(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 4 581 945 A1**

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
09.07.2025 Bulletin 2025/28

(21) Application number: **23860074.6**

(22) Date of filing: **17.08.2023**

(51) International Patent Classification (IPC):
A24D 3/17 *(2020.01)* ***A24D 3/04*** *(2006.01)*
A24F 40/20 *(2020.01)* ***A24F 40/42*** *(2020.01)*

(52) Cooperative Patent Classification (CPC):
A24F 40/42; A24D 1/20; A24D 3/04; A24D 3/17; A24F 40/20; A24F 40/46

(86) International application number:
PCT/JP2023/029756

(87) International publication number:
WO 2024/048311 (07.03.2024 Gazette 2024/10)

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC ME MK MT NL NO PL PT RO RS SE SI SK SM TR

(30) Priority: **31.08.2022 JP 2022138385**

(71) Applicant: **Japan Tobacco Inc.**
Tokyo 105-6927 (JP)

(72) Inventor: **AKAI, Makoto**
Tokyo 130-8603 (JP)

(74) Representative: **Hoffmann Eitle**
Patent- und Rechtsanwälte PartmbB
Arabellastraße 30
81925 München (DE)

(54) NON-COMBUSTION HEATING TYPE FLAVOR INHALATION ARTICLE, AND NON-COMBUSTION HEATING TYPE FLAVOR INHALATION SYSTEM

(57) A non-combustion heating type flavor inhalation article includes: an aerosol-generating segment; and a mouthpiece segment adjacent to the aerosol-generating segment. The mouthpiece segment includes a filter material, and a breakable capsule within the filter material, the breakable capsule having a single-layered core-shell structure. The capsule is spherical or approximately spherical with a diameter of 3.0 mm to 4.5 mm. The capsule has a stress of 2 N or more and 6 N or less against a displacement of 0.5 mm within 4 minutes from 10 minutes of storage under a condition of 45 °C and 90% RH.

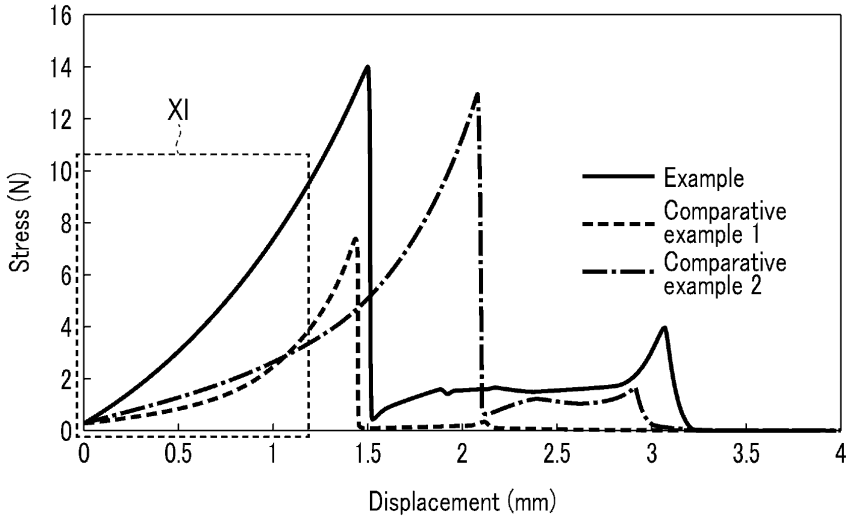

FIG. 10

EP 4 581 945 A1

Description

FIELD

[0001] The present invention relates to a non-combustion heating type flavor inhalation article and a non-combustion heating type flavor inhalation system.

BACKGROUND

[0002] A non-combustion heating type flavor inhalation article, which is used with heat generated by an electric heater or the like without combustion, is known.

[0003] It is also known that a flavorant-enclosing breakable capsule (c.f., for example, WO 2014/171433) is set within the filter material of a combustion type flavor inhalation article such as a cigarette (c.f., for example, WO 2018/011660). A user breaks the capsule by crushing it with fingers or teeth from outside the filter material so as to cause the flavorant in the capsule to be released into the filter material, thereby making the flavor during the inhalation changeable upon breakage of the capsule.

[0004] It has become recognized that a non-combustion heating type flavor inhalation article shows, for example, the following characteristics with inhalation by a user, which constitute differences from a combustion type flavor inhalation article such as a cigarette.

- A vaporized flavor component which moves from the aerosol-generating segment to the downstream segment during use (during the inhalation) has a high temperature.
- Water vapor accounts for a large proportion among all vaporized components.

As such, in response to inhalation by a user, the inside of the filter material of a non-combustion heating type flavor inhalation article becomes hot and humid. For a combustion type flavor inhalation article in which a capsule is provided inside the filter material, inhalation by a user easily creates a high-temperature and high-humidity condition around the capsule. From the above, it is presumed that a capsule within the filter material of a non-combustion heating type flavor inhalation article can be easily softened in response to inhalation by a user.

[0005] In instances where a user of the non-combustion heating type flavor inhalation article that has been subjected to at least one inhalation action is to break a capsule, this capsule, which has been softened, may give the user a misperception that there is no capsule in the filter material or an already broken capsule is contained.

[0006] Note that it is generally very likely that a multi-layered capsule will incur a higher cost than a single-layered capsule.

SUMMARY

[0007] An objective of the present invention is to provide a non-combustion heating type flavor inhalation article and a non-combustion heating type flavor inhalation system that allow a user who has performed at least one inhalation action and who intends to break the capsule to readily perceive the presence of the capsule.

[0008] According to one embodiment of the present invention, a non-combustion heating type flavor inhalation article includes: an aerosol-generating segment; and a mouthpiece segment adjacent to the aerosol-generating segment. The mouthpiece segment includes a filter material, and a breakable capsule within the filter material. The breakable capsule has a single-layered core-shell structure. The capsule is spherical or approximately spherical with a diameter of 3.0 mm to 4.5 mm. The capsule has a stress of 2 N or more and 6 N or less against a displacement of 0.5 mm within 4 minutes from 10 minutes of storage under a condition of 45 °C and 90% RH.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009]

FIG. 1 is a schematic diagram showing an electric heating type flavor inhalation system according to an embodiment.

FIG. 2 is a schematic diagram showing a state where a rod has been inserted into a heater of the electric heating type flavor inhalation system shown in FIG. 1.

FIG. 3 is a graph showing a moisture supply amount in the mouthpiece segment of the rod of the electric heating type flavor inhalation system shown in FIG. 2, with respect to the number of inhalation actions.

FIG. 4 is a schematic diagram showing a state where a test is conducted for measuring the repulsive force of a capsule-containing segment among the mouthpiece segments of the capsule-containing rod.

FIG. 5 is a graph showing a general transition of the repulsive force with respect to a pressing rate in the test shown in FIG. 4.

FIG. 6 is a schematic diagram for explaining definitions for measurement with the pressing rate.

FIG. 7 is a schematic diagram showing a state where a test is conducted for measuring the repulsive force of a segment corresponding to FIG. 4 among the mouthpiece segments of a rod that does not contain a capsule.

FIG. 8 is a graph showing general transition of the repulsive force with respect to a pressing rate in the test shown in FIG. 7.

FIG. 9 is a schematic diagram for explaining a series of processes for conducting a test for measuring the repulsive force of each capsule under a hot and humid condition.

FIG. 10 is a graph showing a general transition of the repulsive forces with respect to a pressing rate in the test shown in FIG. 9.

FIG. 11 is an enlarged view of the portion indicated by symbol "XI" in FIG. 10.

FIG. 12 is a table showing results of evaluating the feeling of breaking capsules in mouthpiece segments which equals the respective capsules used in the test shown in FIG. 9, after the rods including the respective capsules in the mouthpiece segments are each inserted into the heater shown in FIG. 2 and subjected to three inhalation actions properly performed by a user.

FIG. 13 is a schematic diagram showing a state where the rod has been inserted into a heater differing from the heater of the electric heating type flavor inhalation system shown in FIGS. 1 and 2.

DETAILED DESCRIPTION

[0010] As shown in FIG. 1, a non-combustion heating type flavor inhalation system (electric heating type flavor inhalation system) 10 according to the present embodiment is a heating type which differs from traditional cigarettes and which heats a later-described filler 62 through, for example, electrical heating means or the like without combustion so as to allow the flavor of the filler 62 to be tasted.

[0011] The non-combustion heating type flavor inhalation system 10 includes a heater 12 and a rod (non-combustion heating type flavor inhalation article) 14 adapted to be attached to and detached from an insertion part 42 of the heater 12. The heater 12 is intended for repeated use and the rod 14 is discarded after one use.

[0012] The heater 12 includes a box-shaped housing 22, a battery unit (e.g., a secondary battery) 24, a switch 26 for activating the heater 12, a pressure sensing part 28, a heat transfer part (heat transfer tube) 30, a heater element 32 provided around the heat transfer part 30, and a controller 34.

[0013] The housing 22 includes the insertion part 42 and a vent hole 44. The insertion part 42 is formed into a cylindrically recessed shape corresponding to the shape of the rod 14. The vent hole 44 permits communication between the outside of the housing 22 and the insertion part 42, and supplies air to the rod 14 inserted into the insertion part 42.

[0014] The housing 22 is provided with the battery unit 24, the switch 26, the pressure sensing part 28, the heat transfer part (heat transfer tube) 30, the heater element 32 provided around the heat transfer part 30, and the controller 34.

[0015] In one example, the battery unit 24 is formed as a secondary battery assembly which includes a secondary battery or a combination of multiple secondary batteries. The battery unit 24 supplies electric power to, for example, the pressure sensing part 28, the heater element 32, the controller 34, and so on.

[0016] The switch 26 is exposed to the outside of the housing 22 and is arranged at a position next to the insertion hole of the insertion part 42.

[0017] The pressure sensing part 28 is constituted by, for example, a pressure sensor (pressure sensitive sensor), and it is in one example provided within the insertion part 42 (within the vent hole 44).

[0018] The heat transfer part 30 is made of a metal material and formed into a hollow cylindrical shape. The metal material for the heat transfer part 30 is preferably a metal having a high thermal conductivity, such as gold, silver, copper, aluminum, or an alloy using one or more of these metals.

[0019] In one example, the heater element 32 is constituted by a general heating wire such as a nichrome wire. The heater element 32 is arranged, for example, cylindrically around the heat transfer part 30. Note that the heating mode adopted by the heater element 32 is not limited to the mode that utilizes Joule heat from electrical resistance, and it may adopt, for example, an induction heating (IH) mode or a mode utilizing a chemical reaction that produces oxidation heat, etc. For adopting the IH mode, the filler 62 in an aerosol-generating segment 52 is covered by, for example, a magnetic metal thin film. For adopting a mode utilizing a chemical reaction, the material and the shape of the heat transfer part may be selected. The heater element 32 in such cases is also capable of heating the aerosol-generating segment 52 without burning it.

[0020] The controller 34 receives a supply of power from the battery unit 24 and controls the switch 26, the pressure sensing part 28, the heater element 32, etc. The controller 34 controls the pressure sensing part 28 to sense whether or not the rod 14 has been properly inserted into the insertion part 42 and to further sense the negative pressure in the insertion part 42 (in the vent hole 44). Accordingly, the controller 34 may take control so that power is not supplied to the heater element 32 if the rod 14 has not been properly inserted into the insertion part 42. The controller 34 may also count the number of inhalation actions by the user. The controller 34 causes the power from the battery unit 24 to be supplied to the heater element 32 to adjust the temperature of the heater element 32 within an appropriate range. The controller 34 controls the heater element 32 to heat the later-described aerosol-generating segment 52 of the rod 14 at, for example, 30 °C to 400 °C, or preferably 100 °C to 400 °C, or more preferably 150 °C to 250 °C.

[0021] In one example, the rod (non-combustion heating type flavor inhalation article) 14 shown in FIGS. 1 and 2 is formed into a columnar shape.

[0022] The circumferential length of the rod 14 is not particularly limited, but in one example it is preferably 16 mm to 25 mm, or more preferably 21 mm to 23 mm. The overall length (horizontal length) of the rod 14 is not particularly limited, but in one example it is preferably 50 mm to 100 mm, or more preferably 50 mm to 70 mm.

[0023] The rod 14 includes the aerosol-generating

segment (tobacco part) 52, a mouthpiece segment 54, and tipping paper (mouthpiece lining paper) 56.

[0024] In one example, the aerosol-generating segment 52 includes a tobacco-containing filler 62 and a wrapper 64 made of paper which, for example, cylindrically wraps the filler 62.

[0025] The tobacco-containing filler 62 is formed of dried leaf tobacco or a sheet-shaped crushed tobacco plant cut into approximately 1 mm × 3 mm pieces to fill in random orientations. The filler 62 may contain, for example, 0 wt% to 30 wt% of an aerosol source (glycerin, propylene glycol (PG), 1,3-butanediol), and a flavoring material.

[0026] The mouthpiece segment 54 according to this embodiment includes a first segment 72, a second segment 74, a third segment 76, a capsule 78, and a wrapper 80.

[0027] The first segment 72 is formed of a cardboard (thickness: 200 μm to 500 μm) processed into a cylindrical paper tube. The cardboard may be paper made of a wood pulp raw material, such as ordinary paper, or may be a sheet made of a plasticizer (triacetin)-treated and compressed cellulose acetate fiber.

[0028] The second segment 74 includes a hollow rod 82 and an inner plug wrapper 84. The hollow rod 82 is formed by, for example, densely filling cellulose acetate fibers with a hollow center. The inner plug wrapper 84 is constituted mainly by paper and wraps the outer periphery of the hollow rod 82. The cellulose acetate-filled layer has a high density. Accordingly, air and aerosol during inhalation (smoking) flow through the hollow portion inside the hollow rod 82 and do not easily flow into the fiber-filled layer.

[0029] Note that the rod 82 may be formed with a solid center, instead of having a hollow structure.

[0030] The cellulose acetate fibers of the hollow rod 82 in the second segment 74 are cured upon addition of, for example, 6 mass% to 20 mass% of a suitable plasticizer including triacetin or the like with respect to the mass of the cellulose acetate. The hollow portion of the second segment 74 has an inner diameter of, for example, 1.0 mm to 5.0 mm.

[0031] The third segment 76 includes a solid rod (filter material) 92 and an inner plug wrapper 94. The solid rod 92 is provided by filling, for example, cellulose acetate fibers at an appropriate density. The inner plug wrapper 94 is constituted mainly by paper and wraps the outer periphery of the solid rod 92.

[0032] Note that the solid rod 92 in the third segment 76 may be formed at the same filling density as that of the cellulose acetate fibers of the hollow rod 82 in the second segment 74, or may be formed at a different filling density. Also, the cellulose acetate fibers of the solid rod 92 in the third segment 76 preferably contain, for example, a suitable plasticizer including triacetin or the like as in the hollow rod 82 in the second segment 74.

[0033] Here, the long fibers of cellulose acetate that have been plasticized by the plasticizer preferably have a filament denier of 3.0 dpf (denier per filament) or more and 12.0 dpf or less. Also, the long fibers of cellulose acetate that have been plasticized by the plasticizer preferably have a filling density of 130 [mg/cc] or less. Further, the long fibers of cellulose acetate that have been plasticized by the plasticizer preferably have a filling density of 100 [mg/cc] or more. Setting the filling density of the cellulose acetate long fibers plasticized by the plasticizer in such a range can facilitate the fixing of the capsule 78 in the right position and also prevent the capsule 78 from easily popping out at the time of pressing a later-described cutout segment 98.

[0034] In this embodiment, the capsule 78 is arranged within the solid rod 92 in the third segment 76. It is not a limitation to arrange the capsule 78 within the third segment 76 but the capsule 78 may also be arranged within the first segment 72 or the second segment 74. It is also possible to arrange the capsule 78 in, for example, the third segment 76 and at least one of the first segment 72 and the second segment 74. As such, one or more capsules 78 may be disposed in the single mouthpiece segment 54.

[0035] In one example, the capsule 78 includes a shell and a content liquid containing a flavorant. For the present embodiment, it is preferable to constitute the capsule 78 from a shell and a content liquid within the shell. The shell may employ, for example, any of starch, dextrin, polysaccharide, agar, gellan gum, gelatin, various natural gelling agents, glycerin, sorbitol, calcium chloride, etc., and may further contain a flavorant and a coloring agent. The capsule 78 may be colored so that the user can recognize the capsule 78 so as to crush it even if it is enclosed within the inner plug wrapper 94 and the tipping paper 56 which are not transparent. In such a form, the shell preferably contains a coloring agent, such as Blue No. 1.

[0036] As the flavorant of the content liquid, any flavorant for a smoking article such as menthol, plant essential oil, etc. may be used. Typical examples of the flavorant include: menthol; leaf tobacco extract; natural plant flavors (e.g., cinnamon, sage, herb, chamomile, kudzu (Pueraria lobata), sweet hydrangea leaf, clove, lavender, cardamom, caryophyllus, nutmeg, bergamot, geranium, honey essence, rose oil, lemon, orange, cassia bark, caraway, jasmine, ginger, coriander, vanilla extract, spearmint, peppermint, cassia, coffee, celery, cascarilla, sandalwood, cocoa, ylang-ylang, fennel, anise, licorice, St John's bread, prune extract, and peach extract); saccharides (e.g., glucose, fructose, isomerized saccharide, and caramel); cocoa (e.g., powder and extract); esters (e.g., isoamyl acetate, linalyl acetate, isoamyl propionate, and linalyl butyrate); ketones (e.g., menthone, ionone, damascenone, and ethyl maltol); alcohols (e.g., geraniol, linalool, anethole, and eugenol); aldehydes (e.g., vanillin, benzaldehyde, and anisaldehyde); lactones (e.g., γ-undecalactone and γ-nonalactone); animal flavorants (e.g., musk, ambergris, civet, and castoreum); and hydrocarbons (e.g., limonene and

pinene). Each of these flavorants may be used alone, or the flavorants may be used in any combination.

[0037] As a solvent of the content liquid, any solvent suitable for a flavorant may be used, and examples of such a solvent include medium chain fatty acid triglyceride (MCT) (more specifically, tricaprylic/capric acid glycerin), propylene glycol, water, and ethanol. The content liquid may further contain other solvents, and other additives such as a pigment, an emulsifier, and a thickener.

[0038] It is preferable for the capsule 78 according to the present embodiment to have a core-shell structure in which the shell is formed of a single layer, and to be breakable for a given pressure (stress) range in a given displacement range.

[0039] The method for manufacturing the capsule 78 is not particularly limited. For example, use of a dropping method enables the manufacture of the capsule 78 having a seamless shell. This method employs two concentric nozzles to concurrently discharge a content liquid from the inner nozzle and a fluidic shell material from the outer nozzle so that the shell liquid can seamlessly enclose the content liquid. Note that the capsule 78 may also be provided in a form in which a content liquid (without a coloring agent) is enclosed by a capsule main body containing a coloring agent, so that the coloring agent will seep and move into the content liquid from the capsule main body to make a colored content liquid during storage. Also, different nozzles may be employed for the content liquid, and in this case, a single-shelled capsule 78 may be produced using three concentric nozzles to concurrently discharge an inner content liquid from the inner nozzle, an outer content liquid from the intermediate nozzle, and a fluidic shell material from the outer nozzle. By separating the inner content liquid and the outer content liquid from each other, content liquids differing in properties can be discharged at different temperature and viscosity values. For example, a liquid containing a dissolved water-soluble flavorant may be adopted as the inner content liquid and a liquid containing a dissolved lipid-soluble flavorant may be adopted as the outer content liquid. Also, an emulsifier may be contained in the inner content liquid or the outer content liquid.

[0040] It is preferable for the capsule 78 according to the present embodiment to have a shell ratio (the ratio of the weight of the shell to the weight of the capsule 78) of 25 wt% or less.

[0041] It is preferable for the capsule 78 according to the present embodiment to be provided without, for example, a water-resistant coating and/or a heat-resistant coating around its outer periphery. The capsule 78 can therefore be manufactured at a low cost.

[0042] The capsule 78 may have, for example, a shape of a sphere or a shape of a substantial sphere. Such a sphere may either be a sphere having a substantially circular cross-section or an ellipsoid having an elliptical or substantially elliptical cross-section. The capsule 78 preferably has a shape of a sphere that is substantially circular in cross-section. The capsule 78 in the case of being a sphere having a substantially circular cross-section may have a diameter of 3.0 mm to 4.5 mm.

[0043] The second segment 74 and the third segment 76 which contains the capsule 78 are arranged in sequence, and the wrapper 80 wraps the second segment 74 and the third segment 76 so as to couple them together.

[0044] Then, the first segment 72 and a set of the second segment 74 and the third segment 76 wrapped by the wrapper 80 are arranged in sequence, the aerosol-generating segment 52 is placed on the first segment 72 side, and the resultant is wrapped by the tipping paper (mouthpiece lining paper) 56 having a paste (e.g., a vinyl-acetate-based paste) applied to substantially the entire inner surface thereof. The tipping paper 56 is constituted mainly by paper. In other words, the outer peripheries of the aerosol-generating segment 52 and the first segment 72, the second segment 74, and the third segment 76 of the mouthpiece segment 54 are wrapped with the tipping paper 56. The mouthpiece segment 54 is thus connected to the aerosol-generating segment 52 containing the tobacco filler 62 by means of the tipping paper (mouthpiece lining paper) 56. Note that the end of the tipping paper 56 may be aligned with the end of the wrapper 64 (the end 14a of the rod 14), or may be located between the distal end and the proximal end of the wrapper 64 as shown in FIG. 1.

[0045] The total thickness of the wrappers (the inner plug wrapper 94, the wrapper 80, and the tipping paper 56) that constitute the outer periphery of the mouthpiece segment 54 is equal to or less than a predetermined thickness, and in one example, it is preferably equal to or less than 100 μm. A too-large total thickness of the wrappers of the mouthpiece segment 54 is avoided so that the capsule 78 is kept easily perceivable at the time of pressing it from outside the mouthpiece segment 54.

[0046] After the aerosol-generating segment 52 and the mouthpiece segment 54 are connected together by the tipping paper 56, one or more perforations 58 (air vent portions) for introducing air are formed at positions of the mouthpiece segment 54 which correspond to, for example, the first segment 72. The perforations 58 penetrate through the paper tube of the first segment 72. Preferably, each perforation 58 is formed to have a size of approximately 0.5 mm × 1.5 mm.

[0047] It is preferred that multiple of the perforations 58 are formed in a radial arrangement as viewed along the central axis of the rod 14. The present embodiment assumes the multiple perforations 58 arranged in one row, i.e., provided at regular intervals on an annular ring. The multiple perforations 58 may be arranged in two rows, i.e., provided at regular intervals on two annular rings. The multiple perforations 58 may also be discontinuously or irregularly arranged in one or two rows.

[0048] Note that the perforations 58 are formed at positions which come outside the insertion hole of the insertion part 42 of the heater 12 in a state where the end 14a of the rod 14 has been inserted into the insertion part

42 of the heater 12.

[0049] The solid rod 92 is, up to a mouthpiece end 14b of the mouthpiece segment 54, filled with a fiber-filled layer. The mouthpiece end 14b of the mouthpiece segment 54 of the rod 14 has a similar appearance to the mouthpiece end of a conventional cigarette.

[0050] Effects of the non-combustion heating type flavor inhalation system 10 will be described.

[0051] As shown in FIG. 2, attachment of the rod 14 to the heater 12 is realized by inserting the end 14a of the rod 14 into the insertion part 42 of the heater 12. Here, it is assumed that, of the entire length of the aerosol-generating segment 52 of the rod 14, a predetermined length thereof has been appropriately inserted into the insertion part 42. If, in this state, the user presses down the switch 26 to activate the heater 12, the controller 34 starts various control operations for the pressure sensing part 28, the heater element 32, etc. The controller 34 causes the battery unit 24 to supply power to the heater element 32 to raise the temperature of the heater element 32 and the heat transfer part 30 to a predetermined temperature (for example, approximately 20 °C to 400 °C). It is assumed that the heater element 32 and the heat transfer part 30 are heated to 300 °C. The aerosol-generating segment 52 of the rod 14 is heated accordingly, and each component in the filler 62 is volatilized. In this state, once the user puts the mouthpiece end 14b in their mouth and initiates inhalation, outside air is taken into a vapor-containing fluid (mainstream smoke) that flows within the mouthpiece segment 54 through the multiple perforations 58. The vapor is cooled by the air introduced into the first segment 72 through the perforations 58 and thereby quickly turns into an aerosol (becomes minute droplets). With the inhalation by the user, the air and the aerosol pass through the fiber-filled layer, and a part of the aerosol is filtered by the solid rod 92. In this manner, the vapor (aerosol) carrying the flavor of the tobacco filler 62 is released from the aerosol-generating segment 52 into the mouth of the user so that the user can taste the flavor of the filler 62.

[0052] The controller 34 measures the time from the start of various control operations for the pressure sensing part 28, the heater element 32, etc. The controller 34 detects a negative pressure in the housing 22 via the pressure sensing part 28 to count the number of inhalation actions performed by the user. Upon elapse of a predetermined time or upon the number of inhalation actions by the user reaching a predetermined number, the controller 34 performs control to stop the heating of the heater element 32.

[0053] In this way, the heating type flavor inhalation system 10 finishes the non-combustion heating type flavor inhalation operation for one rod 14. The user may then remove the used rod 14 from the insertion part 42 and insert the new rod 14 into the insertion part 42 to operate the heater 12 as described above, so that the user can taste the tobacco flavor from the new rod 14 again.

[0054] It has been confirmed with the cases of the present embodiment that if, for example, a user who uses the above described heater 12 and rod 14 performs one or more inhalation actions from the mouthpiece end 14b in the above manner, the inside of the solid rod (filter material) 92 of the third segment 76, that is, the vicinity of the outer periphery of the capsule 78, becomes hot and humid.

[0055] FIG. 3 shows a graph with a horizontal axis representing the number of inhalation actions and a vertical axis representing the amount of moisture supply to the solid rod 92 of the third segment 76, for an instance where a user performs inhalation actions using the heating type flavor inhalation system 10 according to the present embodiment. It can be seen that, in the present embodiment, the amount of moisture supply to the solid rod 92 reaches the largest at approximately the first to third inhalation actions. Also, it has been found that with the use of, for example, the heater 12 and the rod 14 described above, a hot and humid condition of approximately 45 °C and 90% RH is created in the vicinity of the outer periphery of the capsule 78 inside the solid rod 92 near the mouthpiece end 14b, upon one to three inhalation actions. It has been confirmed that this state is hotter and more humid than the inside of the filter material near the mouthpiece end of a cigarette. For example, in the case of a cigarette, the average moisture amount per one inhalation action in the initial stage of inhalation is approximately 0.8 mg / 55 ml. This is roughly 1/5 to 1/3 of the moisture amount per one inhalation action in the initial stage in the case of using the heating type flavor inhalation system 10. It has also been confirmed that a cigarette does not involve a temperature increase near the mouthpiece end of the cigarette in the initial stage of inhalation. This is because the burning in a cigarette takes place at the opposite end to the mouthpiece end, and the generated smoke is well cooled while traveling through a tobacco portion of the cigarette.

[0056] Now, turning to FIGS. 1, 2, and 4, a rod constituted only by a segment containing the capsule 78 (such a rod will be called a "cutout segment 98") is prepared by cutting it out from a capsule-containing rod (which may be the same as the above described rod 14 or may be a combustion type flavor inhalation article such as a cigarette). For the sake of simplicity of the description, the rod employed is assumed to be the above described rod 14 as shown in FIGS. 1 and 2. It is assumed that the rod 14 before undergoing the heating type flavor inhalation is stored at room temperature. After the storage, a cutout segment 98 in which the capsule 78 is arranged in the solid rod 92 and which is kept wrapped by the tipping paper 56 is cut out.

[0057] A rheometer 100 (Sun RHEO METER CR-3000EX-L (Sun Scientific Co., Ltd.)) shown in FIG. 4 was used to press the tipping paper 56 of such a cutout segment 98 cut out from the rod 14, toward the central axis of the cutout segment 98 so as to measure the repulsive force of the cutout segment 98. The cutout

segment 98 is formed as a cylinder, and the center of the capsule 78 is located on the central axis of the cutout segment 98. That is, the cutout segment 98 has a cylindrical shape in which the capsule 78, the solid rod (filter material) 92, the inner plug wrapper 94, the wrapper 80, and the tipping paper 56 are arranged in this order from the central portion toward the outside in the radial direction.

[0058] The rheometer 100 includes a pair of disks 102 and 104 which are vertically separate from each other. The pair of disks 102 and 104 have respective surfaces 102a and 104a which face each other and are parallel to each other. These surfaces 102a and 104a each have a diameter of 15 mm. The upper disk 104 is connected with a pressing shaft 106 which makes an axial movement along the vertical direction at, for example, a constant speed. The pressing shaft 106 and the upper disk 104 are adapted to be non-rotatable about the axis of the pressing shaft 106. The lower disk 102 is fixed. As such, the axial movement of the pressing shaft 106 causes the upper surface 104a to approach or separate from the lower surface 102a.

[0059] Here, it is assumed that the pressing shaft 106 of the rheometer 100, namely, the upper surface 104a, is controlled to move downward at a constant speed of 20 mm/min.

[0060] The cutout segment 98 was put between the surfaces 102a and 104a of the rheometer 100 shown in FIG. 4 with the capsule 78 arranged on the axis of the pressing shaft 106. More specifically, the tipping paper 56 was brought into contact with the surfaces 102a and 104a, and in this state, the pressing shaft 106 was moved vertically downward to apply a pressing force to the tipping paper 56 toward the central axis of the cutout segment 98, thereby obtaining a graph with a horizontal axis representing a pressing rate and a vertical axis representing a repulsive force as shown in FIG. 5.

[0061] Referring to FIG. 6, the pressing rate will be briefly explained. Suppose that a sphere such as a capsule, or a cylinder (cylindrical body) such as the cutout segment 98, has a diameter L1 in the state without a load. While the sphere or the cylinder is supported by the lower surface 102a of the rheometer 100, the pressing shaft 106 connected to the disk 104 is moved vertically downward to press the sphere or the cylinder using the upper surface 104a, and the vertical length of the sphere or the cylinder at this time, i.e., the distance between the surfaces 102a and 104a at this time, is taken as L2. Here, (L1-L2)/L1 is defined as the pressing rate.

[0062] The repulsive force represented by the vertical axis in FIG. 5 is not an actual magnitude but a ratio. In the example shown in FIG. 5, the repulsive force at the breakage of the capsule 78 in the cutout segment 98 is taken as 1.

[0063] In applying an external force from above and below toward the central axis of the cutout segment 98 in order to break the capsule 78 in the filter material (solid rod) 92, compression takes place in the order of the tipping paper 56, the wrapper 80, the inner plug wrapper 94, the filter material 92, and the capsule 78. Here, the compression makes the tipping paper 56, the wrapper 80, the inner plug wrapper 94, and the filter material 92 thinner while the outer diameter of the capsule 78 is substantially maintained. Then, after the tipping paper 56, the wrapper 80, the inner plug wrapper 94, and the filter material 92 have been compressed, or while they are being compressed, the capsule 78 is compressed and deformed. The capsule 78 here is compressed so as to be changed from the spherical shape to a flat shape while the tipping paper 56, the wrapper 80, the inner plug wrapper 94, and the filter material 92 are maintained in the appropriately thinned state or are further thinned.

[0064] Note that it is assumed here that the repulsive force from the tipping paper 56, the wrapper 80, and the inner plug wrapper 94 which occurs against the pressing of the cutout segment 98 is negligibly small as compared to the repulsive force of the filter material 92 or the capsule 78.

[0065] In the example shown in FIG. 5, there was an inflection point indicated by symbol "α" at a portion between the pressing rate values of 0.2 and 0.3 in the graph. The degree of inclination was large after the inflection point α in the graph as compared to the degree of inclination before the inflection point α. Presumably, this indicates that the tipping paper 56, the wrapper 80, the inner plug wrapper 94, and the filter material 92 of the cutout segment 98 have reached their fully or nearly fully compressed state at the inflection point α.

[0066] Supposing that the pressing operation by the rheometer 100 for the cutout segment 98 represents a finger pushing action by the user, it can be presumed that the user would recognize the repulsive force from the shell of the capsule 78 at the inflection point α through the fingers, etc. It is also presumed that, after the inflection point α, the user would then feel that the user is deforming the shell of the capsule 78 via the tipping paper 56, the wrapper 80, the inner plug wrapper 94, and the filter material 92.

[0067] In the example shown in FIG. 5, the capsule 78 was broken at a point indicated by symbol "β" between the pressing ratio values of 0.4 and 0.5. The capsule 78 in this case was broken before the outer diameter of the cutout segment 98 was reduced to half.

[0068] In the example shown in FIG. 5, the repulsive force immediately after the breakage of the capsule 78 stopped dropping at point γ where it was not below the repulsive force corresponding to the inflection point α, and then rose again to exceed the repulsive force at the point β where the capsule 78 was broken. Upon breakage of the capsule 78, the repulsive force as a ratio value dropped from 1 to approximately 0.6 and then rose again. It can be said that, if the degree of dropping of the repulsive force (difference H in repulsive force values) at this time is large, the user can easily sense the breakage of the capsule 78.

[0069] Note that the experiment for measuring the

repulsive force of the cutout segment 98 shown in FIG. 4 was conducted under the condition that only the cutout segment 98 was subjected to pressing. In this way, it is possible to avoid simultaneous pressing of a segment of the rod 14 that was integrated with the cutout segment 98 before the cutting out of the cutout segment 98. Accordingly, the graph shown in FIG. 5 can be made free from the influence of the material of the segment originally integrated with the cutout segment 98.

[0070] As shown in FIG. 7, a rod 214 including a mouthpiece segment 254 without a capsule was prepared for comparison. A portion of the rod 214 in the vicinity of the mouthpiece end was cut out as a cutout segment 298 corresponding to the cutout segment 98 described above. The cutout segment 298 was formed to have the same construction as that of the cutout segment 98 (cf., FIGS. 1, 2, and 4) except that the capsule 78 was absent and that the portion where the capsule 78 was absent was occupied by a filter material. Thus, the tipping paper, the wrapper, the inner plug wrapper, and the filter material for the cutout segment 298 are assumed to be the same as the tipping paper 56, the wrapper 80, the inner plug wrapper 94, and the filter material 92 of the cutout segment 98. It is assumed that the rheometer 100 shown in FIG. 7 is the same as the rheometer 100 shown in FIG. 4, and that they operate in the same manner.

[0071] FIG. 8 shows the relationship between the pressing rate and the repulsive force in the case of compressing the cutout segment 298 of the rod 214 using the rheometer 100. In the example shown in FIG. 8, there was no point where the inclination of the repulsive force was suddenly changed even with an increased pressing rate, in contrast to the example shown in FIG. 5, and this was presumably because the capsule 78 as shown in FIG. 4 was absent. In other words, in the example shown in FIG. 8, the inflection point α as shown in FIG. 5 did not appear.

[0072] Note, additionally, that even in instances where the cutout segment 298 shown in FIG. 7 contains a capsule 78, the capsule 78 can be easily compressed and flattened together with the tipping paper, the wrapper, the inner plug wrapper, and the filter material if the capsule 78 is as soft as or softer than the compressed filter material. As such, if the capsule 78 is softer than the compressed filter material, it would be likely that the point where the inclination of the repulsive force shows a sudden change will not appear even with an increased pressing rate.

[0073] The experiment for measuring the repulsive force of the cutout segment 298 shown in FIG. 7 was conducted under the condition that only the cutout segment 298 was subjected to pressing. In this way, it is possible to avoid simultaneous pressing of a segment of the rod 214 that was integrated with the cutout segment 298 before the cutting out of the cutout segment 298. Accordingly, the graph shown in FIG. 8 can be made free from the influence of the material of the segment originally integrated with the cutout segment 298.

[0074] Based on the foregoing, it is presumed that the cutout segment 98 of the rod 14 would show an inflection point α as shown in FIG. 5 provided that the capsule 78 is suitably rigid relative to the filter material 92. That is, it can be said that the presence of the capsule 78 would be more easily perceived if the inclination degree after the inflection point α is larger than that before the inflection point α so that a greater change in inclination occurs through the inflection point α. It is also presumed that if the capsule 78 gives a small (weak) repulsive force at the initial compression stage and the shell of the capsule 78 is soft, the inflection point α tends to be unrecognizable and the presence of the capsule 78 would not be easily perceivable; in that case, a user could misperceive that only the tipping paper 56, the wrapper 80, the inner plug wrapper 94, and the filter material 92 are compressed and the capsule 78 is not compressed, even if the fingers of the user are actually compressing the tipping paper 56, the wrapper 80, the inner plug wrapper 94, the filter material 92, and also the capsule 78. Therefore, it is preferable that the capsule 78 for use in the rod 14 of the heating type flavor inhalation system 10 give a large repulsive force at the initial compression stage under the hot and humid condition as discussed above.

[0075] FIG. 9 shows, in the left portion, a device 110 adapted to maintain a given temperature and humidity in the inner space. In the device 110, a temperature and a humidity corresponding to those created upon performing inhalation from the mouthpiece end 14b of the rod 14 with the appropriate use of the heating type flavor inhalation system 10 according to the present embodiment were reproduced, and capsules 78 were stored under this condition. More concretely, the inside of the device 110 was set to a temperature of 45 °C and a humidity of 90% RH, and the capsules 78 were stored for 10 minutes. Thereafter, the capsules 78 were subjected to the same measurement as described above at normal temperature and normal pressure using the above described rheometer 100. The measurement was conducted and finished in such a manner that the breakage of the capsule 78 was completed within 4 minutes after the capsule 78 was taken out from the device.

[0076] Note that a variation in the temperature and the humidity in the device 110 by, for example, $\pm$ several % with respect to the target temperature and humidity condition (e.g., 45 °C and 90% RH) is tolerated.

[0077] Here, as the subject capsules 78, three kinds of capsules having the same or substantially the same outer diameter but differing in composition were prepared and subjected to the above described measurement using the above described rheometer 100 without the presence of the tipping paper 56, the wrapper 80, the inner plug wrapper 94, and the filter material 92 (cf., FIGS. 1 and 2). Although not shown, for convenience, the three kinds of capsules 78 having different compositions will be referred to as a first capsule 78a (a preferred example), a second capsule 78b (a comparative example 1), and a third capsule 78c (a comparative example 2). Here, the

first capsule 78a had a shell composition constituted by 90% deacylated gellan gum, 8% oxidized starch, and 2% calcium chloride. The second capsule 78b had a shell composition constituted by 46% dextrin, 38% gelatin, 14% deacylated gellan gum, and 2% calcium chloride. The third capsule 78c had a shell composition constituted by 50% carrageenan, 35% oxidized starch, 13% glycerin, and 2% calcium chloride.

[0078] FIG. 10 shows results of the measurement of displacements (mm) and repulsive forces (N) of the three kinds of capsules 78 (capsules 78a, 78b, and 78c) differing in compositions, that is, shows all aspects of the measurement graph. FIG. 11 is an enlarged view of the portion surrounded by broken lines indicated by symbol "XI" in FIG. 10.

[0079] As shown in FIGS. 10 and 11, the first capsule 78a, the second capsule 78b, and the third capsule 78c show largely different stresses (repulsive forces) (N) against an initial displacement of, for example, 1 mm or less. The user can perceive that the capsule 78 has a larger hardness as the stress against the displacement increases.

[0080] The first capsule 78a and the second capsule 78b were broken at approximately 1.5 mm, whereas the third capsule 78c was broken at a point beyond 2 mm.

[0081] A rod 14 including the first capsule 78a, a rod 14 including the second capsule 78b, and a rod 14 including the third capsule 78c were prepared. These capsules 78a, 78b, and 78c were not exposed to a hot and humid environment such as the 45 °C and 90% RH condition as discussed above. Then, sensory evaluation (blind evaluation) on the feeling of breaking the capsules 78a, 78b, and 78c in the respective rods 14 were conducted by seven experts and FIG. 12 shows the results of the same. More specifically, the rods 14 in the unused state were each properly set in the heater 12, and the feeling of breaking each of the capsules 78a, 78b, and 78c after appropriately performing three inhalation actions was evaluated. At this time, the capsules 78a, 78b, and 78c had been exposed to a hot and humid environment, e.g., the 45 °C and 90% RH condition.

[0082] The employed scoring criteria were "5" for the best feeling of breaking to "1" for the worst feeling of breaking. The experimental results shown in FIG. 12 are average values.

[0083] The first capsule 78a was evaluated as giving a better feeling of breaking than the second capsule 78b and the third capsule 78c. The second capsule 78b was evaluated as giving a better feeling of breaking than the third capsule 78c but a worse feeling of breaking than the first capsule 78a. The third capsule 78c was evaluated as giving a worse feeling of breaking than each of the second capsule 78b and the third capsule 78c.

[0084] As noted above, the first capsule 78a was evaluated as giving a better feeling of breaking than each of the second capsule 78b and the third capsule 78c.

[0085] Presumably, this is attributable to its large stress against the displacement as shown in FIG. 10. It is presumed that the difference in height H between the point β and the point γ as shown in FIG. 5 would become greater as the degree of stress against the displacement is increased. It is presumed that, as the change in the stress value becomes larger and more sudden, the breakage of the capsule 78 would be perceived by the user with a more comfortable feeling.

[0086] Also, the first capsule 78a shows a high stress against the initial displacement as compared to the second capsule 78b and the third capsule 78c. Thus, it is presumed that the user would perceive the first capsule 78a to be adequately hard. That is, it is presumed that, in the state where the first capsule 78a is adopted in the mouthpiece segment 54 of the rod 14, the user can easily recognize the inflection point corresponding to the point α as shown in FIG. 5, as compared to the cases of using the second capsule 78b and the third capsule 78c.

[0087] Presumably, the displacement of the first capsule 78a that was produced from the start of its deformation to the breakage was neither too small nor too large. Thus, it is presumed that the first capsule 78a was successfully broken within a range of displacement for which the user had an increasing expectation, between the point at which the user became aware of pressing the first capsule 78a with fingers, teeth, or the like and the point of breakage of the first capsule 78a. Therefore, it is presumed that the user gave a favorable evaluation to the first capsule 78a (the rod 14 including the first capsule 78a).

[0088] It is also presumed that the time from the start of deformation to the breakage of the first capsule 78a was neither too short nor too long. Thus, it is presumed that the first capsule 78a was successfully broken within a period of time for which the user had an increasing expectation, between the point at which the user became aware of pressing the first capsule 78a with fingers, teeth, or the like and the point of breakage of the first capsule 78a. Therefore, it is presumed that the user gave a favorable evaluation to the first capsule 78a (the rod 14 including the first capsule 78a).

[0089] As noted above, the second capsule 78b was evaluated as giving a better feeling of breaking than the third capsule 78c, while it was evaluated as giving a worse feeling of breaking than the first capsule 78a.

[0090] As shown in FIG. 11, the second capsule 78b is smaller and softer than the first capsule 78a in the course of initial displacement up to the displacement of 1 mm. As such, it is presumed that, with the use of the second capsule 78b, an inclination difference between before and after the inflection point α as shown in FIG. 5 would be smaller than that appearing in the case of using the first capsule 78a. Thus, it is presumed to be difficult for the user to recognize the pressing of the second capsule 78b, and such recognition would be delayed, as compared to the case of using the first capsule 78a.

[0091] It is also presumed that, with the use of the second capsule 78b, the stress at the breakage would be small and the difference in the height H between the

point β and the point γ as shown in FIG. 5 would also be small as compared to the case of using the first capsule 78a. Therefore, it is presumed that the user gave a less favorable evaluation in the feeling of breaking to the second capsule 78b in the rod 14 than to the first capsule 78a in the rod 14.

[0092] As noted above, the third capsule 78c was evaluated as giving a worse feeling of breaking than each of the second capsule 78b and the third capsule 78c.

[0093] As shown in FIG. 11, the third capsule 78c is smaller and softer than the first capsule 78a in the course of initial displacement up to the displacement of 1 mm. As such, it is presumed that, with the use of the third capsule 78c, an inclination difference between before and after the inflection point α as shown in FIG. 5 would be smaller than that appearing in the case of using the first capsule 78a. Thus, it is presumed that the recognition by the user of the pressing of the third capsule 78c would be delayed as compared to the case of using the first capsule 78a.

[0094] It is also presumed that, with the use of the third capsule 78c, the stress at the breakage would be small and the difference in the height H between the point β and the point γ as shown in FIG. 5 would also be small as compared to the case of using the first capsule 78a. Therefore, it is presumed that the user gave a less favorable evaluation in the feeling of breaking to the third capsule 78c in the rod 14 than for the first capsule 78a in the rod 14.

[0095] Further, the displacement of the third capsule 78c that was produced from the start of its deformation to the breakage was larger than that of the first capsule 78a and that of the second capsule 78b. Thus, it is presumed that the third capsule 78c was broken at a point away from the peak of the range of displacement for which the user had an increasing expectation, between the point at which the user became aware of pressing the third capsule 78c and the point of breakage of the third capsule 78c. For example, it is presumed that since the user felt no breakage of the capsule 78 even by continuously pressing the exterior of the rod 14 toward the central axis with an appropriate stroke, the capsule 78 was broken after the user's expectation that the capsule will break shrunk. Therefore, it is presumed that the user gave a poor evaluation as compared to that given for the first capsule 78a and the second capsule 78b.

[0096] From a different perspective, it is presumed that the third capsule 78c might have been broken while the user remained unable to recognize the pressing of the third capsule 78c. It is thus presumed that the third capsule 78c was broken without increasing the user's expectation that the third capsule 78c will break. Therefore, it is presumed that the user gave a poor evaluation as compared to the first capsule 78a and the second capsule 78b.

[0097] Presumably, the displacement of the third capsule 78c that was produced from the start of its deformation to the breakage was too large (equal to or greater than 2 mm). Thus, it is presumed that the third capsule 78c was broken at the displacement for which the expectation of the user had shrunk, after the range of displacement for which the user had an increasing expectation, between the point at which the user became aware of pressing the first capsule 78a with fingers, teeth, or the like and the point of breakage of the third capsule 78c. It is therefore presumed that the user gave a poor evaluation for the feeling of breaking to the third capsule 78c (the rod 14 including the third capsule 78c).

[0098] It is also presumed that the time from the start of deformation to the breakage of the third capsule 78c was too long. Thus, it is presumed that the third capsule 78c was broken at the time point for which the expectation of the user had shrunk, after the period of time for which the user had an increasing expectation, between the point at which the user became aware of pressing the first capsule 78a with fingers, teeth, or the like and the point of breakage of the third capsule 78c. It is therefore presumed that the user gave a poor evaluation for the feeling of breaking to the third capsule 78c (the rod 14 including the third capsule 78c).

[0099] From the foregoing, it can be said that the most preferred form is that the rod 14 that includes the mouthpiece segment 54 with the third segment 76 in which the first capsule 78a according to the present embodiment is arranged is used together with the heater 12. More specifically, among the capsules 78 stored for 10 minutes under the condition of 45 °C and 90% RH, the capsule 78 to be employed within 4 minutes from the storage is preferably the first capsule 78a having a stress of 2 N or more against the displacement of 0.5 mm, which is larger than the stress of the second capsule 78b and the stress of the third capsule 78c. Also, the capsule 78 is preferably the first capsule 78a having a stress equal to or less than 6 N against the displacement of 5 mm, i.e., the largest repulsive force obtained in the current manufacturing technology. Note that it is more preferable for the first capsule 78a to show 2.5 N or more and 6 N or less against the displacement of 0.5 mm. Accordingly, it is possible to provide a rod 14, i.e., a non-combustion heating type flavor inhalation article, which allows the user who has performed at least one inhalation action and who intends to break the first capsule 78a to readily perceive the presence of the first capsule 78a.

[0100] Also, among the capsules 78 stored for 10 minutes under the condition of 45 °C and 90% RH, the capsule 78 to be employed within 4 minutes from the storage is preferably the first capsule 78a having a stress of 3 N or more and equal to or less than 20 N against the displacement of 1 mm, i.e., the largest repulsive force obtained in the current manufacturing technology, which is larger than the stress of the second capsule 78b and the stress of the third capsule 78c. It is more preferable for the first capsule 78a to show 4 N or more and 20 N or less against the displacement of 1 mm. The capsule 78 is preferably the first capsule 78a formed to be breakable at the displacement of 1 mm or more and 2 mm or less so that the user can receive a feeling that the stroke of the

fingers or the teeth of the user after recognition is not too small or too large. Also with these features, it is possible to provide a rod 14, i.e., a non-combustion heating type flavor inhalation article, which allows the user who has performed at least one inhalation action and who intends to break the first capsule 78a to readily perceive the presence of the first capsule 78a.

[0101] For the shell of the first capsule 78a which is employed within 4 minutes from the 10-minute storage under the condition of 45 °C and 90% RH and which has a stress of 2 N or more and 6 N or less against the displacement of 0.5 mm and a stress of 3 N or more and 20 N or less against the displacement of 1 mm, it is possible to employ, for example, any of starch, dextrin, polysaccharide, agar, gellan gum, gelatin, carrageenan, various natural gelling agents, glycerin, sorbitol, calcium chloride, etc., and the shell may further contain a flavorant and a coloring agent. The first capsule 78a may be produced from appropriate materials in an appropriate recipe so as to satisfy the property that the first capsule 78a, if employed within 4 minutes from the 10-minute storage under the above described condition of 45 °C and 90% RH, would show a stress of 2 N or more and 6 N or less against the displacement of 0.5 mm and a stress of 3 N or more and 20 N or less against the displacement of 1 mm. The shell preferably contains gellan gum and starch, and further, the weight ratio between gellan gum and starch in the shell (gellan gum: starch) is preferably from 50:1 to 1:1, and more preferably from 10:1 to 3:2. Also, the gellan gum is preferably deacylated gellan gum, and the starch is preferably oxidized starch.

[0102] The first capsule 78a suitable for the rod 14 of the heating type flavor inhalation system 10 according to the present embodiment has a shell ratio of 25 wt% or less, and the first capsule 78a is formed as a seamless member containing polysaccharide. Accordingly, it is possible to form the first capsule 78a with a hard shell, while keeping the shell weight relatively small, that is, while preventing the shell from becoming thicker. The shell thickness may be adjusted by changing the temperature, the viscosity, and the discharge amount of a fluidic shell material or a content liquid for producing the capsule in the dropping method.

[0103] It is preferable for the first capsule 78a to be employed such that the ratio of its diameter to the cross-section diameter of the filter material 92 be 45% or more and 70% or less. With the ratio of the diameter of the first capsule 78a to the cross-section diameter of the filter material 92 being 45% or more, the diameter of the first capsule 78a can have a suitable size which is larger than about half of the diameter of the mouthpiece segment 54. This allows the user to readily perceive the presence of the first capsule 78a. Also, with the ratio of the diameter of the first capsule 78a to the cross-section diameter of the filter material 92 being 70% or less, a too large pressure loss of the mouthpiece segment 54 before the breakage of the first capsule 78a can be avoided. If the ratio to the cross-section diameter of the filter material 92 exceeds 70%, troubles in inhalation actions may occur while it is easy to perceive the presence of the first capsule 78a before its breakage. As such, it is preferable that the ratio of the diameter of the first capsule 78a to the cross-section diameter of the filter material 92 be 70% or less.

[0104] Note that in the instance where the first capsule 78a is a sphere having a diameter of 3.0 mm, the mouthpiece segment 54 has a diameter of approximately 4.2 mm to 6.7 mm. In the instance where the first capsule 78a is a sphere having a diameter of 4.5 mm, the mouthpiece segment 54 has a diameter of approximately 6.4 mm to 10 mm. Thus, if the first capsule 78a is a sphere having a diameter of 3.0 mm to 4.5 mm, the mouthpiece segment 54 of the rod 14 has a diameter of approximately 4. mm to 10 mm.

[0105] Additionally, in the heating type flavor inhalation system 10, it is preferable for the filter material 92 of the third segment 76 of the rod 14 to have, for example, a suitably suppressed filling density since such a soft filter material 92 allows the user to easily recognize the capsule 78, which is harder than the filter material 92.

[0106] Generally, a plasticizer that may be contained in the filter material 92 becomes hard as its content increases. Although the filter material 92 may contain a plasticizer, it is preferred that the filter material 92 which encloses the first capsule 78a be formed to have a softness that permits the hardness of the first capsule 78a in the rod 14 to be easily perceivable after, for example, several inhalation actions with the heating type flavor inhalation system 10.

[0107] Moreover, in the heating type flavor inhalation system 10, it is preferable that the inner plug wrapper 94, the wrapper 80, and the tipping paper 56 of the third segment 76 of the rod 14 have, for example, a low basis weight and a a property of flexibility so that the hardness of the first capsule 78a in the rod 14 can be easily perceived.

[0108] According to the present embodiment as described above, it is possible to provide a non-combustion heating type flavor inhalation article 14 which allows the user who has performed at least one inhalation action and who intends to break the first capsule 78a to readily perceive the presence of the first capsule 78a.

[0109] Note that the mouthpiece segment 54 may involve various modifications.

[0110] If the second segment 74 is absent, the first segment 72 and the third segment 76 may be arranged adjacent to each other.

[0111] If the first segment 72 and the second segment 74 are both absent, the third segment 76 may be connected to the aerosol-generating segment 52 for use. The third segment 76 is preferably formed of a paper material rather than cellulose acetate fibers.

[0112] According to other options, it is also preferred that the mouthpiece segment 54 be formed only of the third segment 76 including the first capsule 78a. Also, the solid rod (filter material) 92 of the third segment 76 may be formed of paper.

[0113] The hollow rod 82 of the second segment 74 may be formed of paper.

[0114] Preferably, at least one of the hollow rod 82 of the second segment 74 and the solid rod (filter material) 92 of the third segment 76 has an adsorbent.

[0115] It is also preferred that the hollow rod 82 of the second segment 74 and the solid rod (filter material) 92 of the third segment 76 be formed as a single segment, and the first capsule 78a be arranged in this single segment.

[0116] Note that, as shown in FIG. 2, the heater element 32 and the heat transfer part 30 of the heater 12 are capable of heating the aerosol-generating segment 52 of the rod 14 from outside. As shown in FIG. 13, the heater 12 may include a heating blade 33 instead of using the heater element 32 and the heat transfer part 30. The heating blade 33 is arranged within the insertion part 42. Then, as shown in FIG. 13, upon properly inserting the end 14a of the rod 14 into the insertion part 42 by the user, the blade 33 is inserted through the end 14a into the filler 62 inside the aerosol-generating segment 52 of the rod 14. The blade 33 is then heated so that the filling 62 is directly heated. Thus, any suitable heating means may be employed in the heater 12 in the state not causing the burning of the aerosol-generating segment 52 of the rod 14.

[0117] Note that the heating mode adopted by the heater element 32 may be a mode that utilizes Joule heat from electrical resistance, and it may also adopt an induction heating (IH) mode or a mode utilizing a chemical reaction that produces oxidation heat, etc. In this case, a heat transfer part 30 suitably adapted for the heating mode is selected.

[0118] The present invention is not limited to the foregoing embodiments. For practical implementation, various modifications may be adopted without departing from the gist of the invention. Various embodiments may be discretionarily combined for implementation, and such combinations will produce combined effects. Moreover, the embodiments involve various inventive aspects, and appropriate combinations of the disclosed features will permit various inventions to be derived. For example, if omission of several features from the entire constitution or structure disclosed for the embodiments can realize the intended object and provide the effects, the constitution or structure after such omission may be derived as an invention.

[0119] According to the embodiments described above, the following can be said.

[Appendix 1]

[0120]

1. A non-combustion heating type flavor inhalation article comprising:

an aerosol-generating segment; and
a mouthpiece segment adjacent to the aerosol-generating segment, the mouthpiece segment comprising

a filter material, and
a breakable capsule within the filter material, the breakable capsule having a single-layered core-shell structure,

wherein:

the capsule is spherical or approximately spherical with a diameter of 3.0 mm to 4.5 mm, and
the capsule has a stress of 2 N or more and 6 N or less against a displacement of 0.5 mm within 4 minutes from 10 minutes of storage under a condition of 45 °C and 90% RH.

[Appendix 2]

[0121] The non-combustion heating type flavor inhalation article according to Appendix 1,
wherein the capsule has a stress of 2.5 N or more and 6 N or less against the displacement of 0.5 mm within 4 minutes from the 10 minutes of storage under the condition of 45 °C and 90% RH.

[Appendix 3]

[0122] The non-combustion heating type flavor inhalation article according to Appendix 1 or 2,
wherein the capsule has a stress of 3 N or more and 20 N or less against a displacement of 1 mm within 4 minutes from the 10 minutes of storage under the condition of 45 °C and 90% RH.

[Appendix 4]

[0123] The non-combustion heating type flavor inhalation article according to Appendix 3,
wherein the capsule has a stress of 4 N or more and 20 N or less against the displacement of 1 mm within 4 minutes from the 10 minutes of storage under the condition of 45 °C and 90% RH.

[Appendix 5]

[0124] The non-combustion heating type flavor inhalation article according to any one of Appendixes 1 to 4,
wherein the capsule is breakable at a displacement of 1 mm or more and 2 mm or less.

[Appendix 6]

[0125] The non-combustion heating type flavor inhalation article according to any one of Appendixes 1 to 5,
wherein a ratio of a diameter of the capsule to a cross-section diameter of the filter material is 45% or more and

70% or less.

[Appendix 7]

[0126] The non-combustion heating type flavor inhalation article according to any one of Appendixes 1 to 6, wherein:

a shell ratio of the capsule is 25 wt% or less, and
the capsule is a seamless member containing polysaccharide.

[Appendix 8]

[0127] The non-combustion heating type flavor inhalation article according to any one of Appendixes 1 to 7, wherein:

the filter material comprises a layer filled with cellulose acetate long fibers plasticized by a plasticizer, and
a filling density of the cellulose acetate long fiber-filled layer is 130 [mg/cc] or less.

[Appendix 9]

[0128] The non-combustion heating type flavor inhalation article according to Appendix 8, wherein:
a filament denier of the cellulose acetate long fiber-filled layer is 3.0 dpf or more and 12.0 dpf or less.

[Appendix 10]

[0129] The non-combustion heating type flavor inhalation article according to any one of Appendix 1 to 9, wherein:
the capsule comprises a shell containing gellan gum and starch.

[Appendix 11]

[0130] A non-combustion heating type flavor inhalation system comprising:

the non-combustion heating type flavor inhalation article according to any one of Appendixes 1 to 10; and
a heater configured to heat the aerosol-generating segment without burning.

[0131] 10 ... Non-combustion heating type flavor inhalation system (electric heating type flavor inhalation system), 12 ... Heater, 14 ... Rod (Non-combustion heating type flavor inhalation article), 14a ... End, 14b ... Mouthpiece end, 22 ... Housing, 24 ... Battery unit, 26 ... Switch, 28 ... Pressure sensing part, 30 ... Heat transfer part, 32 ... Heater element, 34 ... Controller, 42 ... Insertion part, 44 ... Vent hole, 52 ... Aerosol-generating segment, 54 ... Mouthpiece segment, 72 ... First segment, 74 ... Second segment, 76 ... Third segment, 78 ... Capsule, 80 ... Wrapper, 92 ... Solid rod (Filter material), 94 ... Inner plug wrapper.

Claims

1. A non-combustion heating type flavor inhalation article comprising:

an aerosol-generating segment; and
a mouthpiece segment adjacent to the aerosol-generating segment, the mouthpiece segment comprising

a filter material, and
a breakable capsule within the filter material, the breakable capsule having a single-layered core-shell structure,

wherein:

the capsule is spherical or approximately spherical with a diameter of 3.0 mm to 4.5 mm, and
the capsule has a stress of 2 N or more and 6 N or less against a displacement of 0.5 mm within 4 minutes from 10 minutes of storage under a condition of 45 °C and 90% RH.

2. The non-combustion heating type flavor inhalation article according to claim 1, wherein the capsule has a stress of 2.5 N or more and 6 N or less against the displacement of 0.5 mm within 4 minutes from the 10 minutes of storage under the condition of 45 °C and 90% RH.

3. The non-combustion heating type flavor inhalation article according to claim 1 or 2, wherein the capsule has a stress of 3 N or more and 20 N or less against a displacement of 1 mm within 4 minutes from the 10 minutes of storage under the condition of 45 °C and 90% RH.

4. The non-combustion heating type flavor inhalation article according to claim 3, wherein the capsule has a stress of 4 N or more and 20 N or less against the displacement of 1 mm within 4 minutes from the 10 minutes of storage under the condition of 45 °C and 90% RH.

5. The non-combustion heating type flavor inhalation article according to any one of claims 1 to 4, wherein the capsule is breakable at a displacement of 1 mm or more and 2 mm or less.

6. The non-combustion heating type flavor inhalation

article according to any one of claims 1 to 5, wherein a ratio of a diameter of the capsule to a cross-section diameter of the filter material is 45% or more and 70% or less.

7. The non-combustion heating type flavor inhalation article according to any one of claims 1 to 6, wherein:

a shell ratio of the capsule is 25 wt% or less, and the capsule is a seamless member containing polysaccharide.

8. The non-combustion heating type flavor inhalation article according to any one of claims 1 to 7, wherein:

the filter material comprises a layer filled with cellulose acetate long fibers plasticized by a plasticizer, and
a filling density of the cellulose acetate long fiber-filled layer is 130 [mg/cc] or less.

9. The non-combustion heating type flavor inhalation article according to claim 8, wherein: a filament denier of the cellulose acetate long fiber-filled layer is 3.0 dpf or more and 12.0 dpf or less.

10. The non-combustion heating type flavor inhalation article according to any one of claims 1 to 9, wherein: the capsule comprises a shell containing gellan gum and starch.

11. A non-combustion heating type flavor inhalation system comprising:

the non-combustion heating type flavor inhalation article according to any one of claims 1 to 10; and
a heater configured to heat the aerosol-generating segment without burning.

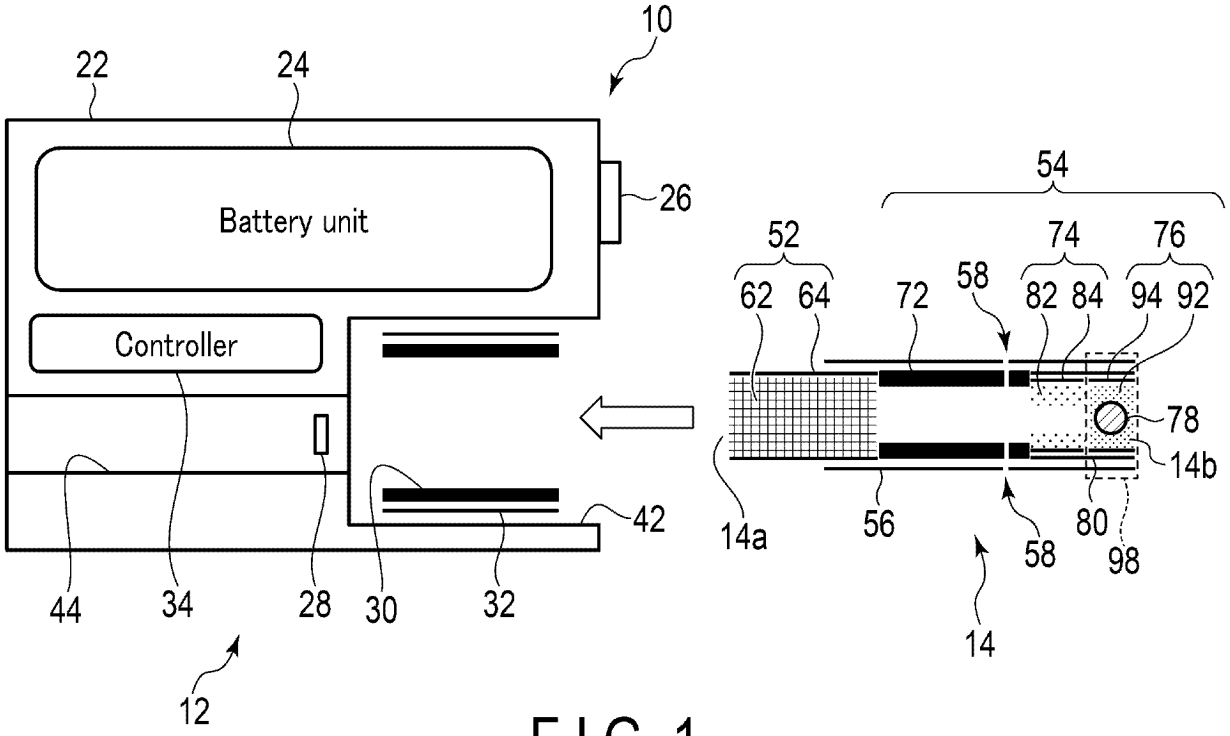
10
22
24
Battery unit
26
Controller
42
44
34
28
30
32
12
54
52
74
76
62
64
72
58
82
84
94
92
78
14b
14a
56
80
98
58
14

FIG. 1

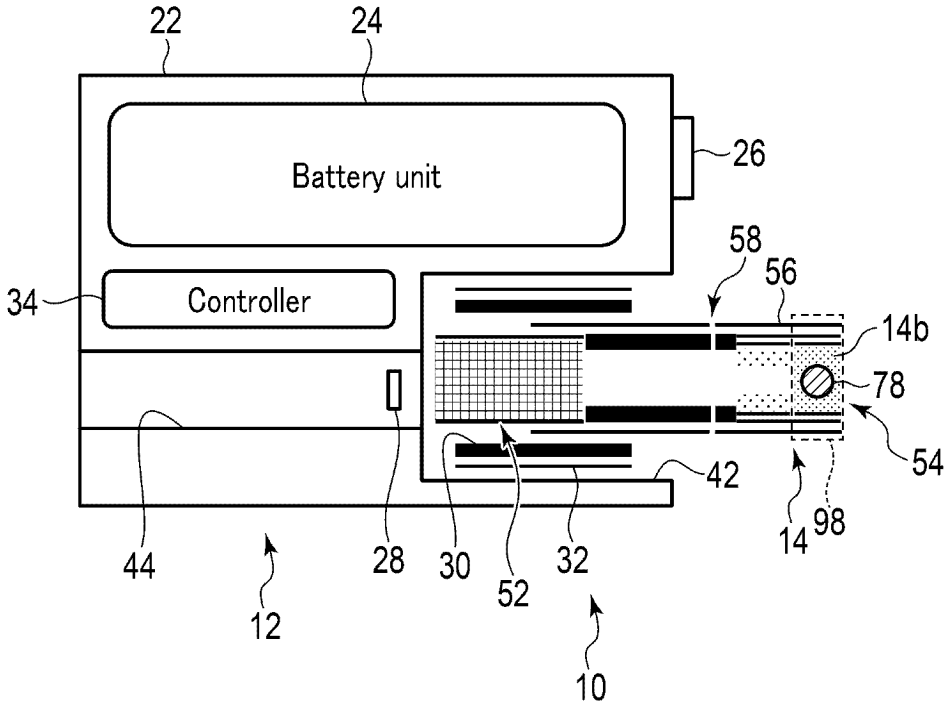
22
24
Battery unit
26
58
56
34
Controller
14b
78
54
42
44
28
30
52
32
14
98
12
10

FIG. 2

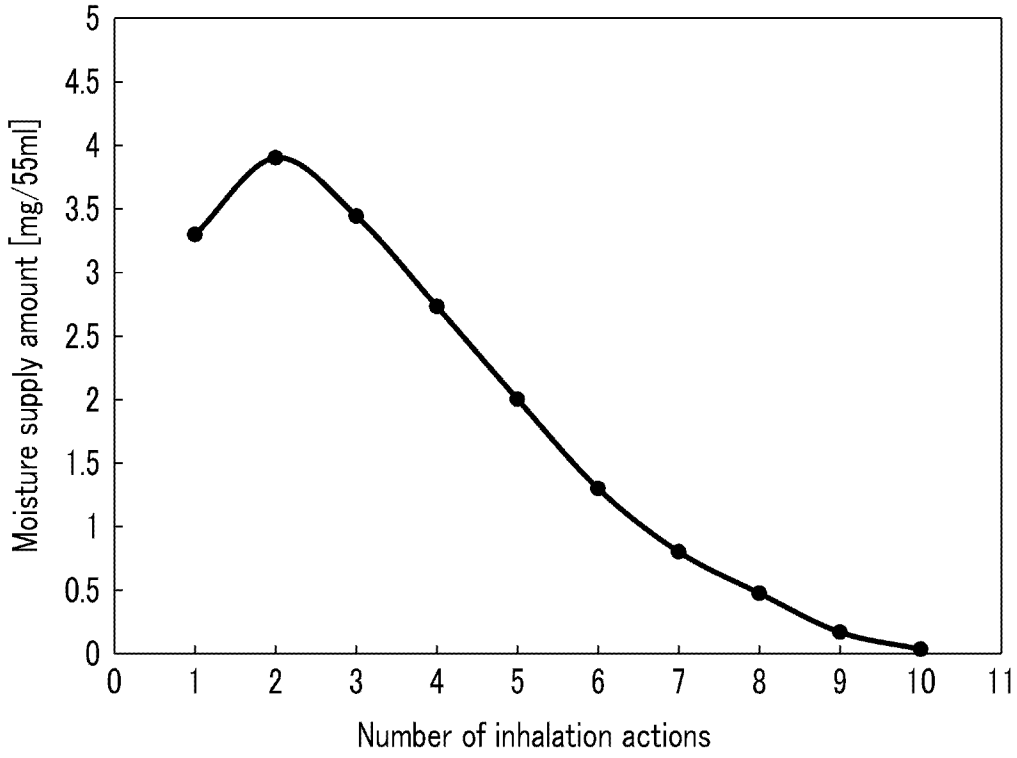
Moisture supply amount [mg/55ml]
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
0
1
2
3
4
5
6
7
8
9
10
11
Number of inhalation actions

FIG. 3

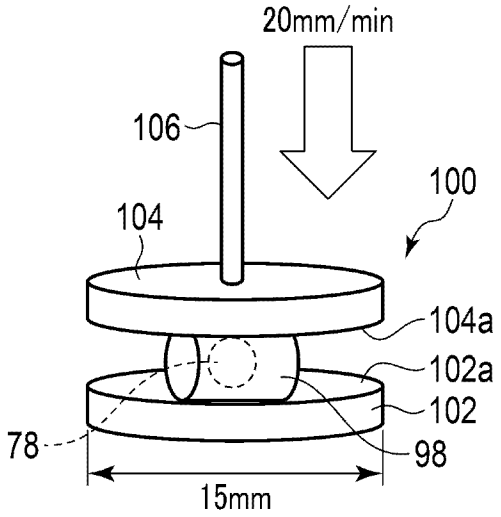
20mm/min
106
100
104
104a
102a
102
78
98
15mm

FIG. 4

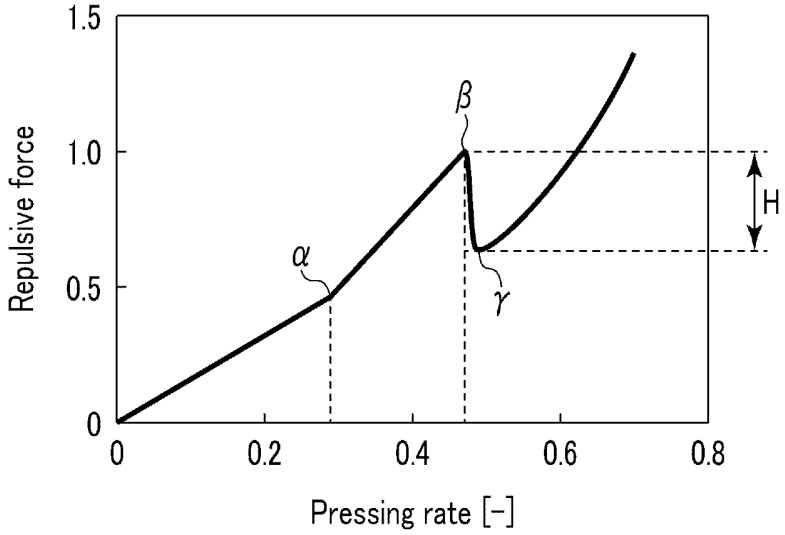

FIG. 5

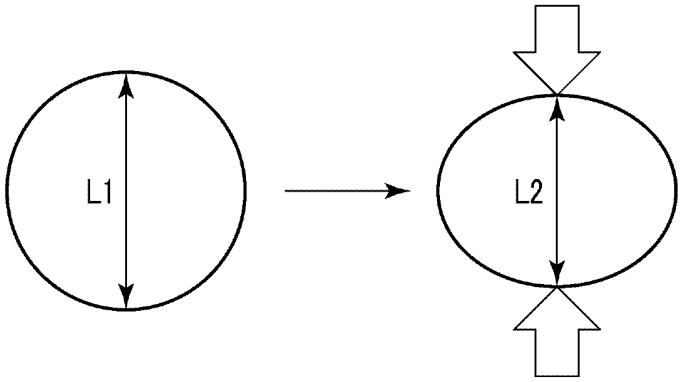

FIG. 6

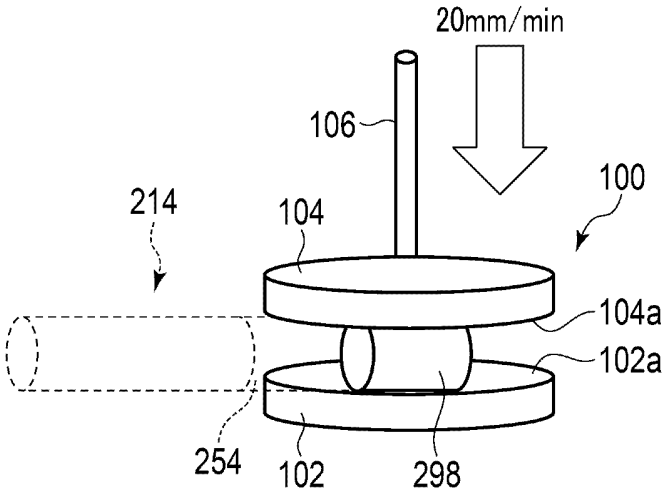

FIG. 7

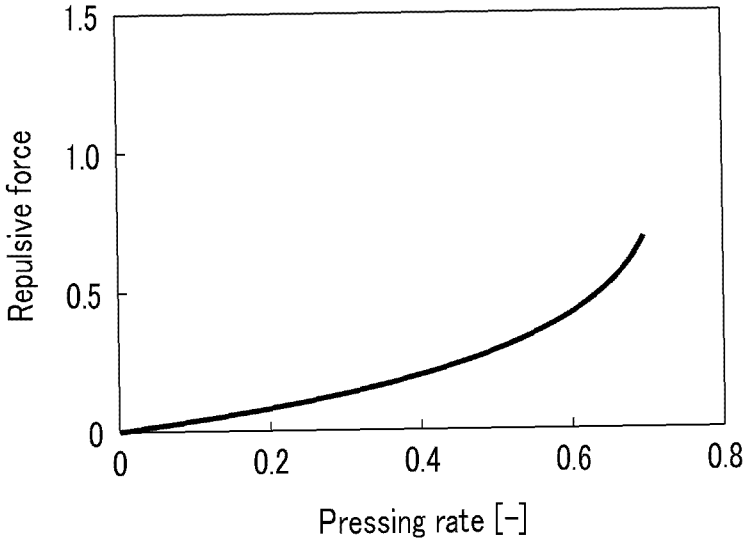

FIG. 8

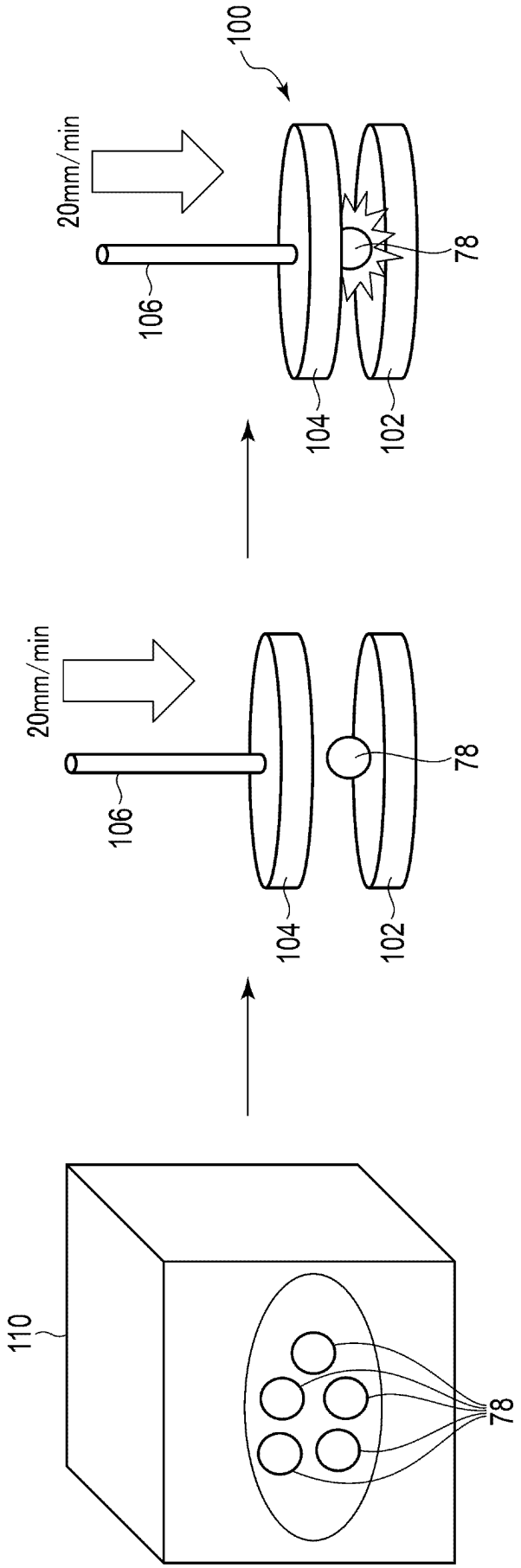

FIG. 9

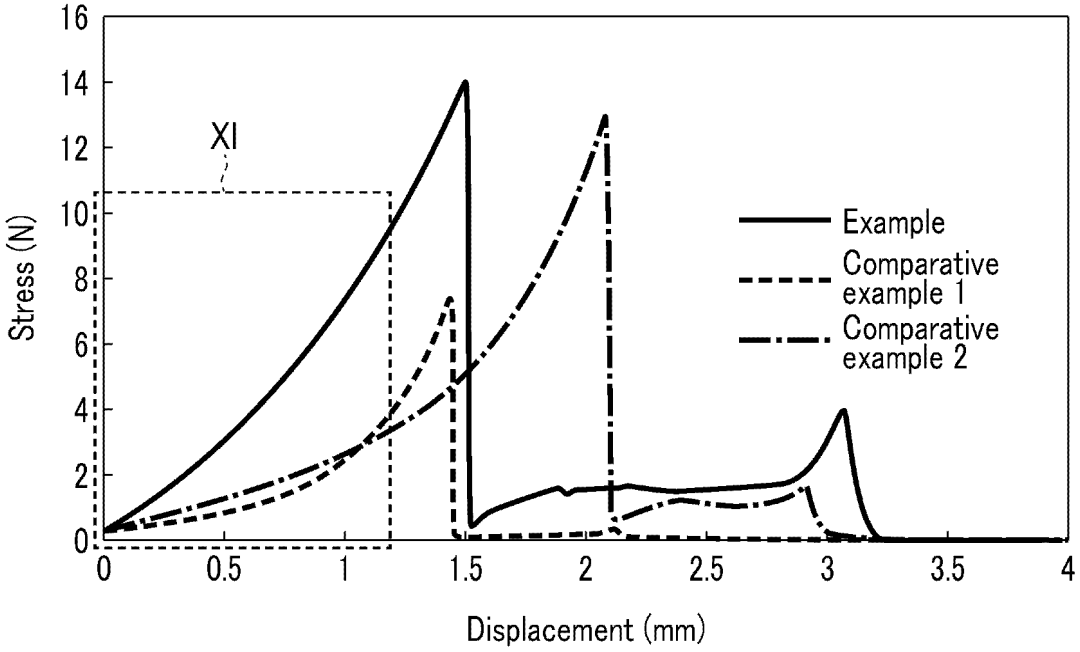
16
14
12
10
8
6
4
2
0
Stress (N)
XI
0
0.5
1
1.5
2
2.5
3
3.5
4
Displacement (mm)
Example
Comparative example 1
Comparative example 2

FIG. 10

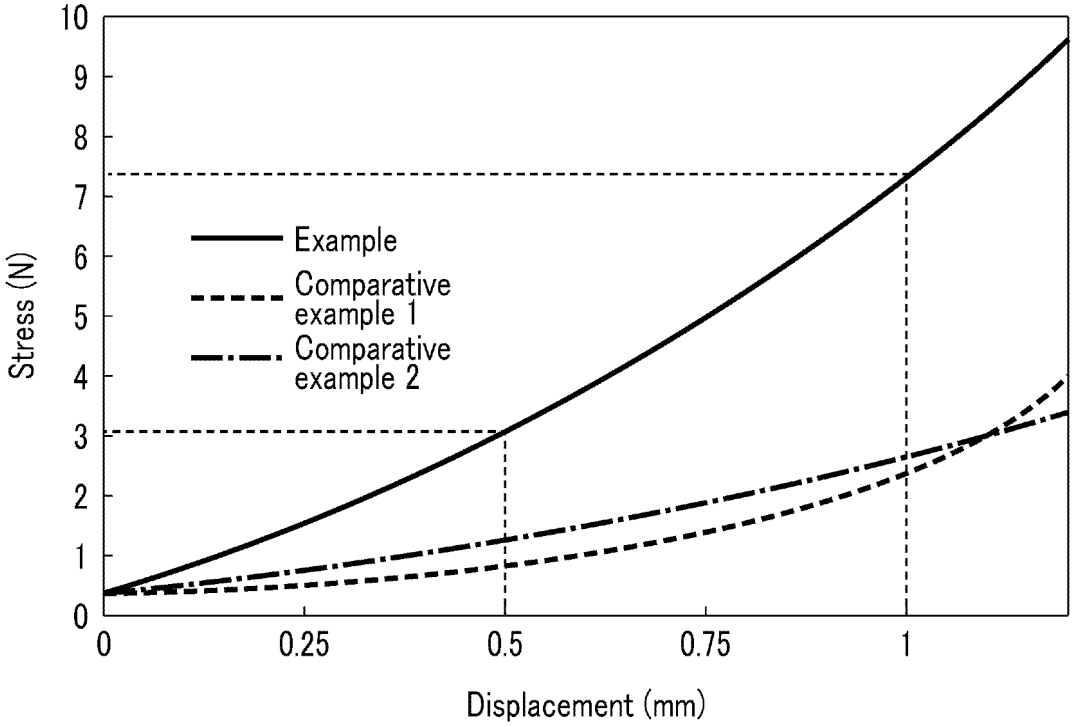
10
9
8
7
6
5
4
3
2
1
0
Stress (N)
0
0.25
0.5
0.75
1
Displacement (mm)
Example
Comparative example 1
Comparative example 2

FIG. 11

Capsule	Feeling of breaking (scored 1 to 5)
Example	4
Comparative example 1	3
Comparative example 2	2

FIG. 12

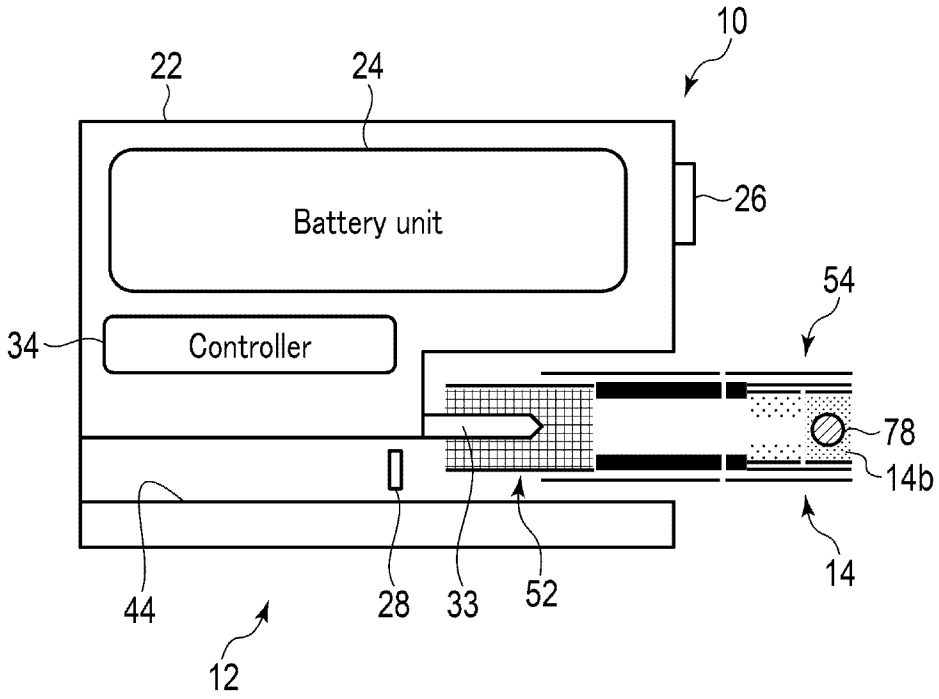

FIG. 13

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2023/029756

A. CLASSIFICATION OF SUBJECT MATTER

A24D 3/17(2020.01)i; ***A24D 3/04***(2006.01)i; ***A24F 40/20***(2020.01)i; ***A24F 40/42***(2020.01)i
FI: A24D3/17; A24D3/04; A24F40/42; A24F40/20

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; A24D3/04; A24F40/20; A24F40/42

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 1971-2023
Registered utility model specifications of Japan 1996-2023
Published registered utility model applications of Japan 1994-2023

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2019-527539 A (PHILIP MORRIS PRODUCTS S.A.) 03 October 2019 (2019-10-03) entire text, all drawings	1-11
A	WO 2013/187245 A1 (JAPAN TOBACCO INC) 19 December 2013 (2013-12-19) entire text, all drawings	1-11
A	JP 2017-511693 A (PHILIP MORRIS PRODUCTS S.A.) 27 April 2017 (2017-04-27) entire text, all drawings	1-11
A	WO 2020/148954 A1 (SANSHO PHARMA CEUTICAL CO., LTD.) 23 July 2020 (2020-07-23) entire text, all drawings	1-11

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

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
04 October 2023	**17 October 2023**
Name and mailing address of the ISA/JP **Japan Patent Office (ISA/JP)** **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/JP2023/029756

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
JP 2019-527539 A	03 October 2019	US 2019/0297937 A1 entire text, all drawings WO 2018/011660 A1 CA 3028986 A1 CN 109310147 A KR 10-2019-0025833 A	
WO 2013/187245 A1	19 December 2013	JP 2015-156806 A	
JP 2017-511693 A	27 April 2017	US 2017/0035102 A1 entire text, all drawings WO 2015/128027 A1 CN 105960177 A KR 10-2016-0125953 A	
WO 2020/148954 A1	23 July 2020	US 2022/0095674 A1 entire text, all drawings JP 6603817 B1 JP 2020-115847 A US 2020/0397038 A1 WO 2020/148924 A1 EP 3888475 A1 EP 3711497 A1 CN 113316398 A	

Form PCT/ISA/210 (patent family annex) (January 2015)

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- WO 2014171433 A **[0003]**
- WO 2018011660 A **[0003]**