. 2 and 3, they are not illustrated in the drawings. An electric heating tobacco product 30 is described below with reference to Fig. 3. In the non-combustion-heating-type tobacco 10 illustrated in Figs. 2 and 3, reference numerals that denote the components illustrated in Fig. 1 are partially omitted.

[0156] When an electric heating tobacco product 30 is used, the above-described non-combustion-heating-type tobacco 10 is inserted into an electric heating device 20 so as to come into contact with a heater member 21 disposed in the electric heating device 20.

[0157] The electric heating device 20 includes a body 24 formed of a resin or the like and a battery unit 22 and a control unit 23 that are disposed inside the body 24.

[0158] When the non-combustion-heating-type tobacco 10 is inserted into the electric heating device 20, the outer circumferential surface of the tobacco rod portion 11 is brought into contact with the heater member 21 of the electric heating device 20 and, subsequently, the entirety of the outer circumferential surface of the tobacco rod portion 11 and a part of the outer circumferential surface of the tipping paper are brought into contact with the heater member 21.

[0159] The heater member 21 of the electric heating device 20 produces heat due to the control performed by the control unit 23. As a result of the heat transferring to the tobacco rod portion 11 of the non-combustion-heating-type tobacco 10, the aerosol-source material, flavor component, and the like included in the tobacco filler of the tobacco rod portion 11 become volatilized.

[0160] The heater member 21 may be, for example, a sheet-shaped heater, a tabular heater, or a tubular heater. The sheet-shaped heater is a flexible, sheet-shaped heater. Examples thereof include a heater including a film (thickness: about 20 to 225 μm) formed of a heat-resistant polymer, such as polyimide. The tabular heater is a stiff, flat sheet-shaped heater (thickness: about 200 to 500 μm). Examples thereof include a heater that includes, for example, a flat-

sheet substrate and a resistance circuit disposed on the substrate, the resistance circuit serving as a heat-producing portion. The tubular heater is a hollow or solid tube-shaped heater (thickness: about 200 to 500 μm). Examples thereof include a heater that includes, for example, a cylinder made of a metal or the like and a resistance circuit formed on the outer periphery of the cylinder, the resistance circuit serving as a heat-producing portion. Examples of the tubular heater further include rod-shaped and cone-shaped heaters made of a metal or the like which include an internal resistance circuit that serves as a heat-producing portion. The cross-sectional shape of the tubular heater may be, for example, a circular shape, an oval shape, a polygonal shape, or the shape of a polygon with rounded corners.

[0161] In the case where the electric heating tobacco product is an electric heating tobacco product that heats the outer circumferential surface of the non-combustion-heating-type tobacco 10 as illustrated in Fig. 2, the sheet-shaped heater, the tabular heater, and the tubular heater can be used. In the case where the electric heating tobacco product is an electric heating tobacco product that heats the inside of the tobacco rod portion 11 included in the non-combustion-heating-type tobacco 10 as illustrated in Fig. 3, the tabular heater, the pillar-shaped heater, and the cone-shaped heater can be used.

[0162] The length of the heater member 21 in the longitudinal direction may fall within the range of $L \pm 5.0$ mm, where L [mm] represents the length of the tobacco rod portion 11 in the longitudinal direction. In order to transfer heat to the tobacco rod portion 11 in a sufficient manner and cause the aerosol-source material, flavor component, and the like included in the tobacco filler to volatilize to a sufficient degree, that is, in consideration of aerosol delivery, the length of the heater member 21 in the longitudinal direction is preferably L mm or more. In order to reduce the generation of components that adversely affect the flavor and the like, the above length is preferably L + 0.5 mm or less, L + 1.0 mm or less, L + 1.5 mm or less, L + 2.0 mm or less, L + 2.5 mm or less, L + 3.0 mm or less, L + 3.5 mm or less, L + 4.0 mm or less, L + 4.5 mm or less, or L + 5.0 mm or less.

[0163] The heating intensity, such as the amount of heating time during which the heater member 21 heats the non-combustion-heating-type tobacco 10 and the heating temperature at which the heater member 21 heats the non-combustion-heating-type tobacco 10, can be predetermined for each electric heating tobacco product 30. For example, the heating intensity can be predetermined such that, after the non-combustion-heating-type tobacco 10 has been inserted into the electric heating device 20, preheating is performed for a predetermined period of time to increase the temperature of the outer circumferential surface of the portion of the non-combustion-heating-type tobacco 10 which is inserted in the electric heating device 20 to X($^{\circ}\text{C}$) and the temperature is subsequently maintained to be a certain temperature equal to or less than X($^{\circ}\text{C}$).

[0164] The temperature X($^{\circ}\text{C}$) is preferably 80 $^{\circ}\text{C}$ or more and 400 $^{\circ}\text{C}$ or less in consideration of the amount of the delivered components generated by heating or the like. Specifically, the temperature X($^{\circ}\text{C}$) can be 80 $^{\circ}\text{C}$, 90 $^{\circ}\text{C}$, 100 $^{\circ}\text{C}$, 110 $^{\circ}\text{C}$, 120 $^{\circ}\text{C}$, 130 $^{\circ}\text{C}$, 140 $^{\circ}\text{C}$, 150 $^{\circ}\text{C}$, 160 $^{\circ}\text{C}$, 170 $^{\circ}\text{C}$, 180 $^{\circ}\text{C}$, 190 $^{\circ}\text{C}$, 200 $^{\circ}\text{C}$, 210 $^{\circ}\text{C}$, 220 $^{\circ}\text{C}$, 230 $^{\circ}\text{C}$, 240 $^{\circ}\text{C}$, 250 $^{\circ}\text{C}$, 260 $^{\circ}\text{C}$, 270 $^{\circ}\text{C}$, 280 $^{\circ}\text{C}$, 290 $^{\circ}\text{C}$, 300 $^{\circ}\text{C}$, 310 $^{\circ}\text{C}$, 320 $^{\circ}\text{C}$, 330 $^{\circ}\text{C}$, 340 $^{\circ}\text{C}$, 350 $^{\circ}\text{C}$, 360 $^{\circ}\text{C}$, 370 $^{\circ}\text{C}$, 380 $^{\circ}\text{C}$, 390 $^{\circ}\text{C}$, or 400 $^{\circ}\text{C}$.

[0165] A vapor including components derived from the aerosol-source material, components derived from the flavor component, etc. which are generated from the tobacco rod portion 11 as a result of heating performed by the heater member 21 is delivered into the oral cavity of the user through the mouthpiece portion 14, which is constituted by the cooling segment 12, the filter segment 13, etc.

[0166] In order to facilitate the entry of outside air and reduce the likelihood of the components generated by heating and air being retained inside the cooling segment 12, the perforations V formed in the cooling segment 12 are preferably present at a position closer to the inhalation port than the inhalation port-side end (the position denoted by the arrow X in the drawing) of a region of the cooling segment 12 which comes into contact with the electric heating device 20, as illustrated in Fig. 4. The insertion opening of the electric heating device 20 through which the non-combustion-heating-type tobacco 10 is inserted into the electric heating device 20 may be tapered as illustrated in Fig. 5 in order to make it easy to insert the non-combustion-heating-type tobacco 10 into the electric heating device 20. In this case, the inhalation port-side end of a region of the cooling segment 12 which comes into contact with the electric heating device 20 is the position denoted by the arrow Y in the drawing. In the non-combustion-heating-type tobacco 10 illustrated in Figs. 4 and 5, reference numerals that denote the components illustrated in Figs. 1 to 3 are partially omitted.

EXAMPLES

[0167] The present invention is described further specifically with reference to Examples below. The present invention is not limited by the following description of Examples without departing from the summary thereof.

<Method for Evaluating Physical Properties>

[BET Specific Surface Area]

[0168] The BET specific surface area of granular active carbon was measured on the basis of a nitrogen adsorption

EP 4 321 039 A1

method (multipoint BET method) with a fully automatic gas adsorption analyzer Autosorb-1-MP (produced by Quanta Chrome Co).

[Pore Volume]

5

[0169] The pore volume of granular active carbon was determined on the basis of the results of the measurement of pore distribution by a nitrogen adsorption method (the measurement conducted using the fully automatic gas adsorption analyzer Autosorb-1-MP (produced by Quanta Chrome Co)). Specifically, the pore volume of granular active carbon was calculated from the amount of gas adsorbed at $P/PO = 0.998$, on the assumption that the pores were filled with liquid nitrogen.

10

[Median Diameter]

[0170] The average particle sizes (median diameters) of granular active carbon and a coolant were measured by dry sieving in conformity with the method described in JIS Z 8815. The particle sizes (D50, D10, and D60) at which a cumulative volume reaches 50%, 10%, and 60% in the resulting particle size distribution were determined.

15

[Bulk Density]

[0171] The bulk densities of granular active carbon and a coolant were determined using Powder Tester PT-X produced by Hosokawa Micron Corporation.

20

[Tap Density]

[0172] The tap densities of granular active carbon and a coolant were determined using Powder Tester PT-X produced by Hosokawa Micron Corporation.

25

[Compression Rate]

[0173] The compression rates of granular active carbon and a coolant were determined using Powder Tester PT-X produced by Hosokawa Micron Corporation.

30

[Angle of Repose]

[0174] The angles of repose of granular active carbon and a coolant were determined in conformity with the method described in JIS 9301-2-2 using a sample stored at a temperature of 22°C and a relative humidity of 60% for 12 to 24 hours with Powder Tester PT-X produced by Hosokawa Micron Corporation.

35

[Angle of Spatula]

[0175] The angles of spatula of granular active carbon and a coolant were determined using Powder Tester PT-X produced by Hosokawa Micron Corporation.

40

[Uniformity]

[0176] The degrees of uniformity of granular active carbon and a coolant were determined using Powder Tester PT-X produced by Hosokawa Micron Corporation.

45

[Airflowability Index]

[0177] The airflowability indices of granular active carbon and a coolant were determined using Powder Tester PT-X produced by Hosokawa Micron Corporation.

50

[Angle of Rupture]

[0178] The angles of rupture of granular active carbon and a coolant were determined using Powder Tester PT-X produced by Hosokawa Micron Corporation under the same conditions as in the measurement of the angle of repose.

55

[Angle of Difference]

[0179] The value obtained by subtracting the angle of rupture from the angle of repose was used for evaluation.

5 [Dispersibility]

[0180] The degrees of dispersibility of granular active carbon and a coolant were determined using Powder Tester PT-X produced by Hosokawa Micron Corporation.

10 [Floodability Index]

[0181] The floodability indices of granular active carbon and a coolant were determined using Powder Tester PT-X produced by Hosokawa Micron Corporation.

15 [Hardness]

[0182] The degrees of hardness of granular active carbon and a coolant were determined by performing shaking using a rotating and tapping shaker produced by Kyoeisha Chemical Co., Ltd. in conformity with the method described in JIS K 1474 7.6, with the upper and lower limits of the sieves being 0.500 and 0.250, respectively.

20

[Preparation of Coolant]

<Example 1>

25 **[0183]** Granular active carbon (Kuraraycoal GGS-N 28/70) was used as a porous granular base material included in a coolant. The granular active carbon had a BET specific surface area of 1169 m²/g and a pore volume of 0.493 mL/g.

[0184] The granular active carbon was charged into SPIR-A-FLOW (produced by Freund Corporation). While the rotor and agitator of the fluidized bed were rotated (rotational speed of rotor: 200 rpm, rotational speed of agitator: 300 rpm, the agitator and rotor were rotated in opposite directions to each other), hot air was fed to the device (air-feed temperature: 30 80°C, air-feed rate: 4.5 to 6.0 m³/min), and the air was exhausted from the device, centrifugal rolling, floating flow, and swirling flow were performed.

[0185] While the active carbon was caused to flow, an aqueous propylene glycol solution including water and propylene glycol at a ratio of water:propylene glycol = 50:50 was gradually added to the active carbon in the form of a mist at a spray rate of 380 mL/min.

35 **[0186]** The speed at which the solution was added to the active carbon, the temperature of the hot air, and the air-feed rate were adjusted such that an increase in moisture content due to the addition of the solution and a reduction in moisture content due to the feeding of hot air was in balance in order to maintain a certain moisture content at which the active carbon could flow.

[0187] After the whole amount of solution had been added to the active carbon, drying was performed by the feeding of hot-air and exhausting of the air until the moisture content in the granules reached about 3% to 9% by weight while the granules were caused to flow.

[0188] The content of propylene glycol in the resulting coolant was 28.0% by weight.

[0189] Table 1 lists the physical properties of the granular active carbon and the coolant.

45 <Example 2>

[0190] A coolant was prepared as in Example 1, except that the granular active carbon was changed from Kuraraycoal GGS-N 28/70 to Kuraraycoal GGS-T 28/70.

50 **[0191]** The active carbon (Kuraraycoal GGS-T 28/70) had a BET specific surface area of 728 m²/g and a pore volume of 0.345 mL/g.

[0192] The content of propylene glycol in the resulting coolant was 19% by weight.

[0193] Table 1 lists the physical properties of the granular active carbon and the coolant.

55

[Table 1]

		Example 1		Example 2	
		Granular active carbon	Coolant	Granular active carbon	Coolant
Median diameter	D50 (μm)	356	362	356	379
	D10 (μm)	258	265	260	273
	D60 (μm)	376	380	378	399
Bulk density	(g/cm^3)	0520	0.747	0.544	0.722
Tap density	(g/cm^3)	0550	0.794	0.571	0.760
Compression rate	(%)	5.5	5.9	4.8	5.1
Angle of repose	($^\circ$)	34.7	38.6	34.2	35.8
Angle of spatula	($^\circ$)	38.4	53.8	38.1	42.0
Uniformity	(-)	1.5	1.4	1.5	1.5
Airflowability index	(-)	86.0	82.0	89.0	85.5
Angle of rupture	($^\circ$)	16.7	21.9	17.8	19.7
Angle of difference	($^\circ$)	18.1	16.8	16.4	46.1
Dispersibility	(%)	20.6	22.2	20.4	20.3
Floodability index	(-)	82.0	78.0	80.0	78.5
Hardness	(%)	99.9	99.9	99.7	99.4

<Evaluation of Cooling Effect>

[0194] A hot-air loading tester (Endo Science Kabushiki Kaisya), with which an evaluation can be implemented using the evaluation system illustrated in Fig. 6, was used for evaluating the cooling effect. Specifically, compressed air (dry) was fed to water 44 as denoted by the arrow A. The compressed air was fed such that a pressure gage 44 read 0.65 MPa. Pressure was controlled with a regulator 42 such that the pressure reached 0.5 MPa. The flow rate of the compressed air was adjusted to 10 to 20 mL/min with a thermal mass flow meter/controller 43 (MODEL 8500 produced by KOFLOC).

[0195] The air fed to the water 44 was then fed to a three-necked flask (50 mL) 52. The water 44 was heated with a pipe heater 47 (produced by Hakko Electric Co., Ltd., 1 KW) while regulation was performed using a temperature regulator 45 (Finethermo DGN-100 produced by Hakko Electric Co., Ltd.) such that the temperature of the water measured with a thermometer 46 was 50°C. The flow rate of the air and moisture content were controlled. Furthermore, in order to control the temperature of the air inside the three-necked flask (50 mL) 52, a temperature controller 48 (temperature controller TR2-303 produced by TOHO Electronics Inc.), a small-volume fluid/gas heater 49 (produced by Shinnetsu Co., Ltd.), a temperature controller 50 (temperature controller TR2-303 produced by TOHO Electronics Inc.), and a small-volume fluid/gas heater 51 (produced by Shinnetsu Co., Ltd.) were used. Using the above-described devices, the temperature, moisture content, and flow rate of the air fed to the three-necked flask (50 mL) 52 were controlled to 85.8°C, 82.8 g/m³, and 2.59 L/min, respectively.

[0196] Subsequently, the air fed to the three-necked flask (50 mL) 52 was fed to a three-necked flask (50 mL) 54 through a specimen container 53 and finally released as denoted with the arrow B. The temperature inside the three-necked flask (50 mL) 52 which was measured with a thermocouple 56 (produced by Hakko Electric Co., Ltd., type K) and the temperature inside the three-necked flask (50 mL) 54 which was measured with a thermocouple 55 (produced by Hakko Electric Co., Ltd., type K) were recorded with a touch-type recorder 57 (produced by Keyence Corporation). The cooling effect was evaluated on the basis of the difference between the above temperatures (in reality, the temperature inside the three-necked flask (50 mL) 54 was used for evaluation since the temperature inside the three-necked flask (50 mL) 52 was controlled to be constant). The amount of evaluation time (measurement time) was set to about 300 seconds. The specimen container 53 used was prepared by covering the upper and lower ends of a glass tube in the airflow direction, which had an inside diameter of 7.0 mm and an outside diameter of 10.0 mm and was capable of accommodating a specimen therein, with plain weave SUS mesh having an opening of 198 μm and a wire diameter of 0.12 mm.

[0197] Fig. 7 illustrates the results of evaluations of the cooling effect produced in the case where any material was

not charged into the specimen container 53 illustrated in Fig. 6 (blank case), the case where a PLA (polylactic acid) film filter (PLA sheet), which is included in a commercial electric heating tobacco product "IQOS" (produced by Philip Morris International Inc.) for cooling purpose, was charged into the specimen container 53, the case where a hollow filter included in IQOS for cooling purpose or reducing heat transfer to the outer circumference was charged into the specimen container 53, the case where the coolant prepared in Example 1 was charged into the specimen container 53, and the case where the coolant prepared in Example 2 was charged into the specimen container 53. In Fig. 7, the horizontal axis represents measurement time, and the vertical axis represents the temperature inside the three-necked flask (50 ml) 54. As for the PLA sheet, a 18-mm rod portion removed from an iQOS including a rod portion composed of a PLA sheet was directly charged into the specimen container 53 and then subjected to the measurement. As for the hollow filter, a 8-mm rod portion removed from an iQOS including a rod portion composed of a hollow filter was cut to a 6-mm piece. Three pieces were prepared in the above-described manner and stacked on top of one another in the airflow direction. The resulting 18-mm piece was charged into the specimen container 53 and subjected to a measurement. The volumes of the coolants prepared in Examples 1 and 2 charged were 0.7 cc.

[0198] The results illustrated in Fig. 7 confirm that the cooling effect produced in the case where the PLA sheet, the coolant prepared in Example 1, or the coolant prepared in Example 2 was charged into the specimen container 53 was strong compared with the case where any material was not charged into the specimen container 53 or the hollow filter was charged into the specimen container 53; that Example 1 had a cooling effect comparable to that of the PLA sheet; and that Example 2 had a stronger cooling effect than any other sample.

[0199] This is presumably because the coolant particles have a high heat-removal capability and the structure of the porous rod takes advantages of the heat-removal capability of the coolant particles.

[0200] As described above, it was confirmed that, by using the coolant according to an embodiment of the present invention, a coolant for a non-combustion-heating-type tobacco which is excellent in terms of efficiency, safety, and stability and which reduces the temperature of the aerosol without adversely affecting the flavor of the aerosol nor increasing the production costs, and a non-combustion-heating-type tobacco and an electric heating tobacco product that include the coolant can be provided.

Reference Signs List

[0201]

10	non-combustion-heating-type tobacco
11	tobacco rod portion
12	cooling segment
13	filter segment
14	mouthpiece portion
15	tipping paper
V	perforation
20	electric heating device
21	heater member
22	battery unit
23	control unit
24	body
30	electric heating tobacco product
41	pressure gage
42	regulator
43	thermal mass flow meter/controller
44	water
45	temperature regulator
46	thermometer
47	pipe heater
48,50	temperature controller
49,51	small-volume fluid/gas heater
52,54	three-necked flask
53	specimen container
55,56	thermocouple
57	touch-type recorder

Claims

1. A coolant for a non-combustion-heating-type tobacco,
5 wherein the coolant comprises a polyhydric alcohol and a porous granular base material,
 the granular base material being impregnated with the polyhydric alcohol.
2. The coolant for a non-combustion-heating-type tobacco according to claim 1, wherein a content of the polyhydric
10 alcohol in the coolant for a non-combustion-heating-type tobacco is 3% by weight or more and 39% by weight or less.
3. The coolant for a non-combustion-heating-type tobacco according to claim 1 or 2, wherein the porous granular base
 material is one or more selected from the group consisting of charcoal, calcium carbonate, cellulose, acetate, sugar,
 starch, and chitin.
- 15 4. The coolant for a non-combustion-heating-type tobacco according to any one of claims 1 to 3, wherein a volume of
 pores included in the porous granular base material is 0.3 mL/g or more and 0.8 mL/g or less.
- 20 5. The coolant for a non-combustion-heating-type tobacco according to any one of claims 1 to 4, wherein the coolant
 has an average particle size of 212 μm or more and 600 μm or less.
- 25 6. The coolant for a non-combustion-heating-type tobacco according to any one of claims 1 to 5, wherein the coolant
 has a bulk density of 0.55 g/cm³ or more and 0.80 g/cm³ or less.
- 30 7. A non-combustion-heating-type tobacco comprising a mouthpiece member including the coolant for a non-combus-
 tion-heating-type tobacco according to any one of claims 1 to 6.
- 35 8. The non-combustion-heating-type tobacco according to claim 7, wherein the mouthpiece portion includes a cooling
 segment, and at least the cooling segment includes the coolant for a non-combustion-heating-type tobacco.
- 40 9. An electric heating tobacco product comprising an electric heating device including a heater member, a battery unit
 serving as a power source for the heater member, and a control unit for controlling the heater member, and the non-
 combustion-heating-type tobacco according to claim 7 or 8, the non-combustion-heating-type tobacco being inserted
 in the electric heating device so as to come into contact with the heater member.
- 45 10. A method for producing a coolant for a non-combustion-heating-type tobacco, the method comprising:
 a step A of spraying a solution including a polyhydric alcohol to a porous granular base material or adding the
 solution dropwise to the porous granular base material to prepare granules; and
 a step B of drying the granules.
- 50 11. The method for producing a coolant for a non-combustion-heating-type tobacco according to claim 10, wherein, in
 the step A, the solution is sprayed or added dropwise to the porous granular base material to prepare granules while
 the porous granular base material is caused to flow.
- 55

FIG. 1

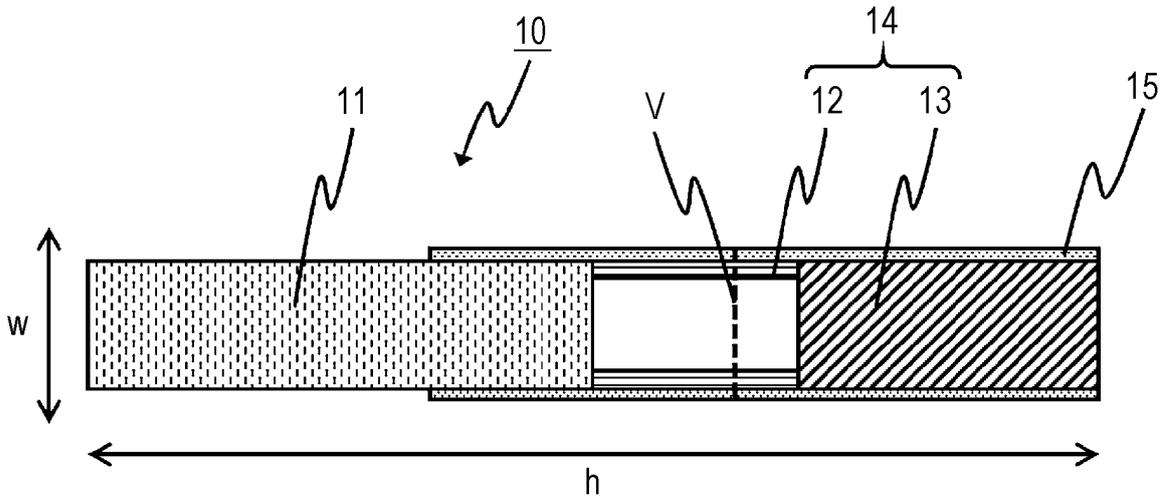


FIG. 2

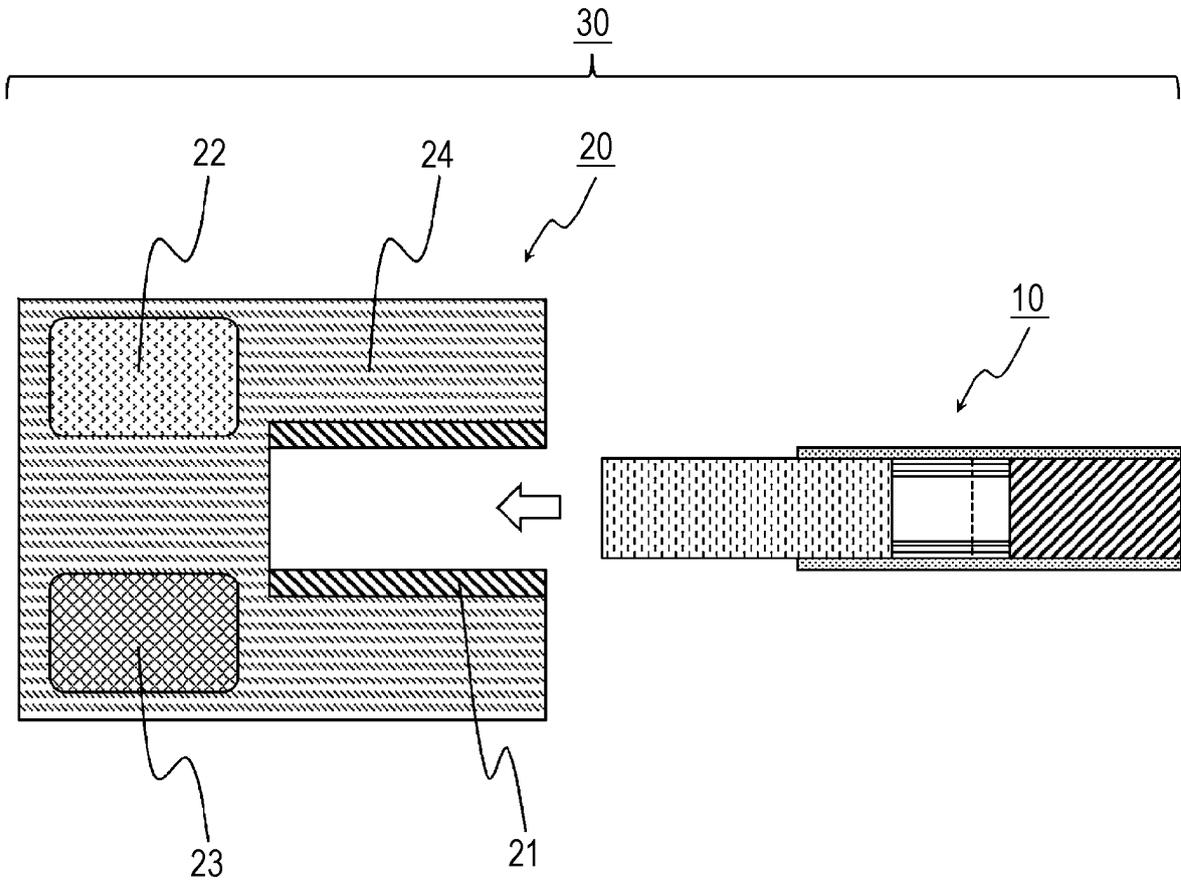


FIG. 3

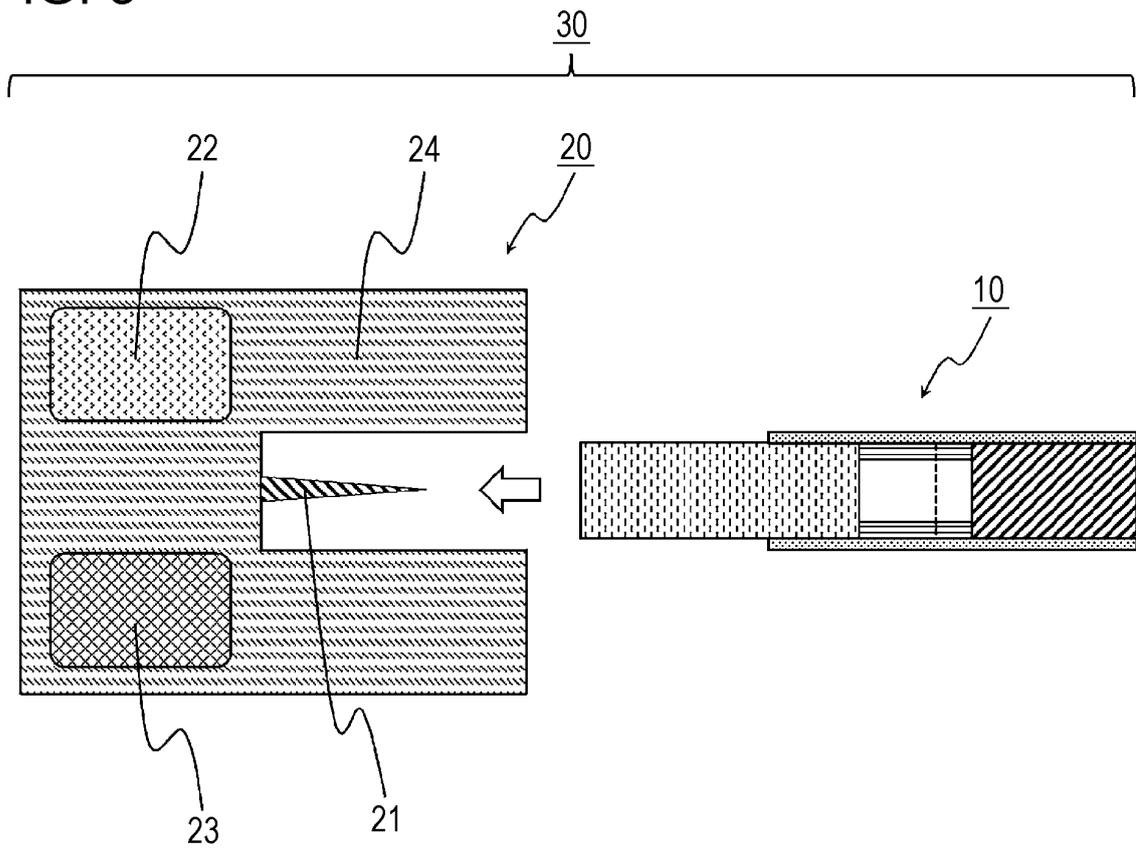


FIG. 4

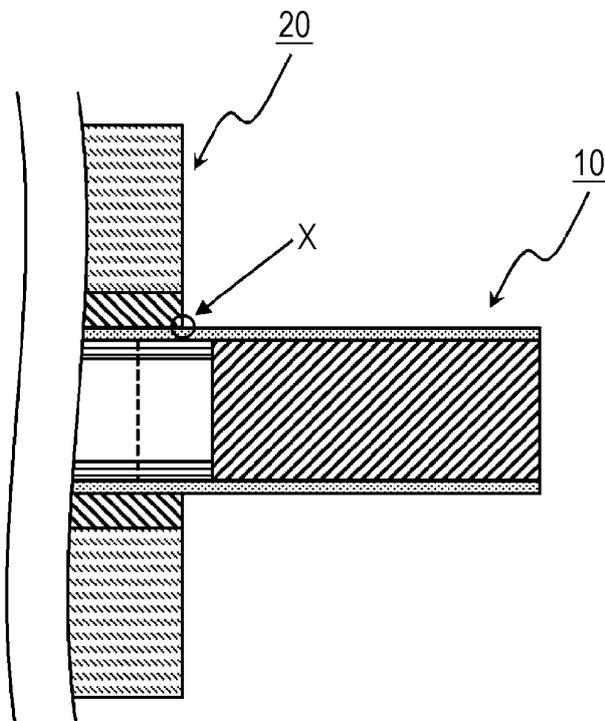


FIG. 5

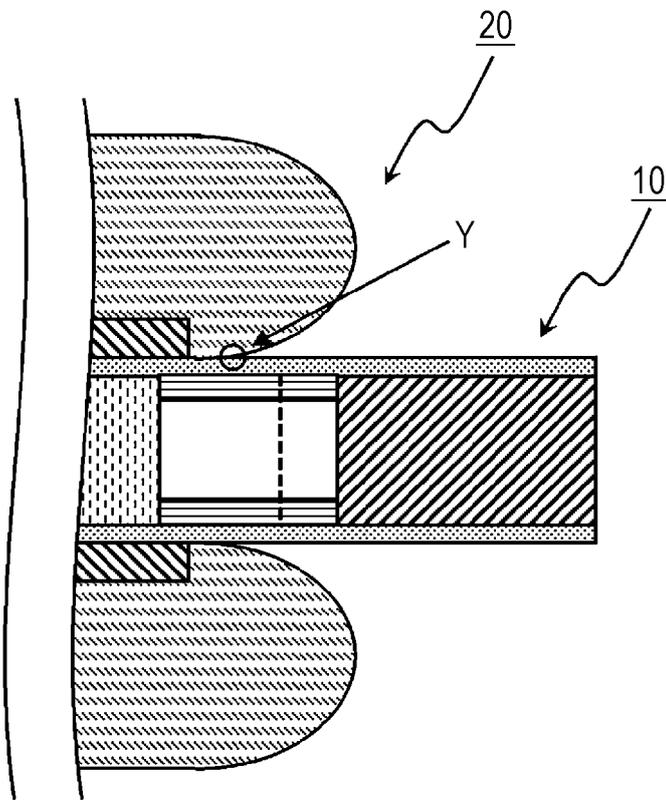


FIG. 6

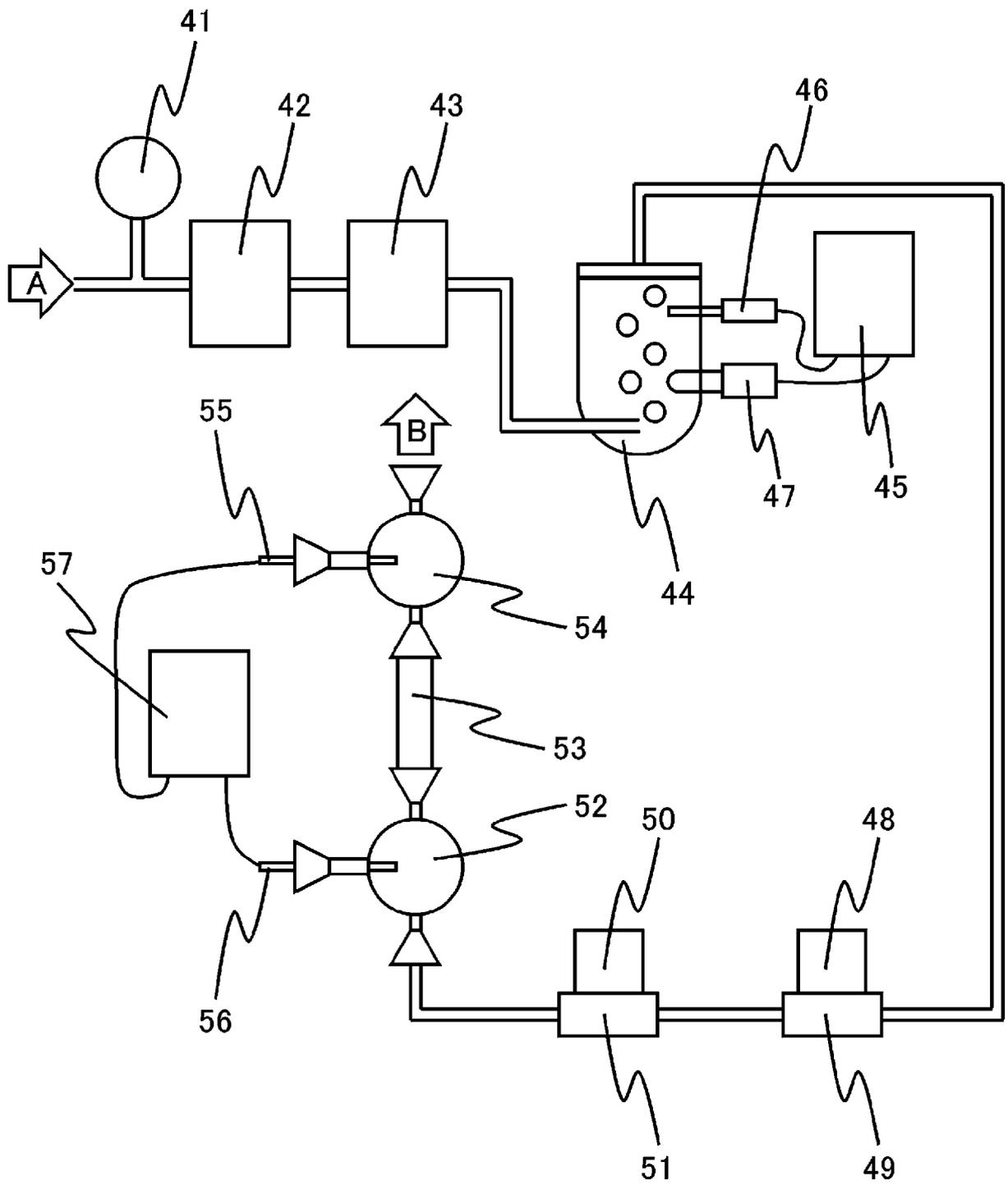
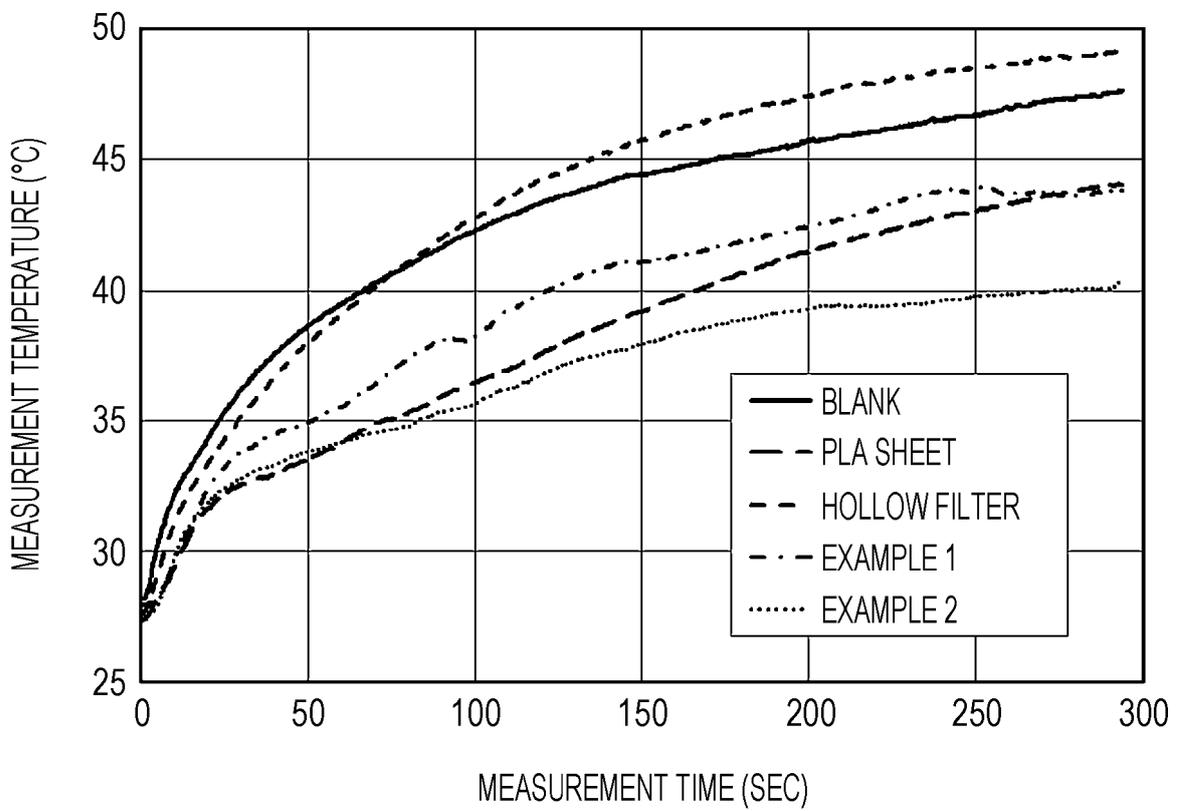


FIG. 7



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2021/014660

A. CLASSIFICATION OF SUBJECT MATTER

A24D 3/17(2020.01)i
FI: A24D3/17

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A24D3/17

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

Published examined utility model applications of Japan	1922-1996
Published unexamined utility model applications of Japan	1971-2021
Registered utility model specifications of Japan	1996-2021
Published registered utility model applications of Japan	1994-2021

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2020-531052 A (DEUTSCHE BENKERT GMBH) 05 November 2020 (2020-11-05) paragraphs [0028]-[0031], fig. 1-4	1-11
Y	WO 2005/026048 A1 (TAIYO KAGAKU CO., LTD) 24 March 2005 (2005-03-24) page 48, examples 2-5	1-11
Y	JP 9-100468 A (DAINIPPON PRINTING CO LTD) 15 April 1997 (1997-04-15) paragraphs [0006]-[0030]	3-11



Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

07 June 2021 (07.06.2021)

Date of mailing of the international search report

22 June 2021 (22.06.2021)

Name and mailing address of the ISA/
Japan Patent Office
3-4-3, Kasumigaseki, Chiyoda-ku,
Tokyo 100-8915, Japan

Authorized officer

Telephone No.

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

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/JP2021/014660

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REFERENCES CITED IN THE DESCRIPTION

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- JP 2013067511 A [0094]
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