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(54) **CIGARETTE**

(57) A cigarette is provided with: a tobacco rod including a tobacco filler and cigarette paper wound around the tobacco filler; a filter including a filter plug including a filtering material, a plurality of sheet members wound around the filter plug in such a manner as to form a plurality of layers, and a capsule located in the filter and including a capsule shell containing a content liquid

therein; and tipping paper wound around the tobacco rod and the filter in such a manner as to connect the tobacco rod and the filter. Each of the sheet members has a density of 0.5 to 1.0 g/cm³, and the sheet members constituting the plurality of layers have a total thickness A in a range of 100 to 250 μm.

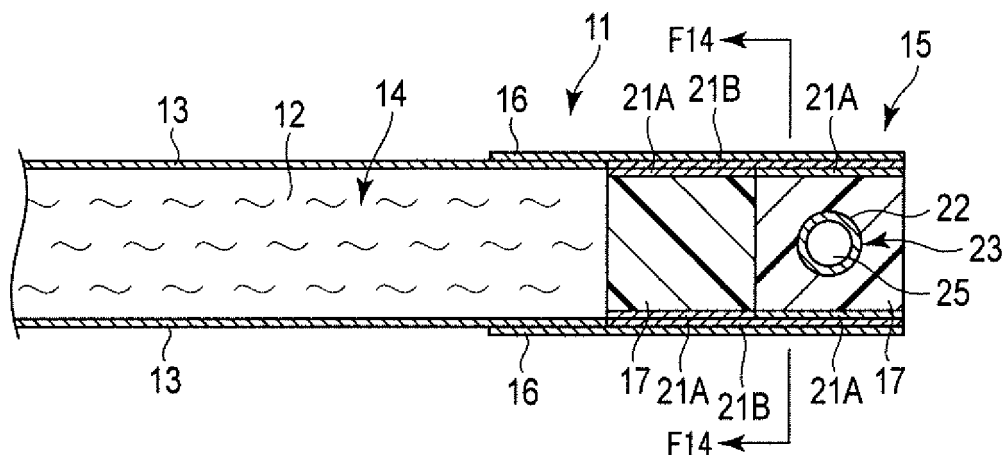


FIG. 12

Description

TECHNICAL FIELD

5 **[0001]** The present invention relates to a cigarette comprising a flavor capsule which is contained in a filter and is easy to break.

BACKGROUND ART

10 **[0002]** A flavor capsule provided in a cigarette filter is known in the art. A smoker breaks the flavor capsule so as to inhale the flavor produced by the content in the capsule at the time of smoking or to mask the smell of the cigarette butt left after the cigarette is extinguished. (Patent Documents 1 and 2) The flavor capsule is described in detail, for example, in Patent Document 3.

15 **[0003]** The flavor capsule is embedded in a filter material constituting a cigarette filter, or is arranged in a cavity section defined between a plurality of filter plugs. In either case, the flavor capsule is located within a filter, and the smoker breaks it by pressing it with a finger, with filter wrapping paper (filter wrapper or outer filter wrapper) and tipping paper being located in between.

[Prior Art Documents]

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[Patent Documents]

[0004]

25 [Patent Document 1] Jpn. Pat. Appln. KOKAI Publication No. 7-250665

[Patent Document 2] Jpn. PCT National Publication No. 2007-520204

[Patent Document 3] Jpn. PCT National Publication No. 2008-546400

SUMMARY OF THE INVENTION

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[Object of the Invention]

[0005] The present invention relates to a cigarette comprising a flavor capsule which is contained in a filter and is easy to break.

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[Means for Achieving the Object]

[0006] According to the present invention, a cigarette comprises: a tobacco rod including a tobacco filler and cigarette paper wound around the tobacco filler; a filter including a filter plug including a filtering material, a plurality of sheet members wound around the filter plug in such a manner as to form a plurality of layers, and a capsule located in the filter and comprising a capsule shell containing a content liquid therein; and tipping paper wound around the tobacco rod and the filter in such a manner as to connect the tobacco rod and the filter. The sheet members have a density of 0.5 to 1.0 g/cm³, and the total thickness of the sheet members stacked is 100 to 250 μm.

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[Advantages of the Invention]

[0007] The cigarette of the present invention is advantageous in that a flavor capsule can be easily broken, with a small force and a short pushing distance. In addition, the cigarette of the present invention enables a force applied to a finger to be distributed on a wide contact surface, and the load of the finger can be reduced, accordingly.

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BRIEF DESCRIPTION OF DRAWINGS

[0008]

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FIG. 1 is a longitudinal section showing a cigarette according to the first aspect of a reference embodiment.

FIG. 2 is a longitudinally sectional view of a cigarette according to the second aspect of the reference embodiment.

FIG. 3 is a table showing the characteristics of each test paper.

FIG. 4 schematically illustrates a measuring system employing a rheometer.

FIG. 5 is a graph representing relationships between a pushing distance of a flavor capsule and a load.
 FIG. 6 schematically illustrates how each test paper is when the same load is applied thereto.
 FIG. 7 is a graph representing relationships between paper thickness and a force transmission characteristic to a flavor capsule.
 FIG. 8 is a graph representing the distribution of pressure applied to test paper.
 FIG. 9 schematically illustrates how test paper is when the same load is applied thereto.
 FIG. 10 is a table showing relationships between a sheet member (single wrapping or double wrapping) and circularity.
 FIG. 11 is a side view showing a cigarette according to the first embodiment.
 FIG. 12 is a longitudinal section showing a cigarette according to the third aspect of the first embodiment.
 FIG. 13 is a longitudinal section showing a cigarette according to the fourth aspect of the first embodiment.
 FIG. 14 is a cross section of the cigarette depicted in FIGS. 12 and 13 and taken along line F14-F14.
 FIG. 15 is a table showing relationships between the breaking feeling and points.
 FIG. 16 is a table showing the evaluation results of the breaking feeling.
 FIG. 17 shows statistical test results of the evaluation results depicted in FIG. 16.
 FIG. 18 is a cross section of the filter of a cigarette according to the second embodiment.
 FIG. 19 is a cross section of the filter of a cigarette according to the third embodiment.
 FIG. 20 is a cross section of the filter of a cigarette according to the fourth embodiment.
 FIG. 21 is a cross section of the filter of a cigarette according to the fifth embodiment.

DESCRIPTION OF EMBODIMENTS

[Reference Embodiment]

[0009] Cigarettes according to a reference embodiment will be described. According to the reference embodiment, the flavor capsule may be embedded in a filter material constituting a cigarette filter (first aspect), or may be arranged in a cavity section defined between a plurality of filter plugs (second aspect).

[0010] As shown in FIG. 1, a cigarette 11 according to the first aspect of the reference embodiment comprises (i) a tobacco rod 14 including a tobacco filler 12 (shredded leaves, tobacco) and cigarette paper 13 wound around the tobacco filler 12; (ii) a filter 15 adjacent to the tobacco rod 14; and (iii) tipping paper 16 wound around the tobacco rod 14 and the filter 15 and serving to connect the tobacco rod 14 and the filter 15.

[0011] The filter 15 comprises a single filter plug 17, filter wrapping paper (filter wrapper) 21 wound around the filter plug 17, and a flavor capsule 23 embedded in the filter 15 (in the filter plug 17) and comprising a capsule shell 22 in which a flavor substance is contained. According to the first aspect of the reference embodiment, at least one of the filter wrapping paper 21 and the tipping paper 16 has a density of 0.5 to 1.0 g/cm³ and a thickness of 100 to 250 μm.

[0012] As shown in FIG. 2, a cigarette 11 according to the second aspect of the reference embodiment comprises (i) a tobacco rod 14 including a tobacco filler 12 and cigarette paper 13 wound around the tobacco filler 12; (ii) a filter 15; and (iii) tipping paper 16 wound around the tobacco rod 14 and the filter 15 and serving to connect the tobacco rod 14 and the filter 15.

[0013] The filter 15 comprises two filter plugs 17 separate from each other, with a cavity section 24 defined therebetween, filter wrapping paper 21 wound around the two filter plugs 17 and defining the cavity section 24, and a flavor capsule 23 located inside the cavity section 24 and comprising a capsule shell 22 in which a flavor substance is contained.

[0014] According to the second aspect of the reference embodiment, at least one of the filter wrapping paper 21 and the tipping paper 16 has a density of 0.5 to 1.0 g/cm³ and a thickness of 100 to 250 μm.

[0015] The following is a description of the features applicable to the two aspects of the reference embodiment, unless otherwise indicated.

[0016] As compared with the filter wrapping paper 21 and the paper normally used as the tipping paper 16, the paper having a density of 0.5 to 1.0 g/cm³ and a thickness of 100 to 250 μm is dense and thick. Because of this density and thickness, the paper provides a high capsule breaking performance.

[0017] The density of paper described herein is a value obtained by (i) measuring the basis weight and thickness of cigarette production paper in the methods as defined by JIS P 8124 and JIS P 8118 and (ii) applying the measurement values to the following formula:

$$\text{density (g/cm}^3\text{)} = \text{basis weight (g/m}^2\text{)} / \text{thickness (mm)} \times 1000 \dots (\text{formula 2})$$

[0018] Where paper having a density of 0.5 to 1.0 g/cm³ and a thickness of 100 to 250 μm is used as the filter wrapping paper 21, the tipping paper 16 may be paper having a density of 0.5 to 1.0 g/cm³ and a thickness of 100 to 250 μm. Alternatively, the tipping paper 16 may be paper having an density and thickness like those of normally-used tipping paper 16. Likewise, where paper having a density of 0.5 to 1.0 g/cm³ and a thickness of 100 to 250 μm is used as the tipping paper 16, the filter wrapping paper 21 may be paper having a density of 0.5 to 1.0 g/cm³ and a thickness of 100 to 250 μm. Alternatively, the filter wrapping paper 21 may be paper having an density and thickness like those of normally-used filter wrapping paper 21.

[0019] According to the reference embodiment, at least one of the filter wrapping paper 21 and the tipping paper 16 has a density of 0.5 to 1.0 g/cm³ and a thickness of 100 to 250 μm, preferably a density of 0.7 to 1.0 g/cm³ and a thickness of 180 to 250 μm, and more preferably a density of 0.8 to 1.0 g/cm³ and a thickness of 240 to 250 μm.

[0020] Even if the thickness of paper is within the range of 100 to 250 μm, the density of the paper should not be lower than 0.5 g/cm³. If the density is lower than 0.5 g/cm³, the paper is likely to deform when the flavor capsule 23 is broken. In addition, since the pressure applied to a finger is concentrated at a particular point, the flavor capsule 23 may not be easily broken. If the density of the paper exceeds 1.0 g/cm³, the manufacturing cost of the paper will be increased, which is not desirable. In order to prevent the content liquid in a capsule from oozing out, the density of paper should be preferably within the range of 0.5 to 1.0 g/cm³.

[0021] Even if the density of paper is within the range of 0.5 to 1.0 g/cm³, the thickness of the paper should not be less than 100 μm. If the thickness is less than 100 μm, the paper is likely to deform when the flavor capsule 23 is broken. In addition, since the pressure applied to a finger is concentrated at a particular point, the flavor capsule 23 may not be easily broken. If the thickness of the paper exceeds 250 μm, the wrapping step involved in the cigarette manufacture is hard to execute, and the breaking of the flavor capsule 23 may not be tactile.

[0022] The filter wrapping paper 21 according to the first aspect is also referred to as filter wrapper. Likewise, where paper having a density of 0.5 to 1.0 g/cm³ and a thickness of 100 to 250 μm is used as the wrapping paper, the basis weight thereof can be controlled to be within the range of 50 to 250 g/m² and the air permeability thereof can be controlled to be within the range of 0 to 30,000 CU. In order to prevent the liquid in the flavor capsule 23 from oozing out of the cigarette 11, the air permeability of the filter wrapping paper 21 of the first aspect can be set as 0.

[0023] The filter wrapping paper 21 according to the second aspect is also referred to as outer filter wrapper. Where paper having a density of 0.5 to 1.0 g/cm³ and a thickness of 100 to 250 μm is used as the filter wrapping paper 21, the basis weight thereof can be controlled to be within the range of 50 to 250 g/m² and the air permeability thereof can be controlled to be within the range of 0 to 30,000 CU. According to the second aspect, the flavor capsule 23 is located in the cavity section 24 of the filter 15. In order to prevent the liquid in the flavor capsule 23 from oozing out of the cigarette 11, the air permeability of the filter wrapping paper 21 of the second aspect can be preferably set as 0. Where paper having a density of 0.5 to 1.0 g/cm³ and a thickness of 100 to 250 μm is used as the filter wrapping paper 21, the tipping paper 16 may be paper having an density and thickness like those of normally-used tipping paper 16. In this case, the basis weight of the tipping paper 16 can be controlled to be within the range of 20 to 60 g/m² and the thickness thereof can be controlled to be within the range of 20 to 60 μm.

[0024] According to the first aspect of the reference embodiment, the flavor capsule 23 is embedded in the filter plug 17, and according to the second aspect of the reference embodiment, the flavor capsule 23 is located in the cavity section 24 between the filter plugs 17. Only one flavor capsule 23 may be provided in the filter 15; alternatively, a plurality of flavor capsules 23 (e.g., two to ten capsules) may be provided. Where the flavor capsule 23 is provided in the cavity section 24, only one flavor capsule 23 may be provided in one cavity section 24; alternatively, a plurality of flavor capsules 23 (e.g., two to ten flavor capsules) may be provided.

[0025] The flavor capsule 23 comprises a capsule shell 22 and a content liquid 25 containing a flavor. The capsule shell 22 may be made of starch, dextrine, polysaccharide, agar, gellan gum, gelatin, various kinds of natural gelatinizing agent, glycerin, sorbitol, calcium chloride or the like. A flavor or a coloring agent may be included in the capsule shell 22. In order for a smoker to recognize the flavor capsule 23 even where it is surrounded by opaque filter wrapping paper 21 or tipping paper 16, the flavor capsule 23 is preferably colored. To be more specific, the capsule shell 22 should preferably contain Blue 1 (Brilliant Blue FCF) or the like.

[0026] The flavor to be contained in the content liquid 25 is, for example, menthol, or an arbitrary kind of flavor used for smoking goods, such as essential oil. For example, examples of the flavor are menthol, tobacco extract, natural vegetable fragrance (e.g., cinnamon, sage, herb, chamomile, kudzu grass, hydrangea tea, clove, lavender, cardamom, clove, nutmeg, bergamot, geranium, honey extract, rose oil, lemon, orange, Chinese cinnamon, caraway, jasmine, ginger, coriander, vanilla extract, spearmint, peppermint, cassia, coffee, celery, cascarilla, sandalwood, cocoa, ylang-ylang, fennel, anise, licorice, Saint John's bread, plum extract, peach extract, or the like), saccharide (e.g., glucose, fructose, isomerized syrup, caramel, or the like), cocoa (powder, extract or the like), esters (e.g., acetic acid isoamyl, acetic acid Rina Lil, propionate isoamyl, butyric acid Rina Lil, or the like), ketones (e.g., menthone, ionone, damascenone, ethyl maltol, or the like), alcohols (e.g., geraniol, linalool, anethole, eugenol, or the like), aldehydes (e.g., vanillin, benzaldehyde, anisic aldehyde, or the like), lactones (e.g., γ-undecalactone, γ-nonolactone or the like), animal fragrances

(e.g., musk, ambergris, Chevette, castoreum, or the like), hydrocarbons (e.g., limonene, pinene, or the like). These flavors may be used singly or in a mixed state.

[0027] As a solvent of the content liquid 25, a solvent suitable to the flavor can be used. For example, medium chain fatty acid triglyceride (MCT) (specifically, capryl/capric acid glycerin), propylene glycol, water, or ethanol may be used.

[0028] Although the manufacturing method of the flavor capsule 23 is not limited to any particular one, the dropping method is advantageously used for manufacturing flavor capsules 23 having seamless capsule shells 22. This method employs a double nozzle. The content liquid 25 is discharged from the inner side nozzle, and simultaneous therewith a liquefied capsule shell substance is discharged from the outer side nozzle. As a result, the capsule shell can contain and hold the content liquid without producing any seam.

[0029] The flavor capsule 23 may be in the form of a sphere or a cylinder. The sphere includes a round object having a substantially circular section and an ellipsoidal object having an ellipsoidal section. Preferably, the flavor capsule 23 is an object having a substantially circular section. When the flavor capsule 23 is a sphere having a substantially circular section, it may have a diameter in the range of 1.0 to 8.0 mm. When it is an ellipsoidal sphere, it may have a maximal diameter in the range of 1.0 to 7.0 mm and a minimal diameter in the range of 1.0 to 7.0 mm. When it is a cylinder, it may have a circle diameter in the range of 1.0 to 7.0 mm and a height in the range of 1.0 to 7.00 mm. As should be clear from example 3 mentioned later, if the flavor capsule 23 is too small in size, the pushing distance at the time of breaking the flavor capsule 23 is inevitably long. Therefore, where the flavor capsule 23 is a sphere, its diameter should preferably be 3.0 mm or more. Likewise, where the flavor capsule 23 is a ellipsoidal object, the smallest diameter of the ellipsoidal object should preferably be 3.0 mm or more. Furthermore, where the flavor capsule is a cylinder, its circle diameter should preferably be 3.0 mm or more.

[0030] It is preferable that the flavor capsule 23 be breakable when a force of approximately 10 to 35 N is applied thereto. Where paper having a density of 0.5 to 1.0 g/cm³ and a thickness of 100 to 250 μm is used, even a comparatively hard capsule, such as a capsule that is breakable when a force in the range of approximately 25 N to 30 N is applied thereto, can be broken with a small force and with a short pushing distance. The hard capsule is advantageous in that it does not easily break when a cigarette 11 containing the capsule is exposed to high temperature or is transported.

[0031] As should be apparent from the reference embodiment mentioned later, when a capsule that is breakable with a force of about 30 N is broken directly with a finger or with outer filter wrapper (50 NFB) interposed, a local finger pressure is felt. When paper having a density of 0.5 to 1.0 g/cm³ and a thickness of 100 to 250 μm is used, however, the capsule can be easily broken without the local finger pressure being felt.

[0032] In the first and second aspects of the reference embodiment, the filter plug 17 is formed of a filter material such as acetate-tow, as in an ordinary filter cigarette. The filter plug 17 may be formed of the filter material alone; alternatively, it may be formed of the filter material and filter wrapping paper wound around the filter material. Where the filter 15 includes a plurality of filter plugs 17, the filter plug 17 on the side of the shredded tobacco and the filter plug 17 on the side of the smoker's mouth may be formed of the same material and have the same structure; alternatively, they may be formed of different materials and have different structures.

[0033] The acetate-tow may have a filament denier of 1.9 to 12.0 (g/9000m), a total denier of 10,000 to 44,000 (g/9000m), a fiber number of 830 to 23,500 (fibers), and an pressure drop of 100 to 600 (mmH₂O/120mm). A plasticizer such as triacetin may be added to the acetate-tow. The plasticizer may be added so that it can account for 6 to 10 percent by weight of the weight of the acetate-tow. Where activated carbon granules are dispersed in the acetate-tow, the plasticizer can be added so that it can account for 2 to 20 percent by weight of the weight of the acetate-tow.

[0034] If the filter material is too hard, the repulsive force which the filter plug 17 generates when the flavor capsule-containing filter is pushed increases. For this reason, the filament denier should be 3.0 (g/9000m) or more, and the total denier should be 35,000 (g/9000m) or less.

[0035] The filter 15 has a circumference of about 14 to 26 mm. Like an ordinary type of filter, the filter 15 has a length of 17 to 31 mm, for example. In the filter 15 of the first aspect, the cavity section 24 has a length greater than the size of the flavor capsule 23. For example, the length of the cavity section is 3 to 7 mm, and the length of each filter plug 17 can be 5 to 20 mm.

[0036] In the cigarette of the second aspect shown in FIG. 2, two filter plugs 17 are arranged, with one cavity section 24 located therebetween. However, n filter plugs 17 (n: an integer of 2 or more) may be arranged, with (n-1) cavity sections 24 located therebetween. The value of n is 2 to 4, preferably 2 or 3, and more preferably 2.

[0037] In the aspects of the reference embodiment, the tobacco rod 14 is like an ordinary cigarette and comprises a tobacco filler material 12 and cigarette paper 13 wound around the tobacco filler material. The tobacco rod 14 has, for example, a circumference of about 14 to 26 mm and a length of 53 to 67 mm.

[Reference Embodiment]

Example 1: the effects which the thickness and density of paper have on the pushing distance when a flavor capsule is broken

[0038] The following six types of test paper were used in Example 1 (the companies from which the test paper was commercially available are indicated within parentheses) The characteristics of each test paper are shown in FIG. 3. Each test paper was cut as a square of 2 cm x 2 cm and was used in the experiment.

- (1) 50 NFB (NIPPON PAPER PAPYLIA CO., LTD.)
- (2) HS (SHIN-TOMOE GAWA CO., LTD.)
- (3) AT (SHIN-TOMOE GAWA CO., LTD.)
- (4) HS120 (SHIN-TOMOE GAWA CO., LTD.)
- (5) S80 (NIPPON PAPER PAPYLIA CO., LTD.)
- (6) Resistive paper (NIPPON PAPER PAPYLIA CO., LTD.)

[0039] In FIG. 3, the breaking strength is a load (N) applied to the flavor capsule when the flavor capsule is broken, and the moving distance is a pushing distance (mm) for which a finger is pushed when the flavor capsule is broken. The basis weight of 50NFB is 50.0 g/m².

[0040] The flavor capsule 23 comprises a capsule shell substance (15 percent by weight) and a content liquid 25 (85 percent by weight), and was prepared using the dropping method. The main components of the capsule shell substance and content liquid constituting the flavor capsule 23 were as follows:

- (i) Capsule shell Substance
gelatin, gellan gum, starch, glycerin, and sorbitol
- (ii) Content Liquid
medium chain fatty acid medium triglyceride (tricapryl/capric acid glycerin) (83 percent by weight)

[0041] The prepared flavor capsule 23 was a sphere having a diameter of about 4.5 mm. The flavor capsule 23 had a breaking strength of about 30 N. In the present embodiment, the content liquid 25 of the flavor capsule 23 contained a solvent only and did not contain any flavor. It is demonstrated that the presence/absence of a flavor has nothing to do with the breakability of a capsule.

[0042] The relationships between the pushing distance and load required for breaking the flavor capsule 23 were examined, using the measuring system 26 shown in FIG. 4. More specifically, a flavor capsule was placed on test paper on elastic rubber, and was broken by applying a pressure from above with the pressure sensing shaft of a rheometer. The pushing distance (mm) (also referred to as a moving distance) and the load (N) were measured. The measurement was performed using Sun RHEO METER CR3000EX (commercially available from K.K. Sun Kagaku).

[0043] The results of measurement are shown in FIG. 5. In FIG. 5, (1) indicates 50NFB, (2) indicates HS, (3) indicates AT, (4) indicates HS120, (5) indicates S80, and (6) indicates resistive paper.

[0044] As can be seen from the results in FIG. 5, the pushing distances (moving distances) required for attaining the same load are shorter in the case of HS, AT, HS120 and S80 than in the case of 50NFB. On the other hand, the pushing distance (moving distance) required for attaining the same load is longer in the case of the resistive paper than in the case of 50NFB. FIG. 6 schematically shows how 50NFB, the resistive paper and S80 are when the same load is applied thereto. FIG. 6 indicates that the use of paper having a predetermined density and thickness (e.g., S80) enables a load to be applied to the flavor capsule with a short pushing distance. In addition, since the paper is not easily folded when the load is applied, the pressure for breaking the flavor capsule 23 can be distributed to a wider range of the contact surface. FIG. 6 also indicates that paper having a low density (e.g., the resistive paper) and the thin paper (e.g., 50NFB) require a long pushing distance to apply a predetermined load, and that the pressure for breaking the flavor capsule 23 is likely to concentrate at a single point because the paper is easily folded when the load is applied.

[0045] FIG. 7, prepared based on these results, shows how paper thicknesses are related to the force transmission characteristics with respect to the force transmitted to the flavor capsule 23. In FIG. 7, the abscissa axis represents the thickness of paper (μm), while the ordinate axis represents (breaking strength (N))/(moving distance (mm)). The breaking strength is a load (N) applied to the flavor capsule 23 when that flavor capsule 23 is broken, and the moving distance is a pushing distance (mm) required for the flavor capsule 23 to be broken. Where the value of (breaking strength (N))/(moving distance (mm)) is large, a high load can be applied to the flavor capsule 23 with a short pushing distance. In other words, a force can be transmitted to the flavor capsule 23 with a short pushing distance. In FIG. 7, (1) indicates 50NFB, (2) indicates HS, (3) indicates AT, (4) indicates HS120, (5) indicates S80, and (6) indicates the resistive paper. For each test paper, twenty samples were prepared, and pushing distances (mm) and loads (N) were measured using

the samples. Average values of the resultant data are plotted in the graph shown in FIG. 7. Of the data obtained using the twenty samples, typical data is selected, and the selected typical data is plotted in the graph shown in FIG. 5.

[0046] From FIG. 7, it can be understood that in the case of paper having a density of 0.5 to 1.0 g/cm³ (namely, in the case of 50NFB, HS, AT, HS120 and S80), the value of (breaking strength (N))/(moving distance (mm)) increases in accordance with an increase in the thickness of paper, so that a force can be easily transmitted to the flavor capsule with a short pushing distance. It should be noted that when the thickness of paper is about 250 μm, the value of (breaking strength (N))/(moving distance (mm)) does not increase more. In the case of the resistive paper having a thickness of 430 μm and a density of 0.27 g/cm³, the value of (breaking strength (N))/(moving distance (mm)) is small, and a force cannot be easily transmitted to the flavor capsule.

[0047] As can be seen from the foregoing, the use of paper having a density of 0.5 to 1.0 g/cm³ and a thickness of 100 μm or more enables a load required for breaking the flavor capsule to be applied with a short pushing distance. The paper having a density of 0.5 to 1.0 g/cm³ and a thickness of 100 μm or more was used in practice. It was presumed that the pressure applied to a finger was low, and the flavor capsule 23 could be easily broken with a small force. Conversely, it can be seen that paper having a density lower than 0.5 g/cm³ and paper having a thickness of less than 100 μm require a longer distance in order to apply the load for breaking the flavor capsule 23. The paper having a density lower than 0.5 g/cm³ and the paper having a thickness of less than 100 μm were used in practice. It was presumed that the pressure applied to a finger was high, that the paper was easily folded or deformed, and that the flavor capsule 23 could not be easily broken.

[0048] The different load peaks observed in FIG. 5 are attributable to the variance of the breaking strength of the flavor capsules 23.

Example 2: the effects which the thickness of paper has on the pressure distribution when a flavor capsule is broken

[0049] As in Example 1, a flavor capsule 23 was placed on test paper on elastic rubber, and was broken by applying a pressure from above with the pressure sensing shaft of a rheometer. When the capsule was broken, the pressure distribution of the test paper was measured. The pressure distribution was measured using the measuring system shown in FIG. 4 and Inastomer commercially available from INABA RUBBER CO., LTD. 50NFB and S80 used in Example 1 were used as test paper.

[0050] The results of measurement are shown in FIG. 8.

[0051] FIG. 8 shows that the pressure is highest at the center of the pressure distribution and gradually decreases in a concentric fashion in accordance with an increase in the distance from the center. In FIG. 8, the pressure is highest in the central portion (black portion in FIG. 8) of test paper 50NFB, is very high in the coarse hatching portion, and is high in the fine hatching portion.

[0052] The results shown in FIG. 8 indicate that the pressure-applied area is wider in the case of S80 than in the case of 50NFB, and that the pressure applied to the central portion is lower in the case of S80 than in the case of 50NFB. This indicates that the use of S80 (namely, test paper having a predetermined density and thickness) reduces the load applied to a finger. That is, the pressure applied to the finger does not concentrate at a local portion but is distributed to a wide range of the contact surface, when the flavor capsule is broken. FIG. 9 schematically illustrates this state, i.e., the state showing how the test paper is when the same load is applied thereto. As can be seen from FIG. 9, in the case of 50NFB (i.e., test paper that does not have a predetermined thickness), the pressure applied to a finger is likely to concentrate at a local portion and to become highest in the central portion. In the case of S80, the pressure applied to a finger can be distributed to a wide range of the contact surface and is not high in the central portion.

[First Embodiment]

[0053] The inventors thought that the circularity of the filter 15 would vary depending upon the thicknesses of the kinds of paper when various kinds of paper having different thicknesses are wound around the filter plugs 17, as in the reference embodiment. The inventors examined the circularities of cigarettes 11.

[0054] FIG. 10 illustrates how the circularities of cigarettes 11 are between the case where 50NFB is used and the case where S2000 is used. The circularity (mm) is calculated by measuring the longer diameter and shorter diameter of a cigarette 11 in the neighborhood of the filter 15, and subtracting the shorter diameter from the longer diameter, that is, circularity = longer diameter - shorter diameter ... (formula 1). When a cigarette is completely circular, there is no difference in diameter, and the value of the circularity is zero. When the cigarette is ellipsoidal, the difference between the longer diameter and the shorter diameter large, so is the value of the circularity. The measurement of the longer and shorter diameters was made using a QTM measuring device commercially available from Cerulean (a UK company).

[0055] In FIG. 10, N denotes the number of samples (the number of cigarettes examined as samples), and Ave denotes an average of circularities. SD denotes a standard deviation, Min denote a minimum value (mm), and Max denotes a maximum value (mm). The single wrapping refers to a cigarette 11 wherein one layer of either 50NFB or S2000 is

provided around the filter plug 17. The double wrapping refers to a cigarette 11 wherein two layers of 50NFB are provided around the filter plug 17.

[0056] With respect to the single wrapping of 50NFB, double wrapping of 50NFB and single wrapping of S2000 shown in FIG. 10, the average differences of circularities were examined (the difference between the population means of two groups was examined). The examination showed that there was no significant difference between the average values of circularities of the single wrapping of 50NFB and the average values of circularities of the double wrapping of 50NFB. The examination showed that there was a significant difference (significance level: 1%) between the average values of circularities of the single wrapping of 50NFB and the double wrapping of 50NFB and the average values of circularities of the single wrapping of S2000. As can be seen from this, the single wrapping of 50NFB and the double wrapping of 50NFB are superior to the single wrapping of S2000 in light of the circularity characteristic.

[0057] The cigarette 11 according to the first embodiment will be described in detail with reference to FIGS. 11 to 17. According to the first embodiment, the sheet member (filter wrapping paper 21) around the filter plug 17 has a double wrapping structure (a double layer structure), thereby improving the circularity of the cigarette 11, as compared with that of the reference embodiment. A description will be given mainly of how the first embodiment differs from the reference embodiment. As for the features common to the first embodiment and the reference embodiment, a description and illustration of them will be omitted.

[0058] In the cigarette 11 of the first embodiment, the flavor capsule 23 may be embedded in a filter material constituting a filter 15 (third aspect), as shown in FIG. 12. Alternatively, the flavor capsule 23 may be arranged in a cavity section 24 defined between a plurality of filter plugs 17 (fourth aspect), as shown in FIG. 13.

[0059] As shown in FIG. 12, a cigarette 11 according to the third aspect comprises (i) a tobacco rod 14 including a tobacco filler 12 (shredded leaves, tobacco) and cigarette paper 13 wound around the tobacco filler 12; (ii) a filter 15 adjacent to the tobacco rod 14; and (iii) tipping paper 16 wound around the tobacco rod 14 and the filter 15 and serving to connect the tobacco rod 14 and the filter 15.

[0060] The filter 15 comprises two filter plugs 17, two first filter wrapping papers 21A wound around the respective filter plugs 17, a single second filter wrapping paper 21B wound around the first wrapping paper 21A in such a manner as to cover the two filter plugs 17, and a flavor capsule 23 embedded in the filter 15 and comprising a capsule shell 22 in which a content liquid 25 including a flavor is contained.

[0061] According to the third aspect, the first filter wrapping paper 21A has a density of 0.5 to 1.0 g/cm³ and a thickness of 50 to 125 μm. The first filter wrapping paper 21A is formed, for example, of 50NFB mentioned above. The second filter wrapping paper 21BA has a density of 0.5 to 1.0 g/cm³ and a thickness of 50 to 125 μm. The first filter wrapping paper 21A and the second filter wrapping paper 21B are examples of the sheet members.

[0062] As shown in FIG. 13, a cigarette 11 according to the fourth aspect comprises (i) a tobacco rod 14 including a tobacco filler 12 and cigarette paper 13 wound around the tobacco filler 12; (ii) a filter 15; and (iii) tipping paper 16 wound around the tobacco rod 14 and the filter 15 and serving to connect the tobacco rod 14 and the filter 15.

[0063] The filter 15 comprises two filter plugs 17 separate from each other, with a cavity section 24 formed therebetween, filter wrapping paper 21A wound around the two filter plugs 17 and defining the cavity section 24 between the filter plugs 17, second filter wrapping paper 21B wound around the first filter wrapping paper 21A, and a flavor capsule 23 located inside the cavity section 24 and comprising a capsule shell 22 in which a content liquid 25 including a flavor substance is contained.

[0064] According to the fourth aspect, the first filter wrapping paper 21A has a density of 0.5 to 1.0 g/cm³ and a thickness of 50 to 125 μm. The first filter wrapping paper 21A is formed, for example, of 50NFB mentioned above. The second filter wrapping paper 21B has a density of 0.5 to 1.0 g/cm³ and a thickness of 50 to 125 μm. The second filter wrapping paper 21B is formed, for example, of 50NFB mentioned above. The first filter wrapping paper 21A and the second filter wrapping paper 21B are examples of the sheet members.

[0065] The cigarette of the third aspect and the cigarette of the fourth aspect have substantially the same sectional shape. FIG. 14 is a cross section of the cigarette depicted in FIGS. 12 and 13 and taken along line F14-F14. The following is a description applicable to both the two aspects, unless otherwise indicated.

[0066] The filter plugs 17 are filter members of acetate-tow. They may have the same characteristics; alternatively they may have different characteristics. Where the two filter plugs 17 have different characteristics, one of them may be formed of an ordinary acetate-tow filtering material, and the other may be formed of acetate-tow filtering material including activated carbon granules.

[0067] As shown in FIG. 14, the first filter wrapping paper 21A and the second filter wrapping paper 21B constituting a plurality of layers (two layers) have a total thickness A in the range of 100 to 250 μm.

[0068] As shown in FIG. 14, the filter plug 17 and the first filter wrapping paper 21A are adhered to each other at a point in the circumferential direction of the filter plug 17 by means of an adhesive (a first adhesive 31). Likewise, the filter wrapping paper 21A and the second filter wrapping paper 21B are adhered to each other at a point in the circumferential direction of the filter plug 17 by means of an adhesive (a second adhesive 32). The second wrapping paper 21B and the tipping paper 16 are adhered to each other at a point in the circumferential direction of the filter plug 17 by

means of an adhesive (a third adhesive 33). The first adhesive 31, second adhesive 32 and third adhesive 33 are provided in such a manner that they extend linearly throughout the length of the filter 15 in the longitudinal direction of the cigarette 11.

[0069] The feeling of breaking the flavor capsule was evaluated with respect to the cigarette 11 of the first embodiment (third aspect). Six male persons and six female persons actually broke flavor capsules 23 of cigarettes 11, and evaluated the easiness (difficulty) of breaking the flavor capsules 23 as points. In this evaluation, the flavor capsules 23 were broken with respect to the samples according to the third aspect of the first embodiment and the samples of comparative examples, and points were determined for the respective breaking operations. As shown in FIG. 15, seven evaluation points were assigned to the respective breaking feelings, from "very difficult" to "very easy." In the cigarettes of the comparative examples, the second filter wrapping paper 21B was made of 50NFB, for example, and the first filter wrapping paper 21A was made of LPWSOLL, for example. LPWSOLL is an ordinary type of filter wrapping paper and is thinner than 50NFB.

[0070] Evaluation results (answers to questions) are shown in FIG. 16. With respect to the cigarettes of the comparative examples, the average of the breaking feelings was 3.08, and the standard deviation was 1.83. With respect to the cigarettes of the embodiment, the average of the breaking feelings was 4.25, and the standard deviation was 1.42.

[0071] With respect to the averages of the comparative example and the embodiment, the difference between the population means of two groups was tested (t tests). Since the same persons evaluated both the comparative example and the embodiment, the evaluations of the comparative example and the evaluations of the embodiment were correlated with each other. In this case, the null hypothesis was that there was no difference between the breaking feeling of the comparative example and the breaking feeling of the embodiment. The alternative hypothesis was that where (average m_1 of the comparative example) < (average m_2 of the embodiment), the embodiment is superior to the comparative example in terms of the breaking feeling of flavor capsules. A P value is a probability of statistical value t in a standardized normal distribution. Since the alternative hypothesis is " $m_1 < m_2$ ", the t test in this case is a one-sided test.

[0072] In the results of the t test, the one-sided P value was 0.04184, which was less than a statistical significance level of 5%. Since the breaking feeling of the embodiment and the breaking feeling of the comparative example were significantly different, the alternative hypothesis that "the embodiment is superior to the comparative example in terms of the breaking feeling of flavor capsules" could be adopted. In the cigarette 11 according to the fourth aspect of the first embodiment, the flavor capsule 23 is located inside the cavity section 24. According to the fourth aspect, therefore, no repulsive force of the filter plug 17 is applied to the hand when a load is applied to the flavor capsule 23. It cannot therefore be thought that the cigarette of the fourth aspect is inferior to the cigarette of the third aspect (wherein the flavor capsule 23 is embedded in the filter plug 17) in terms of the breaking feeling of the flavor capsule 23. Therefore, the cigarette 11 of the fourth aspect is considered to provide a better breaking feeling of the flavor capsule 23 than that of the cigarette of the comparative example.

[0073] According to the first embodiment, a cigarette 11 comprises: a tobacco rod 14 including a tobacco filler 12 and cigarette paper 13 wound around the tobacco filler 12; a filter 15 including a filter plug 17 including a filtering material, a plurality of sheet members wound around the filter plug 17 in such a manner as to form a plurality of layers, and a capsule located in the filter 15 and comprising a capsule shell 22 containing a content liquid 25 therein; and tipping paper 16 wound around the tobacco rod 14 and the filter 15 in such a manner as to connect the tobacco rod 14 and the filter 15. The sheet member has a density of 0.5 to 1.0 g/cm³, and the total thickness A of the sheet members is in the range of 100 to 250 μ m.

[0074] In general, the paper used in the reference aspects (reference embodiment) has high rigidity (low flexibility) and is therefore easily bent. Such paper is not suitable for forming complete circularity of a filter 15 (cigarette 11). Owing to the features mentioned above, the first embodiment enables the cigarette 11 to have complete circularity and yet provides a better feeling when the smoker breaks the capsule. Moreover, each of the sheet members is reduced in thickness. Unlike the reference embodiment which employs one thick filter wrapping paper 21, the first embodiment provides cigarettes for which the existing tobacco making machine and filter making machine can be suitably employed. Hence, the manufacturing cost of the cigarettes according to the first embodiment is not very high as compared with the manufacturing cost of the conventional cigarettes.

[Second Embodiment]

[0075] The cigarettes 11 according to the second embodiment will be described with reference to FIG. 18. The second embodiment is similar to the first embodiment in that the double sheet member (two layers) is wound around the filter plug 17 but differs from the first embodiment in light of the structure of the sheet member. A description will be given mainly of how the second embodiment differs from the first embodiment. As for the features common to the first embodiment, a description and illustration of them will be omitted.

[0076] In the longitudinal direction, a cigarette 11 according to the second embodiment has structures similar to those of the cigarettes according to the third aspect (FIG. 12) and fourth aspect (FIG. 13) of the first embodiment.

[0077] FIG. 18 is a cross section of the cigarette 11 of the second embodiment, the cross section being taken along the line corresponding to F14-F14 in FIGS. 12 and 13.

[0078] As shown in FIGS. 12, 13 and 18, the cigarette 11 comprises (i) a tobacco rod 14 including a tobacco filler 12 (shredded leaves, tobacco) and cigarette paper 13 wound around the tobacco filler 12; (ii) a filter 15 adjacent to the tobacco rod 14; and (iii) tipping paper 16 wound around the tobacco rod 14 and the filter 15 and serving to connect the tobacco rod 14 and the filter 15.

[0079] The filter 15 comprises a single filter plug 17, filter wrapping paper 21 wound around the filter plug 17, a resin layer 35 between the filter wrapping paper 21 and the filter plug 17, and a flavor capsule 23 arranged in a similar manner to that of the third aspect (FIG. 12) or the fourth aspect (FIG. 13).

[0080] The filter wrapping paper 21 has a density of 0.5 to 1.0 g/cm³ and a thickness of 50 to 125 μm. The filter wrapping paper 21A is an example of the sheet member and is formed, for example, of 50NFB mentioned above.

[0081] The resin layer 35 is a cylindrical member covering the circumference of the filter plug 17 and extending throughout the length of the filter plug 17. The resin layer 35 has a density of 0.5 to 1.0 g/cm³ and a thickness of 50 to 125 μm. The resin layer 35 is an example of the sheet member and is formed, for example, of a hot-melt adhesive. The resin layer 35 is not limited to the hot-melt adhesive but may be another kind of material such as starch, polyvinyl alcohol, carboxymethyl cellulose-based material. The filter wrapping paper 21 and the resin layer 35 constituting a plurality of layers (two layers) have a total thickness A in the range of 100 to 250 μm.

[0082] The second wrapping paper 21A and the tipping paper 16 are adhered to each other at a point in the circumferential direction of the filter plug 17 by means of an adhesive (a first adhesive 31). The first adhesive 31 is provided in such a manner as to extend linearly throughout the length of the filter 15 in the longitudinal direction of the cigarette 11.

[0083] According to the second embodiment, at least one of the two sheet members is filter wrapping paper 21, and at least one of the sheet members is a resin layer 35. The resin layer 35 is formed of an adhesive. Even though one of the sheet members is the resin layer 35 (adhesive), the second embodiment enables the cigarette 11 to have complete circularity and yet provides a better feeling when the smoker breaks the capsule. Since the resin layer 35 is used as a sheet member, the content liquid 25 in the capsule is reliably prevented from penetrating the sheet member and oozing out therefrom.

[Third Embodiment]

[0084] A cigarettes 11 according to the third embodiment will be described with reference to FIG. 19. The third embodiment differs from the first embodiment in that a triple sheet member (three layers) is wound around the filter plug 17. A description will be given mainly of how the third embodiment differs from the first embodiment. As for the features common to the first embodiment, a description and illustration of them will be omitted.

[0085] In the longitudinal direction, the cigarette 11 according to the third embodiment has structures similar to those of the cigarettes according to the third aspect (FIG. 12) and fourth aspect (FIG. 13) of the first embodiment, though the number of sheet members (filter wrapping paper) is different.

[0086] FIG. 19 is a cross section of the cigarette 11 of the third embodiment, the cross section being taken along the line corresponding to F14-F14 in FIGS. 12 and 13.

[0087] As shown in FIGS. 12, 13 and 19, the cigarette 11 comprises (i) a tobacco rod 14 including a tobacco filler 12 (shredded leaves, tobacco) and cigarette paper 13 wound around the tobacco filler 12; (ii) a filter 15 adjacent to the tobacco rod 14; and (iii) tipping paper 16 wound around the tobacco rod 14 and the filter 15 and serving to connect the tobacco rod 14 and the filter 15.

[0088] The filter 15 comprises a filter plug 17, first filter wrapping paper 21A wound around the filter plug 17, second filter wrapping paper 21B wound around the first filter wrapping paper 21A, third filter wrapping paper 21C wound around the second filter wrapping paper 21B, and a flavor capsule 23 arranged in a similar manner to that of the third aspect (FIG. 12) or the fourth aspect (FIG. 13).

[0089] Each of the first filter wrapping paper 21A to the third filter wrapping paper 21C has a density of 0.5 to 1.0 g/cm³ and a thickness of 50 to 125 μm. The first filter wrapping paper 21A to the third filter wrapping paper 21C are examples of sheet members. The first filter wrapping paper 21A to the third wrapping paper 21C are formed, for example, of 50NFB mentioned above. The filter wrapping papers 21A, 21B and 21C constituting a plurality of layers (three layers) have a total thickness A in the range of 100 to 250 μm.

[0090] As shown in FIG. 19, the filter plug 17 and the first filter wrapping paper 21A are adhered to each other at a point in the circumferential direction of the filter plug 17 by means of an adhesive (a first adhesive 31). Likewise, the filter wrapping paper 21A and the second filter wrapping paper 21B are adhered to each other at a point in the circumferential direction of the filter plug 17 by means of an adhesive (a second adhesive 32). The second filter wrapping paper 21B and the third filter wrapping paper 21C are adhered to each other at a point in the circumferential direction of the filter plug 17 by means of an adhesive (a third adhesive 33). The third wrapping paper 21C and the tipping paper 16 are adhered to each other at a point in the circumferential direction of the filter plug 17 by means of an adhesive (a fourth

adhesive 34). The first adhesive 31 to the fourth adhesive 34 are provided in such a manner that they extend linearly throughout the length of the filter 15 in the longitudinal direction of the cigarette 11.

[0091] Even though the sheet members are made of three layers, the third embodiment enables the cigarette 11 to have complete circularity and yet provides a better feeling when the smoker breaks the capsule.

[Fourth Embodiment]

[0092] A cigarettes 11 according to the fourth embodiment will be described with reference to FIG. 20. The fourth embodiment differs from the third embodiment in light of the structure of the sheet members (filter wrapping paper and resin layer) wound around the filter plug 17. A description will be given mainly of how the fourth embodiment differs from the third embodiment. As for the features common to the third embodiment, a description and illustration of them will be omitted.

[0093] In the longitudinal direction, the cigarette 11 according to the fourth embodiment has structures similar to those of the cigarettes according to the third aspect (FIG. 12) and fourth aspect (FIG. 13) of the first embodiment, though the number of sheet members (filter wrapping paper and resin layer) is different.

[0094] FIG. 20 is a cross section of the cigarette 11 of the fourth embodiment, the cross section being taken along the line corresponding to F14-F14 in FIGS. 12 and 13.

[0095] As shown in FIG. 20, the cigarette 11 comprises (i) a tobacco rod 14 including a tobacco filler 12 (shredded leaves, tobacco) and cigarette paper wound around the tobacco filler 12; (ii) a filter 15 adjacent to the tobacco rod 14; and (iii) tipping paper 16 wound around the tobacco rod 14 and the filter 15 and serving to connect the tobacco rod 14 and the filter 15.

[0096] The filter 15 comprises a filter plug 17, first filter wrapping paper 21A wound around the filter plug 17, second filter wrapping paper 21B wound around the first filter wrapping paper 21A, a resin layer 35 interposed between the filter plug 17 and the first filter wrapping paper 21A, and a flavor capsule 23 arranged in a similar manner to that of the third aspect (FIG. 12) or the fourth aspect (FIG. 13).

[0097] Each of the first filter wrapping paper 21A and the second filter wrapping paper 21B has a density of 0.5 to 1.0 g/cm³ and a thickness of 50 to 125 μ m. The first filter wrapping paper 21A and the second filter wrapping paper 21B are examples of sheet members. The first filter wrapping paper 21A and the second wrapping paper 21B are formed, for example, of 50NFB mentioned above.

[0098] The resin layer 35 is a cylindrical member covering the circumference of the filter plug 17 and extending throughout the length of the filter plug 17. The resin layer 35 has a density of 0.5 to 1.0 g/cm³. The resin layer 35 is an example of the sheet member and is formed, for example, of a hot-melt adhesive. The resin layer 35 is not limited to the hot-melt adhesive but may be another kind of material such as starch, polyvinyl alcohol, or carboxymethyl cellulose-based material.

[0099] The filter wrapping paper 21A, the second filter wrapping paper 21B and the resin layer 35, constituting a plurality of layers (three layers), have a total thickness A in the range of 100 to 250 μ m.

[0100] As shown in FIG. 20, the first filter wrapping paper 21A and the second filter wrapping paper 21B are adhered to each other at a point in the circumferential direction of the filter plug 17 by means of an adhesive (a first adhesive 31). The second wrapping paper 21B and the tipping paper 16 are adhered to each other at a point in the circumferential direction of the filter plug by means of an adhesive (a second adhesive 32). The first adhesive 31 and the second adhesive 32 are provided in such a manner that they extend linearly throughout the length of the filter 15 in the longitudinal direction of the cigarette 11.

[0101] According to the fourth embodiment, at least one of the sheet members is filter wrapping paper 21, and at least one of the sheet members is a resin layer 35. Even though one of the sheet members is the resin layer 35, the fourth embodiment enables the cigarette 11 to have complete circularity and yet provides a better feeling when the smoker breaks the capsule. Since the resin layer 35 is used as a sheet member, the content liquid 25 in the capsule is reliably prevented from penetrating the sheet member and oozing out therefrom.

[Fifth Embodiment]

[0102] A cigarettes 11 according to the fifth embodiment will be described with reference to FIG. 21. The fifth embodiment differs from the third embodiment in light of the structure of the sheet members wound around the filter plug 17. A description will therefore be given mainly of how the fifth embodiment differs from the third embodiment. As for the features common to the third embodiment, a description and illustration of them will be omitted.

[0103] In the longitudinal direction, the cigarette 11 according to the fifth embodiment has structures similar to those of the cigarettes according to the third aspect (FIG. 12) and fourth aspect (FIG. 13) of the first embodiment, though the number of sheet members (filter wrapping paper and resin layer) is different.

[0104] FIG. 21 is a cross section of the cigarette 11 of the fifth embodiment, the cross section being taken along the

line corresponding to F14-F14 in FIGS. 12 and 13.

[0105] As shown in FIG. 21, the cigarette 11 comprises (i) a tobacco rod 14 including a tobacco filler 12 (shredded leaves, tobacco) and cigarette paper wound around the tobacco filler 12; (ii) a filter 15 adjacent to the tobacco rod 14; and (iii) tipping paper 16 wound around the tobacco rod 14 and the filter 15 and serving to connect the tobacco rod 14 and the filter 15.

[0106] The filter 15 comprises a filter plug 17, filter wrapping paper 21 wound around the filter plug 17, a first resin layer 35A interposed between the filter wrapping paper 21 and the filter plug 17, a second resin layer 35B interposed between the filter wrapping paper 21 and the tipping paper 16, and a flavor capsule 23 arranged in a similar manner to that of the third aspect (FIG. 12) or the fourth aspect (FIG. 13).

[0107] The filter wrapping paper 21 is an example of the sheet member and is formed, for example, of 50NFB mentioned above. The filter wrapping paper 21 has a density of 0.5 to 1.0 g/cm³ and a thickness of 50 to 125 μm.

[0108] Each of the first resin layer 35A and the second resin layer 35B is cylindrical and extends throughout the length of the filter plug 17. Each of the first resin layer 35A and the second resin layer 35B has a density of 0.5 to 1.0 g/cm³. Each of the first resin layer 35A and the second resin layer 35B is an example of the sheet member and is formed, for example, of a hot-melt adhesive. Each of the first resin layer 35A and second resin layer 35B is not limited to the hot-melt adhesive but may be another kind of material such as starch, polyvinyl alcohol, or carboxymethyl cellulose-based material.

[0109] The filter wrapping paper 21, first resin layer 35A and second resin layer 35B constituting a plurality of layers (three layers) have a total thickness A in the range of 100 to 250 μm.

[0110] According to the fifth embodiment, at least one of the sheet members is filter wrapping paper 21, and at least one of the sheet members is a resin layer 35. Even though one of the sheet members is the resin layer 35, the fifth embodiment enables the cigarette 11 to have complete circularity and yet provides a better feeling when the smoker breaks the capsule. Since the resin layer 35 is used as a sheet member, the content liquid 25 in the capsule is reliably prevented from penetrating the sheet member and oozing out therefrom.

[0111] It is to be noted that the cigarettes are not limited to those described in connection with the foregoing embodiments, and the structural elements of the cigarettes can be modified in various manners without departing from the spirit when they are reduced to practice. For example, in the foregoing embodiments, the filter wrapping paper 21 is used as an example of a sheet member, but a film may be used as a sheet member. The number of sheet members (layers) is not limited to two or three but may be four or more. Furthermore, some of the structural elements may be omitted from the embodiments, and structural elements of different embodiments may be combined properly at the time of the reduction to practice of the embodiments.

[Explanation of Reference Symbols]

[0112]

11...Cigarette, 12...Tobacco Filler, 13... cigarette Paper, 14...Tobacco Rod, 15...Filter, 16...Tipping Paper, 17...Filter Plug, 21...Filter Wrapping Paper, 23...Flavor Capsule, 24...Cavity Section, 35...Resin Layer

Claims

1. A cigarette comprising:

a tobacco rod including a tobacco filler and cigarette paper wound around the tobacco filler;
a filter including a filter plug including a filtering material, a plurality of sheet members wound around the filter plug in such a manner as to form a plurality of layers, and a capsule located in the filter and comprising a capsule shell containing a content liquid therein; and
tipping paper wound around the tobacco rod and the filter in such a manner as to connect the tobacco rod and the filter,

wherein each of the sheet members has a density of 0.5 to 1.0 g/cm³, and
the sheet members constituting the plurality of layers have a total thickness in a range of 100 to 250 μm.

2. The cigarette according to claim 1, wherein the plurality of layers are two layers.

3. The cigarette according to claim 1, wherein the plurality of layers are three layers.

EP 3 072 404 A1

4. The cigarette according to any one of claims 1 through 3, wherein each of the sheet members is filter wrapping paper.
5. The cigarette according to any one of claims 1 through 3, wherein at least one of the sheet members is filter wrapping paper, and at least one of the sheet members is a resin layer.
6. The cigarette according to claim 5, wherein the resin layer includes an adhesive.
7. The cigarette according to claim 1, wherein each of the sheet members has a thickness in a range of 50 to 125 μm .

5

10

15

20

25

30

35

40

45

50

55

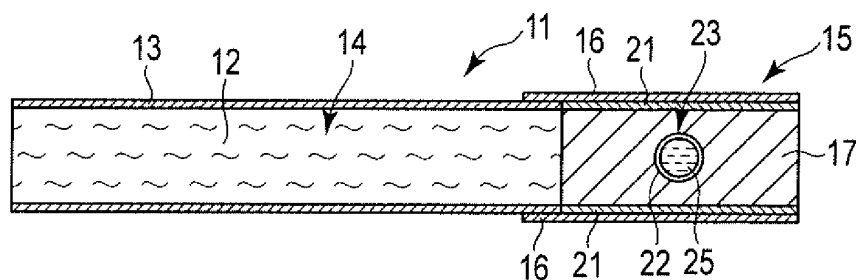


FIG. 1

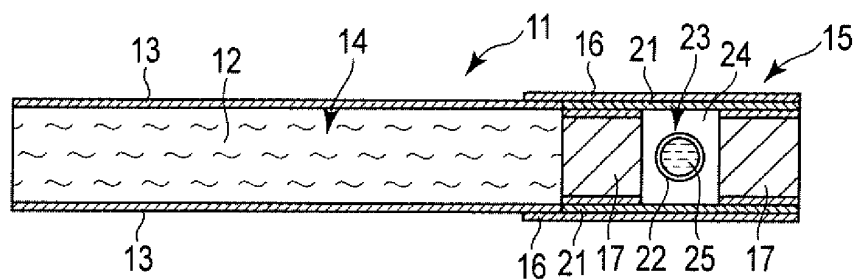


FIG. 2

	(1) 50NFB	(2) HS	(3) AT	(4) HS120	(5) S80	(6) Resistive paper
Density [g/cm ³]	0.96	0.82	0.58	0.74	0.61	0.27
Thickness [μm]	52	244	493	180	131	430
Breaking strength [N]	28.9	30.9	30.1	32.4	34.7	32.8
Moving distance [mm]	1.87	1.58	1.58	1.81	2.05	2.10
Breaking strength /Moving distance	15.3	19.4	18.9	17.6	16.8	15.3

FIG. 3

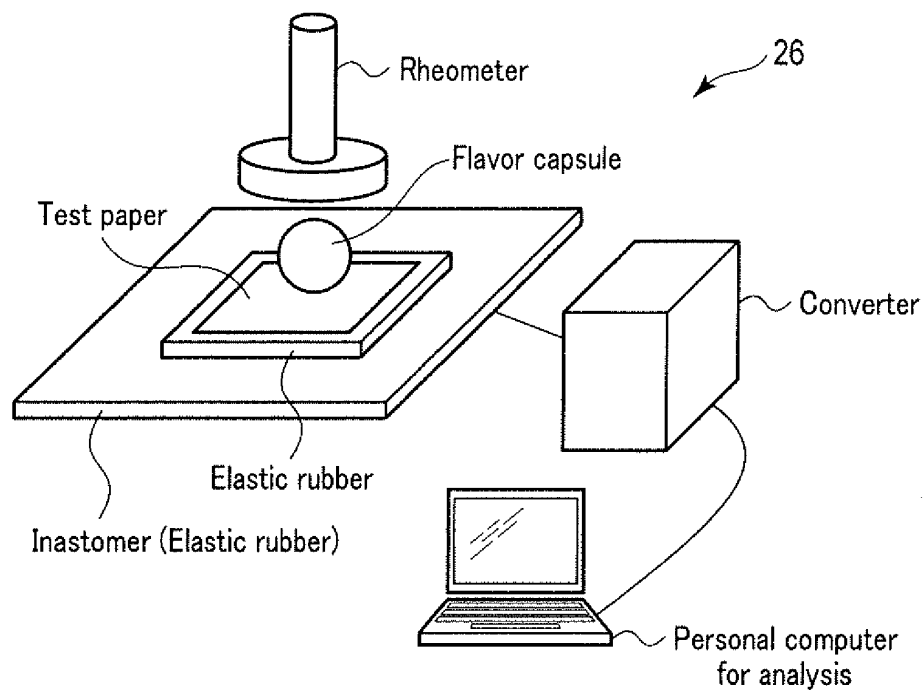


FIG. 4

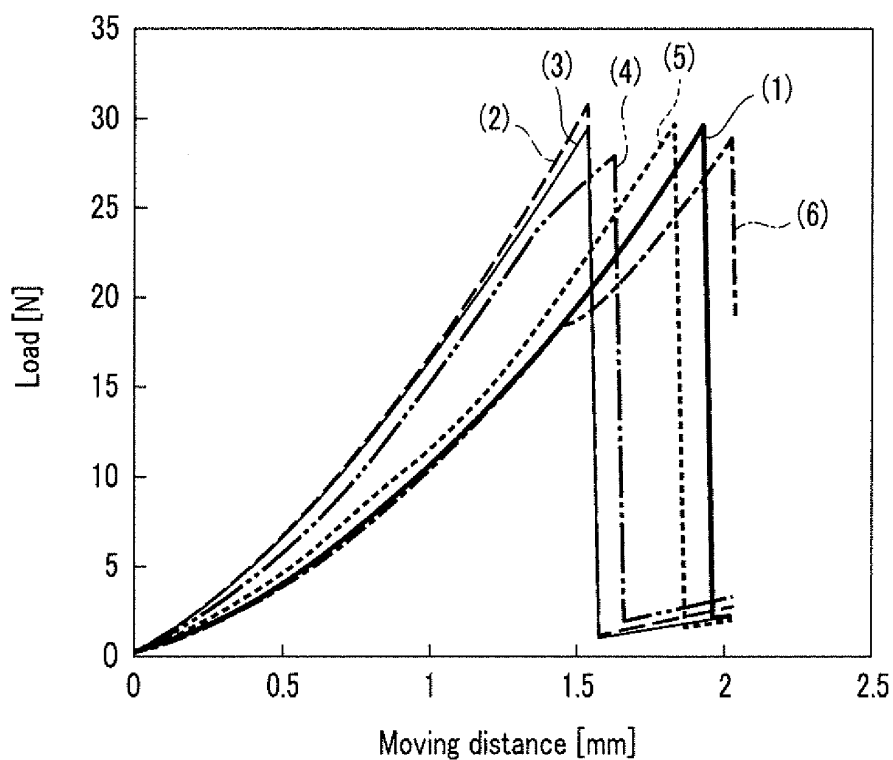


FIG. 5

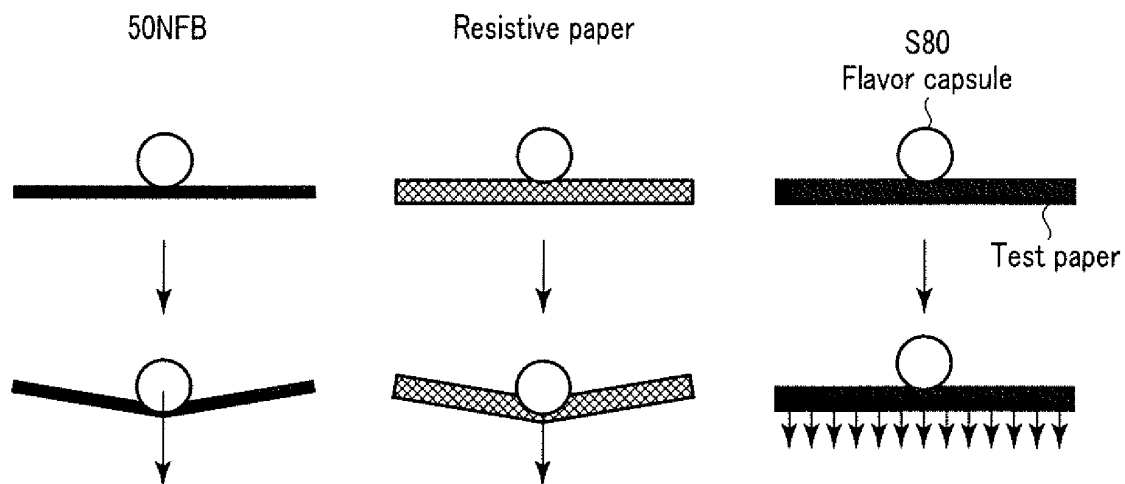


FIG. 6

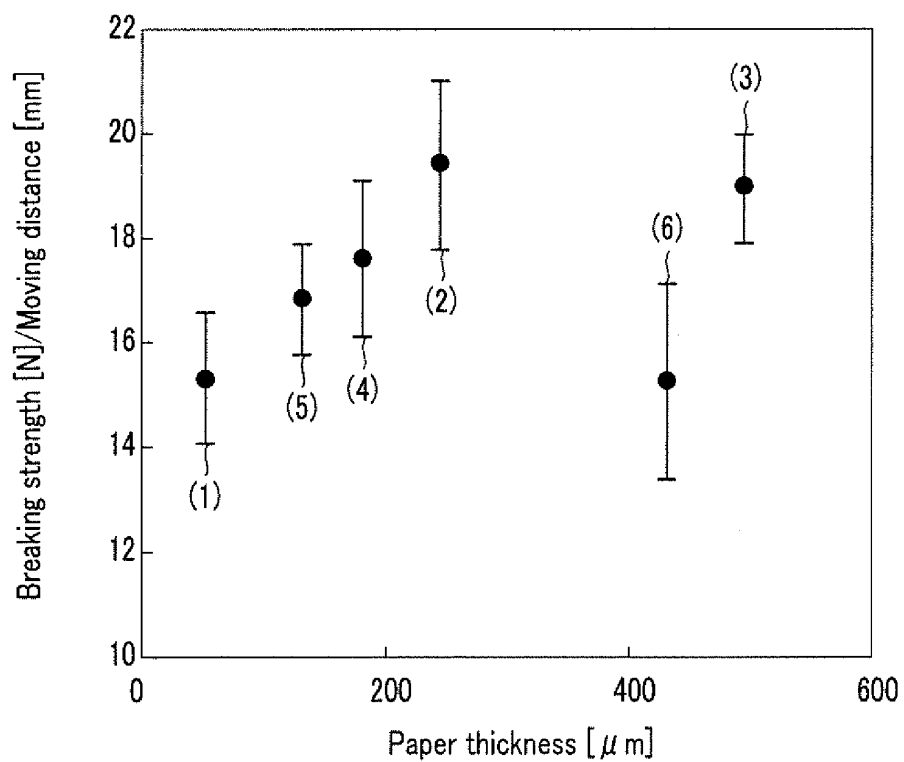


FIG. 7

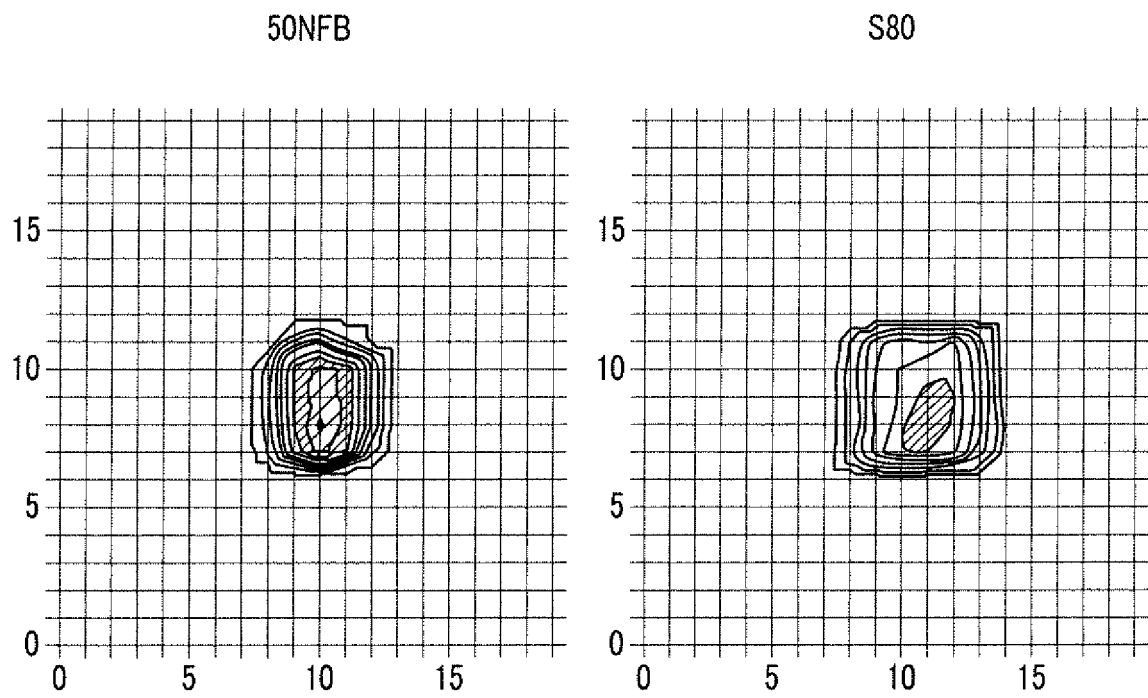


FIG. 8

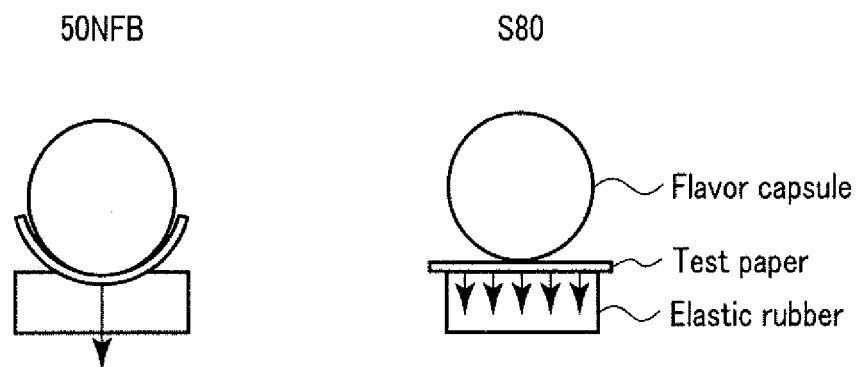


FIG. 9

	Basis weight (g/m ²)	Paper thickness (μ m)	Density (g/cm ³)	Winding manner	Circularity(mm)			
					N	Ave	SD	Min Max
50NFB	50.00	52.00	0.962	Single winding	10	0.236	0.066	0.15 0.37
					10	0.217	0.039	0.16 0.28
				Double winding	20	0.208	0.063	0.12 0.32
S2000	117.00	220.00	0.532	Single winding	10	0.649	0.038	0.60 0.73
					10	0.704	0.076	0.54 0.79

FIG. 10

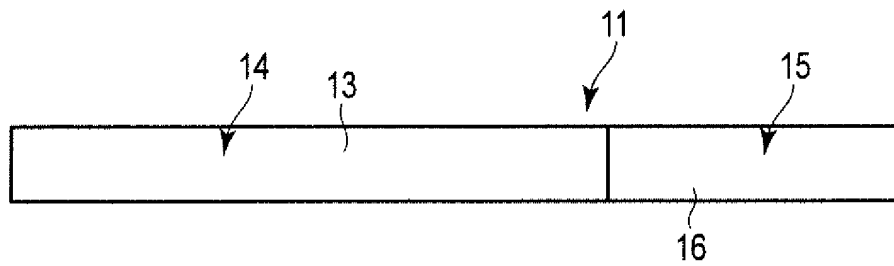


FIG. 11

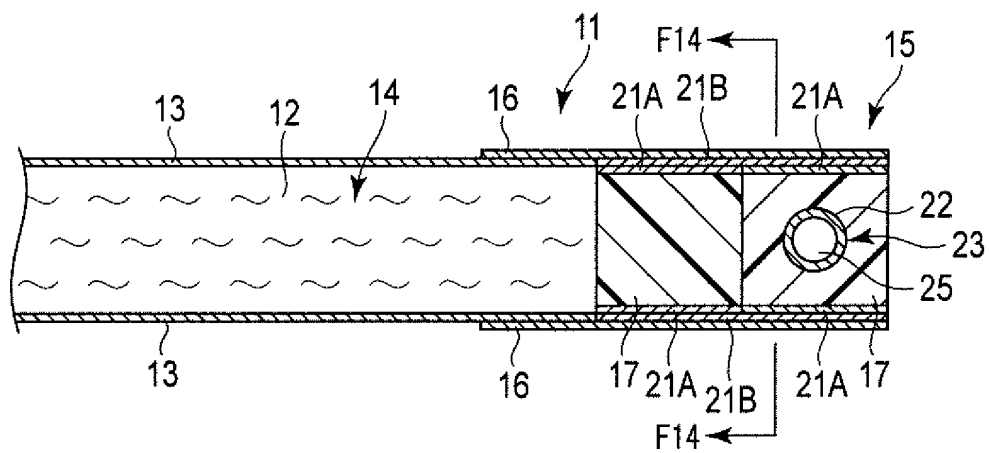


FIG. 12

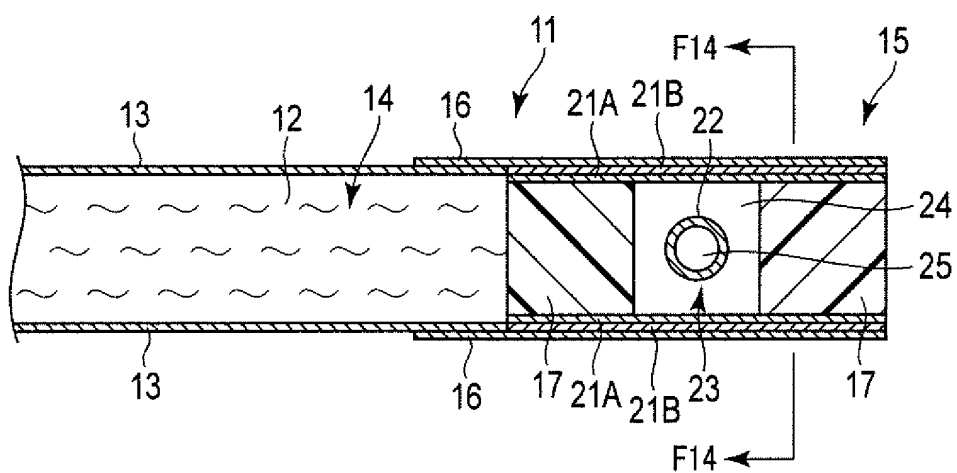


FIG. 13

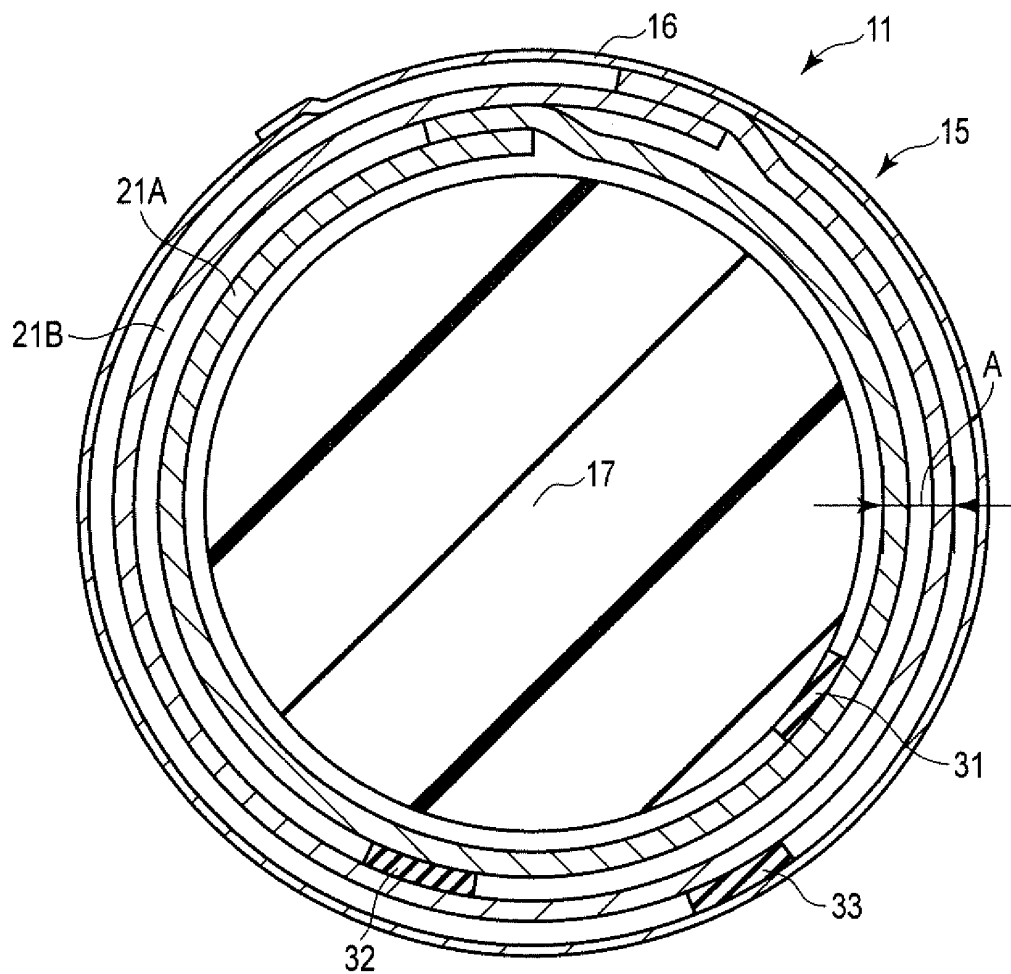


FIG. 14

Questions and points

	Points
Very difficult	1
Difficult	2
Slightly difficult	3
Medium	4
Slightly easy	5
Easy	6
Very easy	7

FIG. 15

Evaluation results

	Comparative example 50NFB+LPWSOLL	Embodiment 50NFB+50NFB
Male①	4	3
Male②	3	6
Male③	5	5
Male④	2	5
Male⑤	1	5
Male⑥	2	3
Female①	2	5
Female②	5	3
Female③	7	5
Female④	1	1
Female⑤	3	5
Female⑥	2	5
Ave	3.08	4.25
SD	1.83	1.42

FIG. 16

Test of difference between population means of two groups (correlated)

Variable	Comparative example	Embodiment	Difference	t test	
Number of samples	12	12		Statistical value: t	1.90196
Average	3.08333	4.25	1.16667	Degree of freedom	11
Unbiased estimate of population variance	3.35606	2.02273	4.51515		
Standard deviation	1.83196	1.42223	2.12489	One-sided P value	0.04184 *

FIG. 17

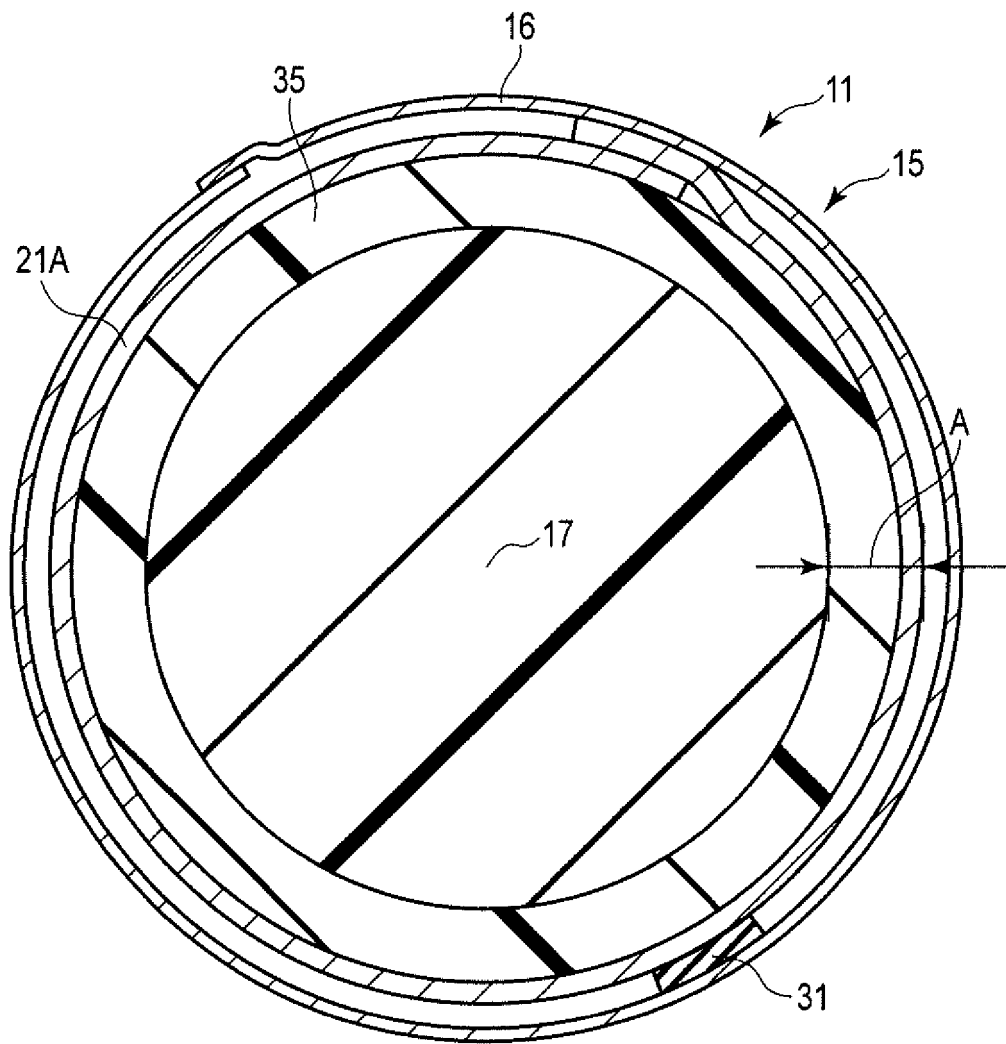


FIG. 18

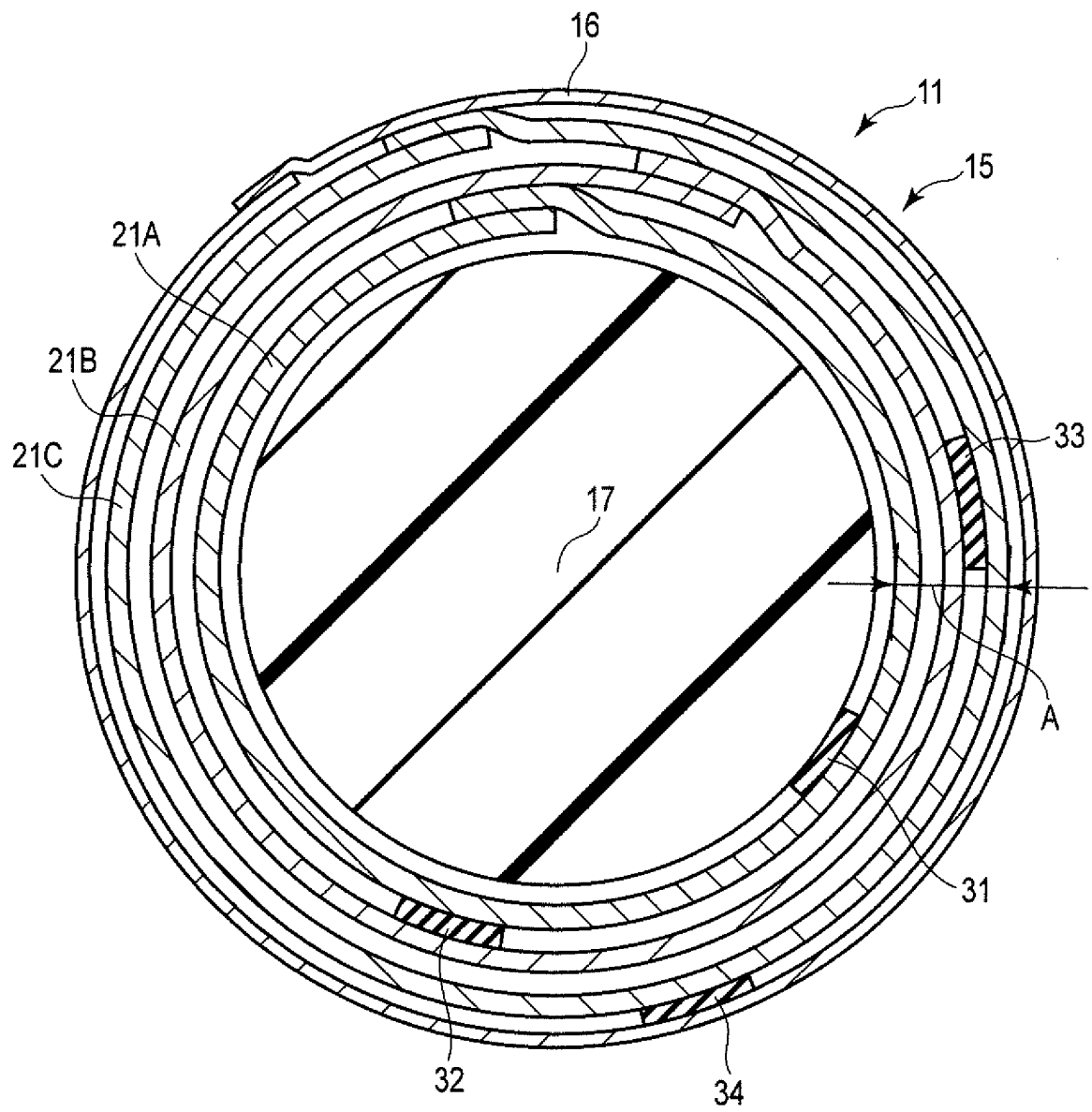


FIG. 19

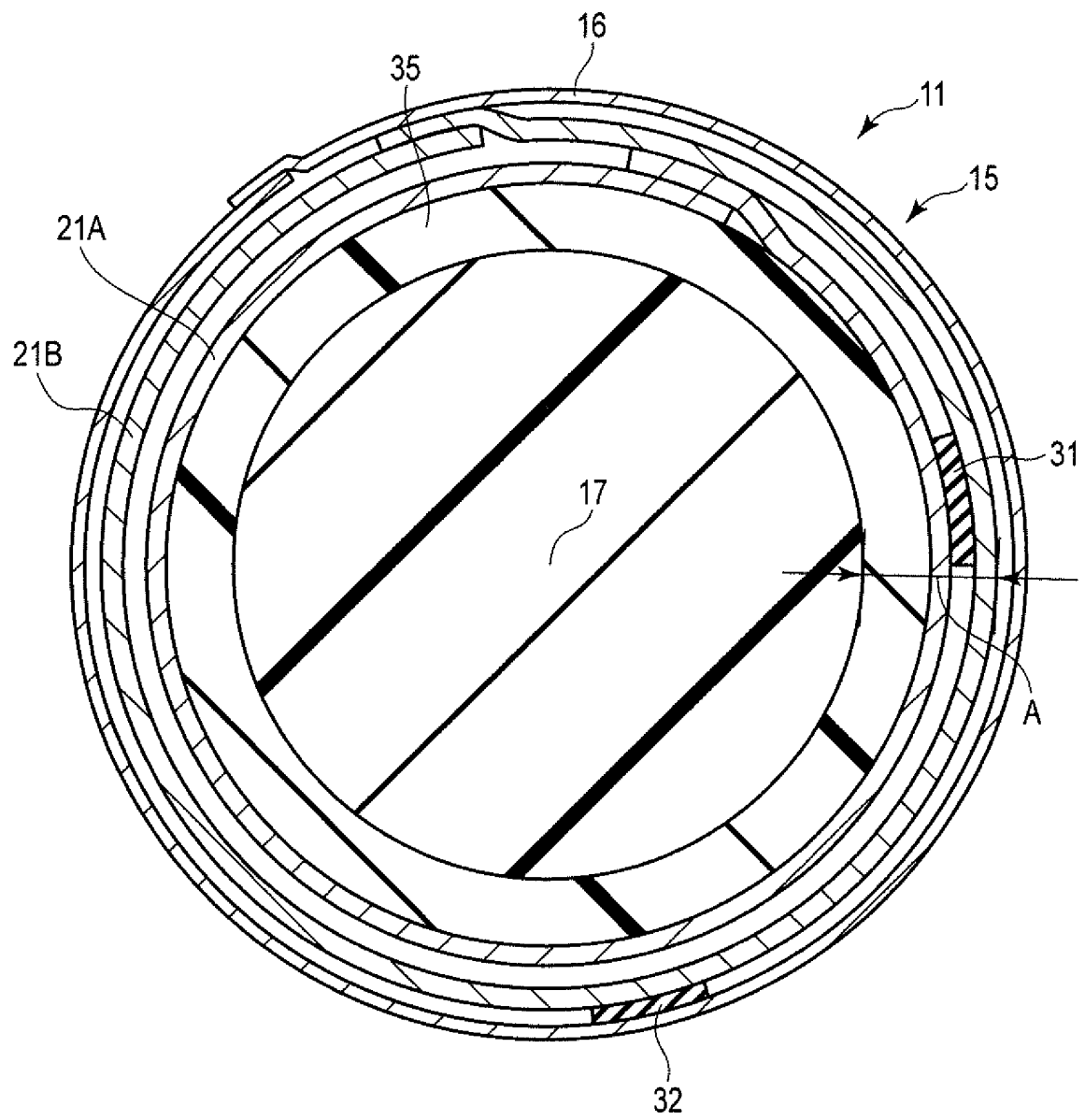


FIG. 20

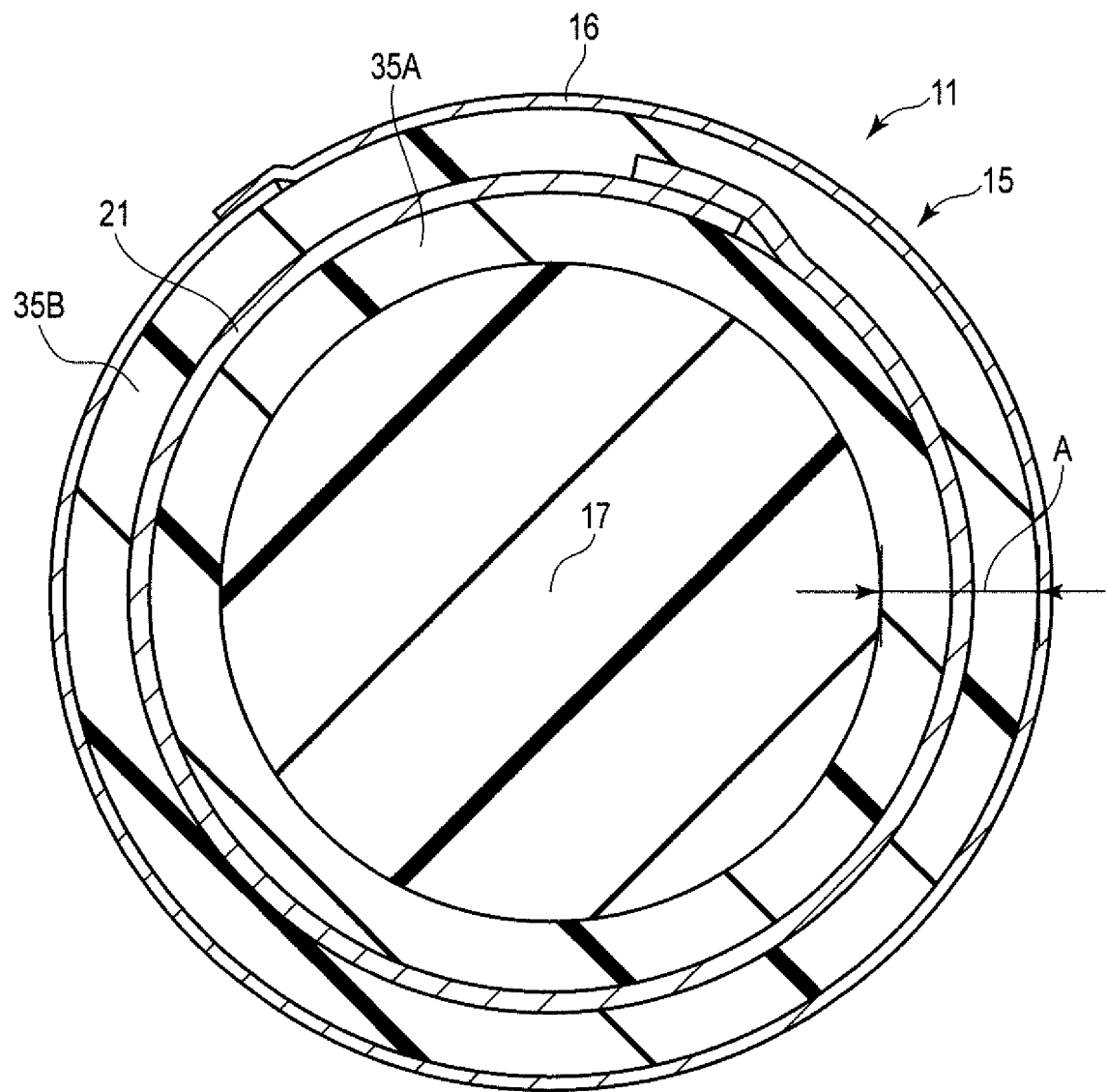


FIG. 21

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2013/081450

A. CLASSIFICATION OF SUBJECT MATTER

A24D3/04(2006.01)i, A24D3/06(2006.01)i

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

A24D3/02, A24D3/04, A24D3/06, A24D3/14

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

Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2014

Kokai Jitsuyo Shinan Koho 1971-2014 Toroku Jitsuyo Shinan Koho 1994-2014

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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☒ 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 February, 2014 (07.02.14)Date of mailing of the international search report
18 February, 2014 (18.02.14)Name and mailing address of the ISA/
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INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2013/081450

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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REFERENCES CITED IN THE DESCRIPTION

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