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(54) **SMOKING ARTICLE PROVIDED WITH FILTER**

RAUCHARTIKEL MIT FILTER

ARTICLE À FUMER POURVU D'UN FILTRE

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Description

Technical Field

5 **[0001]** The present invention relates to a smoking article provided with a filter.

Background Art

10 **[0002]** A smoking article provided with a filter, for example, a filtered cigarette is formed by making a cigarette rod about on a filter, wrapping the outer circumferential surface of the filter and the outer circumferential surface of the cigarette rod near the butting portion with outer wrapper and integrating the cigarette and the filter.

[0003] In a smoking article provided with a filter, the filter wound with the outer wrapper functions as a mouthpiece portion that the user holds in the mouth at smoking. The user's impression of the smoking article provided with a filter depends on the physical properties of the mouthpiece portion, which give the user various feelings at smoking.

15 **[0004]** Patent Literature 1 discloses a smoking article filter having hardness of a certain or higher level at the mouth side end such that the user can enjoy chewing the mouth side end of the smoking article filter during the smoking experience.

Citation List

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Patent Literature

[0005] Patent Literature 1: JP 2016-523565 A1

25 Summary of Invention

Technical Problem

30 **[0006]** However, Patent Literature 1 focuses on the action of the user who enjoys biting the filter, and does not evaluate the feeling (holding comfort in user's mouth) when the user holds the mouthpiece portion with the lips at smoking.

[0007] An object of the present invention is to provide a smoking article provided with a filter having a good feeling (holding comfort in user's mouth) when the user holds the mouthpiece portion with the lips at smoking.

Solution to Problem

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[0008] Provided according to the present invention is a smoking article provided with a filter comprising an aerosol generating member; a filter comprising a filter material and one or more filter wrappers wound around an outer circumferential surface of the filter material; and an outer wrapper wound around the outer circumferential surface of an end part of the aerosol generating member and the filter, wherein the outer circumferential surface of the outer wrapper has an arithmetic mean roughness of less than 2.0 μm , and the filter wound with the outer wrapper has a compression recovery of 60% or more after a compression load of 2.5 N is applied to a range of a length of 10 mm in the diameter direction thereof.

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Advantageous Effects of Invention

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[0009] According to the present invention, a smoking article provided with a filter having a good feeling (holding feeling in user's mouth) when the user holds the mouthpiece portion with lips at smoking can be provided.

Brief Description of Drawings

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[0010]

FIG. 1 is a schematic graph showing a compressive deformation amount - compression restoring force curve for calculating compression recovery.

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FIG. 2 is a schematic diagram illustrating the definition of hardness.

FIG. 3 is a schematic cross-sectional view showing a smoking article provided with a filter according to a first embodiment.

FIG. 4 is a schematic cross-sectional view showing a smoking article provided with a filter according to a third

embodiment.

FIG. 5 is a schematic view showing a method of measuring the compression recovery.

Mode for Carrying Out the Invention

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[0011] A smoking article provided with a filter according to the present invention will be described hereinafter in detail.

[0012] The smoking article provided with a filter according to the present invention comprises an aerosol generating member, a filter comprising a filter material and one or more filter wrappers wound around the outer circumferential surface of the filter material, and outer wrapper wound around outer circumferential surfaces of an end part of the aerosol generating member and the filter. The outer circumferential surface of the outer wrapper has an arithmetic mean roughness of less than $2.0\ \mu\text{m}$, and the filter wound with the outer wrapper has a compression recovery of 60% or more after a compression load of 2.5 N is applied to a range of a length of 10 mm in the diameter direction thereof.

[0013] In the smoking article provided with a filter, the filter wound with the outer wrapper is a mouthpiece portion which the user holds in the mouth at smoking. In addition, the outer circumferential surface of the outer wrapper is the outer circumferential surface of the mouthpiece portion which the user's lips touch at smoking. The present inventors have found that the smoking article provided with a filter of the present invention has a particularly good feeling (holding comfort in user's mouth) when the user holds the mouthpiece portion by the lips at smoking.

[0014] In addition, the present inventors have found that, to further improve the holding comfort in user's mouth of the smoking article provided with a filter, the arithmetic mean roughness of the outer circumferential surface of the outer wrapper is favorably $1.5\ \mu\text{m}$ or less and, more favorably, $1.0\ \mu\text{m}$ or less.

[0015] The present inventors have further found that, to further improve the holding comfort in user's mouth of the smoking article provided with a filter, the filter wound with the outer wrapper has a compression recovery of 60% or more after a compression load of 2.5 N is applied to a range of a length of 10 mm in the diameter direction thereof.

[0016] As the arithmetic mean roughness of the outer circumferential surface of the outer wrapper is lower, a smoother feeling is given to the user's lips when the user holds the mouthpiece portion with the lips at smoking. If the compression recovery of the mouthpiece portion is appropriate, a favorable pressure is given to the user's lips when the user holds the mouthpiece portion with the lips at smoking. If a compression recovery is high, it is preferable since the shape of the mouthpiece portion can be restored to the state before compression after the user holds and compresses the mouthpiece portion with the lips at smoking. In contrast, if the compression recovery of the mouthpiece portion is appropriate but the arithmetic mean roughness of the outer wrapper is high, the holding comfort is not desirable since a coarse feeling is given to the user's lips.

[0017] In addition, the present inventors have found that to further improve the holding comfort in user's mouth of the smoking article provided with a filter, the recovery angle after folded of the outer wrapper or one or more filter wrappers is favorably 60 degrees or more, more favorably 100 degrees or more, and further favorably 100 degrees or more and 120 degrees or less. If the recovery angle after folded of the outer wrapper or one or more filter wrappers is large, the user's lips feel the hardness and make the user feel a good holding comfort in user's mouth when the user holds the mouthpiece portion with the lips at smoking. In general, when the recovery angle after folded of the outer wrapper or one or more filter wrappers is large, the compression recovery of the filter wound with the outer wrapper is improved.

[0018] Furthermore, the present inventors have found that to further improve the holding comfort in user's mouth of the smoking article provided with a filter, the hardness of the filter wound with the outer wrapper is favorably less than 90%, more favorably 80% or more and less than 90%, and further favorably 85% or more and less than 90%. It has been found that the holding comfort in user's mouth of the smoking article provided with a filter is preferable as the hardness of the mouthpiece portion is not too large.

[0019] The definitions of the above terms "arithmetic mean roughness", "compression recovery", "recovery angle after folded" and "hardness" will be described below.

<Arithmetic Mean Roughness>

[0020] The term "arithmetic mean roughness" as used herein refers to an arithmetic mean roughness (Ra) measured using a surface roughness meter under measurement conditions conforming to ISO1997.

<Compression Recovery>

[0021] The term "compression recovery" as used herein refers to recovery property for compression. The compression recovery is calculated from a compressive deformation amount - compression restoring force curve obtained when a test sample, which is a filter wound with an outer wrapper, is compressed to a compression load of 2.5 N to a range of the length of 10 mm in the diameter direction thereof, by using a cylindrical plunger having a diameter of 10 mm, the compressing operation is stopped, and the shape of the test sample is restored. The compressive deformation amount

is the deformation amount [mm] in the diameter of the test sample compressed by the compression load. The compressive deformation amount - compression restoring force curve is measured by using, for example, a rheometer. FIG. 1 is a schematic graph showing a compressive deformation amount - compression restoring force curve obtained by compressing a test sample in a diameter direction to a compression load of 2.5 N at a set speed (curve A-B), stopping the compressing operation, and plotting the compression restoring force [N] (curve B-C) for the compressive deformation amount [mm] when the shape is restored until the restoring force from the test sample becomes 0 N.

[0022] In the compressive deformation amount - compression restoring force curve, the amount of work (area of region ABD) at the time of compression (curve A-B) and the amount of work (area of region CBD) at the time of restoration (curve B-C) are calculated. The compression recovery [%] is calculated by the following equation.

$$\text{Compression recovery [\%]} = (\text{area of region CBD}) / (\text{area of region ABD}) \times 100 [\%]$$

[0023] The reason for setting the compression load to 2.5 N is that the average value of the force of the user holding the mouthpiece portion with the lips at smoking is a compression load of 2.5 N for a range of the length of 10 mm. The compression recovery becomes higher as the compressive deformation amount of the test sample after stopping the compressing operation (T_C mm) approaches the compressive deformation amount before compression (0 mm). In addition, the compression recovery becomes higher as the compression restoring forces [N] for the compressive deformation amounts [mm] at the pressurization (curve A-B), and at the restoration after stopping the compressing operation (curve B-C) are close.

<Recovery angle after folded>

[0024] The term "recovery angle after folded" as used herein refers to the restoring force to return to the original planar shape of the sheet. The recovery angle after folded refers to the folding back angle of the sheet after folding back a certain sheet to 180 degrees at a constant pressure and leaving it to stand still for 30 seconds.

<Hardness>

[0025] The term "hardness" as used herein refers to resistance to compression. The hardness is measured by applying a load of 2 kg to a filter wound with ten outer wrappers for 20 seconds and measuring the average diameter of the recess in the filter wound with the outer wrapper. FIG. 2 shows a filter 101 wound with the outer wrapper before loaded, and a filter 102 wound with the outer wrapper while loaded. The hardness is calculated from the diameter D_s before the load F is applied and the diameter D_d of the recess when the load F is applied, by the following equation.

$$\text{Hardness (\%)} = D_d / D_s \times 100 (\%)$$

[0026] This test can be performed using a device that is DD60A-type Densmeter manufactured by Borgwaldt Corporation. This test is called DD60A test and is performed in the standard test method for this device. This test is conducted at an ambient temperature of 22 ± 2 degrees Celsius.

[0027] Several embodiments will be described with reference to the drawings. The same symbols are given to the common elements throughout the embodiments, and the overlapping descriptions will be omitted. In addition, each drawing is a schematic view for promoting understanding of the embodiments, and the shape, size, ratio, etc. are often different from actual values. As used herein, the terms "upstream" and "downstream" are used as appropriate, based on the direction of flow of the aerosol when smoking a smoking article provided with a filter.

(First Embodiment)

[0028] FIG. 3 is an enlarged schematic cross-sectional view showing a part of the smoking article provided with a filter 1 according to the first embodiment. In the following descriptions, filtered cigarette is described as an example of the smoking article provided with a filter 1, but the smoking article provided with a filter is not limited to this. The smoking article provided with a filter 1 may be the other smoking article to which a filter is connected, for example, cigar, cigarillo, non-combustion type smoking device utilizing electric heating/chemical reaction heat, a non-heating smoking device, etc.

[0029] The smoking article provided with a filter 1 comprises an aerosol generating member 11, a filter 12, and an outer wrapper 13. The aerosol generating member 11 is, for example, a cigarette rod 11. The cigarette rod 11 comprises

shredded tobacco 111 and cigarette paper 112 wound around the shredded tobacco 111, similarly to an ordinary cigarette. The cigarette paper 112 is, for example, air permeable paper.

[0030] The filter 12 is disposed at the downstream end of the cigarette rod 11. The filter 12 has the same or substantially the same diameter as the cigarette rod 11. The filter 12 is composed of a filter material 121 and filter wrapper 122 wound around the filter material 121. The filter 12 has a mono filter structure consisting of a single filter material.

[0031] The outer wrapper 13 is wound around the downstream end portion of the cigarette rod 11 and the outer circumferential surface of the filter 12 to connect the cigarette rod 11 and the filter 12. The outer wrapper 13 is adhered to the cigarette rod 11 and the filter 12 by an ordinary adhesive used in the manufacture of general smoking articles provided with a filter.

[0032] The compression recovery of the filter 12 wound with the outer wrapper 13 after applying a compression load of 2.5 N, is 60% or more, favorably 60% or more and less than 80%, and more favorably 60% or more and less than 70%. The compression recovery of the filter 12 wound with the outer wrapper 13 is comprehensively determined by the material, thickness and basis weight of the outer wrapper 13 and the filter wrapper 122, the material of the filter material 121, and the like. It is preferable that the compression recovery of the mouthpiece portion composed of the filter 12 wound with the outer wrapper 13 be obtained from the physical properties of the outer wrapper 13.

(a) Outer wrapper (13)

[0033] The outer circumferential surface of the outer wrapper 13 has an arithmetic mean roughness of less than 2.0 μm , preferably 1.5 μm or less, and further preferably 1.0 μm or less when wound around a filter. The recovery angle after folded of the outer wrapper 13 is desirably 60 degrees or more, more desirably 100 degrees or more, and still more desirably 100 degrees or more and 120 degrees or less.

[0034] The outer wrapper 13 is not particularly limited as long as it is configured to satisfy the above-described arithmetic mean roughness, the compression recovery and, preferably, the recovery angle after folded. The outer wrapper 13 is composed of, for example, a sheet including a plurality of layers. The sheet including a plurality of layers includes, for example, a base layer, and a surface layer provided on one side or both sides of the base layer.

[0035] The base layer is not particularly limited, but is preferably formed of a material having a high recovery angle after folded, for example, a resin film. The resin film is preferably a thermoplastic resin film, for example, polyethylene resin, polyolefin resin such as polypropylene, polyamide resin such as nylon-6, polyester resin such as polyethylene terephthalate, polystyrene resin, and polycarbonate or polyphenyl sulfide or a film containing a mixture thereof. In particular, the base layer is desirably a film of a polyethylene resin, a polyolefin resin such as polypropylene, or a polyester resin, and more desirably a film containing polyester or polyolefin as a main component. It is preferable that the base layer is a biaxially-drawn film to increase the rigidity and strength and to increase the recovery angle after folded. The base layer may contain an inorganic filler such as calcium carbonate, calcined clay, alumina, or titanium dioxide, or an organic filler. The base layer may have a single layer structure or a multilayer structure.

[0036] The surface layer is not particularly limited as long as the outer circumferential surface of the outer wrapper 13 has an arithmetic mean roughness of 2.0 μm or less and, for example, a coating layer containing an inorganic filler, a paper-like layer formed of resin or a coating layer containing cellulose nanofiber is mentioned as the surface layer.

[0037] The coating layer containing an inorganic filler is, for example, a white pigment coating layer similar to the surface layer of ordinary coated paper. The coating layer containing an inorganic filler may contain, for example, an aqueous resin binder, an inorganic filler, and an aqueous polymer, and may contain a colorant. Examples of the inorganic filler include calcium carbonate, satin white, silica, titanium oxide, alumina, zinc white, iron oxide, clay, aluminum sulfate, and the like, and in particular, fillers such as calcium carbonate and pigments such as titanium oxide, zinc oxide, and iron oxide are preferable as the inorganic filler. To lower the arithmetic mean roughness of the surface layer, the particle size of the inorganic filler is preferably 15 μm or less. By providing the surface layer containing the inorganic filler, effects such as improvement of printability, improvement of pencil writability, improvement of whiteness, coloring, imparting of opacity and improvement of surface smoothness can be obtained.

[0038] The paper-like layer formed of resin is, for example, a resin film having a large number of microvoids by being stretched and oriented only in a uniaxial direction. The paper-like layer formed of resin may contain the above-mentioned inorganic filler. The paper-like layer formed of a resin can obtain effects such as improvement of printability, improvement of pencil writability, improvement of whiteness, coloring, imparting of opacity, and improvement of surface smoothness, by the large number of microvoids.

[0039] The coating layer containing cellulose nanofibers is, for example, a coating layer containing cellulose nanofibers having an average of 50 nm or less and an average fiber length of 10 μm or more. The coating layer containing the cellulose nanofibers can be prepared by dispersing the cellulose nanofibers in a suitable solvent (for example, water or alcohol) to prepare a slurry, coating the slurry on a base layer, and drying the slurry.

[0040] It is preferable that if the outer wrapper 13 has a surface layer, a feeling like plastics is eliminated when the user holds the mouthpiece portion with the lips at smoking if the base layer is a resin film. In addition, since the outer

wrapper 13 is generally printed with a logo mark, a pattern or the like to enhance a property of design, the outer wrapper preferably has a surface layer having printability.

[0041] The outer wrapper 13 is preferably a synthetic paper having a base layer which is a resin film, a coating layer containing an inorganic filler, or a surface layer of a paper-like layer formed of a resin. In general, synthetic paper having a coating layer containing an inorganic filler is referred to as synthetic paper of a surface coating method, for example, Peach Coat (registered trademark) (WER-135DS, WEFY-120, or SEY-130FPP) (Nisshinbo Paper Products Co., Ltd.). In general, synthetic paper having a paper-like layer formed of a resin film is referred to as synthetic paper of an internal papermaking system, for example, Yupotrace (registered trademark), New Yupo (trade name), Ultra Yupo (registered trademark) (Yupo Corporation), and the like.

[0042] The basis weight of the outer wrapper 13 is desirably 50 g/m² or more and less than 200 g/m², more desirably 100 g/m² or more and less than 200 g/m² to obtain appropriate compression recovery in the mouthpiece portion. If the basis weight of the outer wrapper 13 is large, it is preferable since the recovery angle after folded of the outer wrapper 13 is also improved in general.

[0043] The thickness of the outer wrapper 13 is desirably 50 μm or more and less than 150 μm and, more desirably, 100 μm or more and less than 150 μm to obtain an appropriate compression recovery in the mouthpiece portion. If the outer wrapper 13 is thick, it is favorable that, in general, the recovery angle after folded is improved.

(b) Filter Material (121)

[0044] The filter material 121 may be formed of an ordinary filter material 121, and is formed of, for example, cellulose acetate fiber. The physical properties of the filter material 121 affect the compression recovery of the mouthpiece portion.

[0045] A plasticizer may be further added to the filter material 121. The plasticizer is not particularly limited as long as it is a plasticizer that plasticize cellulose acetate fiber, and examples thereof include triacetin. When a plasticizer is added to the cellulose acetate fiber, the cellulose acetate fiber is partially melted and the fibers are joined. As a result, the compression recovery of the filter material 121 is increased by adding a plasticizer to the cellulose acetate fiber. As the amount of addition of the plasticizer increases, the compression recovery of the filter material 121 increases. For this reason, the compression recovery of the filter material 121 can be adjusted by adjusting the amount of addition of the plasticizer. The amount of plasticizer added may be appropriately selected according to the compression recovery required for the mouthpiece portion. In the filter material 121, it is preferable that the amount of the plasticizer contained in the cellulose acetate fiber is, for example, 0 wt% to 20 wt% with respect to the cellulose acetate fiber. In addition, an adhesive may be added to the filter material 121. When the adhesive is added, an effect similar to that obtained when the plasticizer is added can be obtained, and the compression recovery of the filter material 121 is increased. For this reason, the compression recovery of the filter material 121 can be adjusted by adjusting the amount of addition of the adhesive. In addition, the filter material 121 may further contain an adsorbent such as activated carbon and a flavor release material such as a perfume capsule.

(c) Filter wrapper (122)

[0046] The filter wrapper 122 may be composed of, for example, a filter wrapper 122 used for an ordinary smoking article provided with a filter 1, for example a cellulose-based material, paper, cardboard, recon, cellulose-based film or a combination thereof may be mentioned as the filter wrapper. The filter wrapper 122 may be a single layer or may be formed of a plurality of sheets adhered by an adhesive or the like. The physical properties of the filter wrapper 122 affect the compression recovery of the mouthpiece portion. When the basis weight and the thickness of the filter wrapper 122 increase, the compression recovery and the stiffness of the mouthpiece portion generally increase. However, if the filter wrapper 122 is composed of a general-purpose filter wrapper, i.e., paper having a thickness of 50 μm and a basis weight of 27 g/m², the influence on the compression recovery is small.

[0047] According to the smoking article provided with a filter 1 of the first embodiment, since both the arithmetic mean roughness of the outer circumferential surface of the outer wrapper 13 and the compression recovery of the mouthpiece portion are satisfied, the effect that the user has a good feeling (holding comfort in user's mouth) when holding the mouthpiece portion at smoking can be obtained.

[0048] In the first embodiment, an example in which the entire mouthpiece portion, which is a filter wound with the outer wrapper, satisfies the arithmetic mean roughness and the compression recovery is described, but the present invention is not limited to this example. For example, only the downstream end portion of the mouthpiece portion, in contact with the user when holding the mouthpiece portion with the lips at the smoking, may satisfy these physical properties. The downstream end portion is, for example, in the range of 15 mm from the downstream end side and, preferably, in the range of 10 mm from the downstream end. Even in such a structure, since the above-described physical characteristics are satisfied at the part where the user holds the mouthpiece portion by the lips at smoking, smoking article provided with a filter with a good holding comfort in user's mouth can be obtained.

[0049] In the smoking article provided with a filter according to the first embodiment, the hardness of the filter wound with the outer wrapper is desirably less than 90%, more desirably 80% or more and less than 90%, still more desirably 85% or more and less than 90%. It is preferable that the hardness of the mouthpiece portion of the smoking article provided with a filter is not extremely high.

[0050] In the first embodiment, the example in which a single filter wrapper is used is described, but a plurality of filter wrappers may be bonded by an adhesive or the like.

(Second Embodiment)

[0051] A smoking article provided with a filter 1 according to the second embodiment has the same configuration as that of the first embodiment shown in FIG. 3, but is different from the first embodiment with respect to only materials contained in the outer wrapper 13 and the filter wrapper 122.

(a) Outer wrapper (13)

[0052] The outer wrapper 13 is not particularly limited as long as its material has an arithmetic mean roughness on the outer circumferential surface of less than $2.0\ \mu\text{m}$, more desirably less than $1.0\ \mu\text{m}$ when wound around a filter. The outer wrapper 13 is formed of, for example, the same material as the outer wrapper 13 described in the first embodiment, and has a smaller thickness and basis weight than those described in the first embodiment. The outer wrapper 13 may be, for example, ordinary coated paper.

(b) Filter Wrapper (122)

[0053] The recovery angle after folded of the filter wrapper 122 is desirably 60 degrees or more, more desirably 100 degrees or more, and still more desirably 100 degrees or more and 120 degrees or less. The filter wrapper 122 is formed of, for example, the same material as the base layer described in the first embodiment. The filter wrapper 122 is desirably a film of a polyethylene resin, a polyolefin resin such as polypropylene, or a polyester resin, and more desirably a film containing polyester or polyolefin as a main component. It is preferable that the filter wrapper 122 is a biaxially-drawn film to increase the rigidity and strength and to increase the recovery angle after folded.

[0054] The basis weight of the filter wrapper 122 is desirably $50\ \text{g/m}^2$ or more and less than $200\ \text{g/m}^2$, more desirably $100\ \text{g/m}^2$ or more and less than $200\ \text{g/m}^2$ to obtain appropriate compression recovery in the mouthpiece portion. The thickness of the filter wrapper 122 is desirably $50\ \mu\text{m}$ or more and less than $150\ \mu\text{m}$ and, more desirably, $100\ \mu\text{m}$ or more and less than $150\ \mu\text{m}$ to obtain an appropriate compression recovery in the mouthpiece portion. When the basis weight and the thickness of the outer wrapper 13 increase, generally, the recovery angle after folded is improved and the compression recovery of the mouthpiece portion increases.

[0055] In addition, the basis weight of the outer wrapper 13 and the filter wrapper 122 is desirably $50\ \text{g/m}^2$ or more and less than $200\ \text{g/m}^2$, more desirably $100\ \text{g/m}^2$ or more and less than $200\ \text{g/m}^2$ to obtain appropriate compression recovery in the mouthpiece portion. In addition, the basis weight of the outer wrapper 13 and the filter wrapper 122 is desirably $50\ \mu\text{m}$ or more and less than $150\ \mu\text{m}$, more desirably $100\ \mu\text{m}$ or more and less than $150\ \mu\text{m}$ to obtain appropriate compression recovery in the mouthpiece portion.

[0056] In the configuration according to the second embodiment, the effect that the user has a good feeling (holding comfort in user's mouth) when holding the mouthpiece portion with the lips at smoking can be obtained, similarly to the smoking article provided with a filter 1 according to the first embodiment.

[0057] In the second embodiment, the example in which a single filter wrapper is used is described, but a plurality of filter wrappers may be bonded by an adhesive or the like. In that case, it is preferable that a plurality of filter wrappers adhered has the above-mentioned fold restoration angle. The total basis weight and thickness of a plurality of filter wrappers are preferably within the above-mentioned range.

(Third Embodiment)

[0058] FIG. 4 is an enlarged schematic cross-sectional view showing a part of a filtered cigarette 2 according to a third embodiment. The filtered cigarette 2 according to the third embodiment has the same structure as the filtered cigarette 1 according to the first embodiment except that the structure of the filter is different.

[0059] The filter 22 comprises two filter segments 22a and 22b. More specifically, the filter 22 is a so-called dual filter comprising a first filter segment 22a arranged on the upstream side and a second filter segment 22b arranged on the downstream side.

[0060] The first filter segment 22a is composed of a first filter material 221a, and a first inner filter wrapper 222a wound around the first filter material 221a. The second filter segment 22b is composed of a second filter material 221b, and a

second inner filter wrapper 222b wound around the second filter material 221b. The first filter segment 22a and the second filter segment 22b are wound and connected by an outer filter wrapper 22c covering their outer circumferential surfaces. The outer wrapper 23 is wound around the outer circumferential surfaces of the downstream end portion of the cigarette rod 11 and filter 22 to connect the cigarette rod 11 and the filter 22.

5 **[0061]** In the third embodiment, at a portion corresponding to at least the second filter segment 22b located on the downstream end side, of the first and second filter segments 22a and 22b, the compression recovery after applying a compression load of 2.5 N is 60% or more, more desirably 60% or more and less than 80%, and still more desirably 60% or more and less than 70%. An arithmetic mean roughness of the outer circumferential surface in at least a portion of the outer wrapper, corresponding to the second filter segment 22b, is less than 2.0 μm , more desirably 1.5 μm or less, still more desirably 1.0 μm or less.

(a) Outer wrapper (23)

15 **[0062]** The outer wrapper 23 is formed of, for example, the same material as the outer wrapper 13 described in the first embodiment.

(b) Filter Material (221a, 221b)

20 **[0063]** The first filter material 221a and the second filter material 221b are formed of, for example, the same material as the filter material 121 described in the first embodiment.

(c) Filter Wrapper (222a, 222b, 22c)

25 **[0064]** The first and second inner filter wrapper 222a and 222b is formed of the same material as the filter wrapper 122 described in the first embodiment. The outer filter wrapper 22c is formed of, for example, the same material as the filter wrapper 122 according to the first embodiment.

30 **[0065]** In the configuration according to the third embodiment, the downstream end portion that contacts the lips when the user holds the mouthpiece portion by the lips at smoking satisfies the arithmetic mean roughness of the outer wrapper and the compression recovery of the mouthpiece portion, similarly to the smoking article provided with a filter according to the first embodiment. For this reason, in the configuration according to the third embodiment, the effect, that the user has a good feeling (holding comfort in user's mouth) when holding the mouthpiece portion with the lips at smoking, can be obtained, similarly to the first embodiment.

35 **[0066]** In the third embodiment, the first and second filter segments are formed of the same material, but the present invention is not limited to this. For example, the smoking article may be configured to have a dual filter having the other functions that the first filter segment is a charcoal filter in which an adsorbent, for example, activated carbon or the like, is dispersedly added to the fiber gaps of cellulose acetate fibers, and the second filter segment is a white filter material composed of ordinary cellulose acetate fibers.

40 **[0067]** In addition, the smoking article provided with a filter according to the third embodiment is not limited to the dual filter, but may be a filter having three or more filter segments. The smoking article provided with a filter may be configured to have one hollow portion between two filter segments or may be configured to be provided with a destructive perfume capsule and flavor particles in the hollow portion. In these configurations, if the physical characteristics of the compression recovery and the arithmetic mean roughness are satisfied at least in a portion corresponding to a filter segment located on the downstream end side, of a plurality of filter segments constituting the filter, the same effect as that of the smoking article provided with a filter according to the first embodiment can be obtained.

45 (Fourth Embodiment)

50 **[0068]** A smoking article provided with a filter according to a fourth embodiment has the same configuration as the smoking article provided with a filter 2 according to the third embodiment shown in FIG. 4, and is different with respect to the only materials to form the outer wrapper 23, the outer filter wrapper 22c and the second inner filter wrapper 222b.

(a) Outer wrapper (23)

55 **[0069]** The outer wrapper is not particularly limited as long as its material has an arithmetic mean roughness on the outer circumferential surface of less than 2.0 μm , more desirably less than 1.0 μm when wound around a filter. The outer wrapper is formed of, for example, the same material as the outer wrapper 13 described in the first embodiment, and material having smaller thickness and basis weight than those described in the first embodiment. The outer wrapper 23 may be, for example, ordinary coated paper.

(b) Filter Wrapper (222a, 222b, 22c)

[0070] In the fourth embodiment, the first and second filter materials 221a and 221b are wound around two filter wrappers, i.e., the first and second inner filter wrappers 222a and 222b and the outer filter wrapper 22c.

[0071] The material of the first inner filter wrapper 222a is not particularly limited, and is formed of, for example, the same material as the filter wrapper 122 described in the first embodiment.

[0072] The material of the second inner filter wrapper 222b and the material of the outer filter wrapper 22c are formed of, for example, the same material as the base layer described in the first embodiment. The material of the second inner filter wrapper 222b and the outer filter wrapper 22c are desirably a film of a polyethylene resin, a polyolefin resin such as polypropylene, or a polyester resin and, more desirably, a biaxially-drawn film containing polyester or polyolefin as its main component.

[0073] The second inner filter wrapper 222b and the outer filter wrapper 22c desirably in a state they are adhered to each other have a recovery angle after folded of 60 degrees or more, more desirably 100 degrees or more, and still more desirably 100 degrees or more and 120 degrees or less.

[0074] The total basis weight of the second inner filter wrapper 222b and the outer filter wrapper 22c is desirably 50 g/m² or more and less than 200 g/m², and more preferably 100 g/m² or more and less than 200 g/m² to obtain the compression recovery of the mouthpiece portion. The total thickness of the second inner filter wrapper 222b and the outer filter wrapper 22c is desirably 50 μm or more and less than 150 μm, more desirably 100 μm or more and less than 150 μm to obtain appropriate compression recovery in the mouthpiece portion. When the basis weight and the thickness of the outer wrapper increase, generally, the recovery angle after folded is increases and the compression recovery of the mouthpiece portion increases.

[0075] In addition, the total basis weight of the outer wrapper 23, the second inner filter wrapper 222b and the outer filter wrapper 22c is desirably 50 g/m² or more and less than 200 g/m², and more preferably 100 g/m² or more and less than 200 g/m² to obtain appropriate compression recovery of the mouthpiece portion. The total thickness of the outer wrapper 23, second inner filter wrapper 222b, and the outer filter wrapper 22c is desirably 50 μm or more and less than 150 μm, more desirably 100 μm or more and less than 150 μm to obtain appropriate compression recovery in the mouthpiece portion.

[0076] In the configuration according to the fourth embodiment, the downstream end portion that is in contact when the user holds the mouthpiece portion by the lips at smoking satisfies the arithmetic mean roughness of the outer wrapper and the compression recovery of the mouthpiece portion. In the configuration according to the fourth embodiment, the effect that the user has a good feeling (holding comfort in user's mouth) when holding the mouthpiece portion with the lips at smoking can be obtained, similarly to the smoking article provided with a filter according to the third embodiment.

[0077] In the fourth embodiment, the filter material disposed at the downstream end is wound with two filter wrappers, but may be wound with three or more filter wrappers. In that case, a plurality of filter wrappers adhered preferably has the above-mentioned recovery angle after folded. In addition, it is preferable that the total basis weight and thickness of a plurality of sheets of filter wrapper be within the above-mentioned range.

(Examples and Comparative Examples)

[0078] The embodiments will be further described using examples and comparative examples.

[0079] Tests (1) to (5) described below were performed out using the outer wrappers, filters, and test samples according to Examples 1 to 7 and Comparative Examples 1 to 4 shown in Table 1. The test sample is a filter wound with an outer wrapper produced by the method described later. In the outer wrappers according to Examples 1 to 7 and Comparative Examples 1 to 4, measurement of (1) arithmetic average roughness and (2) recovery angle after folded was performed. Next, sensory evaluations of (3) compression recovery, (4) hardness, and (5) holding comfort in user's mouth were performed by using the test samples.

[0080] Table 1 shows product names, basis weights, thicknesses, arithmetic mean roughnesses and fold restoration angles, and plasticizer amounts of filters, of the outer wrappers used in Examples 1 to 7 and Comparative Examples 1 to 4, and the results of the sensory evaluations of the compression recovery, hardness, and holding comfort in user's mouth of the test samples.

Table 1

	Outer wrapper					Filter	Test sample		
	Product name	Basis weight [g/m ²]	Thickness [μ m]	Arithmetic mean roughness [μ m]	Restoration angle after folding [°]		Plasticizer amount [wt%]	Compression Recovery [%]	Hardness [%]
Example 1	Peach Coat	180.4	132	0.7	100	0.0	61	89	5.1
Example 2	Peach Coat	180.4	132	0.7	100	9.0	78	97	4.6
Example 3	Peach Coat	180.4	132	0.7	100	17.0	73	98	4.0
Example 4	YUPOTRACE #60	60.7	61	1.5	138	9.0	60	86	4.8
Example 5	YUPOTRACE #60	60.7	61	1.5	138	17.0	73	91	4.2
Example 6	YUPOTRACE #60	93.5	92	1.3	141	9.0	68	89	4.6
Example 7	YUPOTRACE #60	93.5	92	1.3	141	17.0	69	92	4.3
Comparative Example 1	General-purpose tipping paper	37	42.2	2.5	6	0.0	41	66	3.6
Comparative Example 2	Cellophane	32.6	31	2.0	56	0.0	40	72	3.0
Comparative Example 3	Cellophane	32.6	31	2.0	56	9.0	60	85	3.3
Comparative Example 4	Cellophane	32.6	31	2.0	56	17.0	70	90	3.7

[0081] First, the outer wrappers according to Examples 1 to 7 and Comparative Examples 1 to 4 will be described. In Examples 1 to 3, Peach Coat (registered trademark) (WER-135DS, Nisshinbo Paper Products Inc.), which is synthetic paper, was used. Peach Coat (registered trademark) is formed of the base layer which is a polyethylene terephthalate film, which is polyester resin, and a surface layer which is a white pigment coating layer. In Examples 4 and 5, YUPOTRACE (registered trademark) (TPRA #60, Yupo Corporation) which is synthetic paper was used. In Examples 6 and 7, YUPOTRACE (registered trademark) (TPRA #90, Yupo Corporation) was used. YUPOTRACE (registered trademark) is formed of a base layer which is a biaxially-drawn film formed of a polypropylene resin, and a surface layer which is a paper-like layer formed of a resin. In contrast, in Comparative Example 1, general-purpose tipping paper formed of paper used for filtered cigarettes such as Mobius Light (registered trademark) of Japan Tobacco Inc. was used. In Comparative Examples 2 to 4, cellophane (basis weight: 33 g/m² and thickness: 30 μm) was used.

[0082] Next, filters according to Examples 1 to 7 and Comparative Examples 1 to 4 will be described. As the filter material, cellulose acetate fibers (Daicel Corporation) having a filament denier of 1.9 g / 9000 m was used. As the filter wrapper, paper (manufactured by Nippon Paper Papyrus Co., Ltd.) having a thickness of 50 μm and a basis weight of 27 g/m², which is a general-purpose filter wrapper, was used.

[0083] In the filters according to Example 1 and Comparative Examples 1 and 2, a filter material composed of only cellulose acetate fibers was used. In the filters according to Examples 2, 4 and 6 and Comparative Example 3, a filter material obtained by adding 9.0 wt% of a plasticizer which is triacetin, to cellulose acetate fibers was used. In the filters according to Examples 3, 5 and 7 and Comparative Example 4, a filter material obtained by adding 17.0 wt% of a plasticizer which is triacetin, to cellulose acetate fibers was used.

[0084] In addition, the test sample was produced by the following method. The filter materials according to Examples 1 to 7 and Comparative Examples 1 to 4 were wound in a usual manner with a filter wrapper and cut to prepare filters having a length of 27 mm and a diameter of 24.2 mm. Next, the outer wrappers according to Examples 1 to 7 and Comparative Examples 1 to 4 were wound around each filter using a double-sided tape. In this test sample, since the double-sided tape is applied only to the joint part of the outer wrapper, the tape does not affect the sensory evaluation of the holding comfort in user's mouth.

[0085] The contents of the tests (1) to (5) will be described below.

(1) Arithmetic Mean Roughness

[0086] The arithmetic mean roughness was measured for the outer wrappers according to Examples 1 to 7 and Comparative Examples 1 to 4. Arithmetic mean roughness was measured on the surface serving as the outer circumferential surface when wound around a filter, of the surfaces of the outer wrapper. The measurement of the arithmetic mean roughness was measured using SurfTest SJ-210 (trade name) manufactured by Mitutoyo Corporation. A Gaussian filter was used for filtering in the measurement of the arithmetic mean roughness. In addition, as the detector, a detector having a shape with a stylus tip R = 2 μm and a tip angle of 60 degrees was used. The measurement conditions were determined by setting the standard conditions to conform to ISO1997, and setting the roughness curve R to the cutoff value $\lambda_c = 2.5$ mm, $\lambda_s = 8$ μm, and the number of sections (N) 4.

(2) Recovery angle after folded

[0087] The recovery angle after folded was measured for the outer wrappers according to Examples 1 to 7 and Comparative Examples 1 to 4. As an evaluation machine, a rubber roller and a metal roller which were in contact with each other so as to have a nip pressure of 0.1 MPa were used. First, the outer wrappers according to Examples 1 to 7 and Comparative Examples 1 to 4 were cut in a size of 5.5 cm × 5.5 cm, and shaped in a loop while being bent so as not to be creased and positioning one side to the opposite side. Then, each of the outer wrappers was passed between the rubber roller and the metal roller of the above-mentioned evaluation machine, and the each of outer wrappers folded at 180 degrees was quickly moved onto a laboratory table, and the recovery angle after folded (°) after 30 seconds was measured.

(3) Compression recovery

[0088] The compression recovery test was conducted on the test samples according to Examples 1 to 7 and Comparative Examples 1 to 4. The compression recovery is calculated from a compressive deformation amount - compression restoring force curve obtained by plotting the compression restoring force [N] corresponding to the compressive deformation amount [mm] as shown in FIG. 1. The compressive deformation amount [mm] is the deformation amount of the diameter of the test samples compressed by the compressive load. The compression recovery force [N] is the force by which the compressed test samples attempt to return to an original shape.

[0089] A rheometer (CR-3000EX-S manufactured by Sun Scientific Co., Ltd.) was used as an evaluation machine for

the measurement of the compressive deformation amount - compression restoring force curve. FIG. 5 is a schematic view showing a method of measuring the compression recovery. The rheometer comprises a measurement table 103 on which a test sample is placed, and a cylindrical plunger 104 having a diameter of 10 mm. Next, the test sample 105 was placed on an upper surface of the rheometer measurement table 103 such that the side surfaces thereof were in contact. When the plunger 104 does not apply a compression load to the test sample 105 ((a) in FIG. 5), the compression restoring force from the test sample 105 is 0 N, and the compressive deformation amount is 0 mm (point A). Next, the cylindrical plunger 104 is vertically advanced at a speed of 13 mm/minute until the compression load applied to the test sample 105 is 2.5 N, and the test sample 105 is vertically compressed ((b) in FIG. 5). The compression restoring force [N] corresponding to the compressive deformation amount [mm] at this time is recorded (curve A-B). Next, when the compression load reaches 2.5 N (compression restoring force is 2.5 N), the compression operation performed by the plunger 104 is stopped, and the compressive deformation amount T_B mm at that time is recorded (point B). After that, the compression operation is stopped, and the plunger 104 is allowed to move freely in the vertical direction, and the compression restoring force [N] corresponding to the compressive deformation amount mm when the shape is restored until the restoring force from the test sample 105 becomes 0 N (curve B-C). Next, when the compression restoring force reaches 0 N, the compressive deformation amount T_C mm at that time is recorded (point C). As a result, different curves were shown at the time of compression (curve A-B) and at the time of restoration (curve B-C) in the compressive deformation amount - compression restoring force curve as shown in FIG. 1. In FIG. 1, a point at which the compressive deformation amount T_B mm and the compression restoring force 0 N are represented as point D.

[0090] The amount of work (area of region ABD) at the time of compression (curve A-B) and the amount of work (region CBD) at the time of restoration (curve B-C) are calculated in the compressive deformation amount - compression restoring force curve. The compression recovery [%] is calculated by the following equation.

$$\text{Compression recovery [\%]} = \frac{\text{area of region CBD}}{\text{area of region ABD}} \times 100 \text{ [\%]}$$

(4) Hardness

[0091] The hardness test was conducted on the test samples according to Examples 1 to 7 and Comparative Examples 1 to 4. As an evaluation machine, a DD60A Densmeter manufactured by Borgwaldt Corporation was used. The hardness is determined by applying a 2 kg load to 10 test samples for 20 seconds and measuring the recessed average diameter of the filter wound with the outer wrapper. The test is conducted at an ambient temperature of 22 ± 2 degrees Celsius according to the standard test method for this instrument.

[0092] Such a device comprises two parallel metal cylinder pairs, each cylinder being 16 cm long and 10 mm in diameter. The first cylinder pair is arranged 16 mm apart and parallel below the ten pieces of test samples to act as a support for the test samples, and ten pieces of test samples are arranged parallel at regular intervals such that the test samples pass the first cylinder pair. During the test, the first cylinder pair remains stationary. The second cylinder pair is aligned with the first cylinder pair such that the first cylinder pair and the second cylinder pair approach each other with the test samples interposed during testing. The second cylinder pair is arranged to move towards ten test samples, and applies 2 kg load over ten test samples. At this time, the first and second cylinder pairs each contact the test samples at 20 points. The load is held on the test sampled for 20 seconds, and the test is completed after measuring the diameters of the compressed test samples. During the test, the test samples are arranged apart so as not to touch each other. A frame is used to support the tips of the ten test samples, enabling the ten test samples to be certainly spaced apart at regular intervals and parallel to one another during the test.

[0093] This test method is the same as the hardness measurement method disclosed in JP 2016-523565 A.

(5) Sensory Evaluation of Holding Feeling

[0094] The test samples according to Examples 1 to 7 and Comparative Examples 1 to 4 were actually held by a panel of twenty-three persons, and the sensory evaluation was conducted on the feeling of holding the mouthpiece portion by the lips (holding comfort in user's mouth). The panel of twenty-three persons evaluated the holding comfort in user's mouth by numerical values of seven stages, i.e., "7" when feeling that they felt very comfortable, "6" when feeling that they liked it, "5" when feeling that they like it a little, "4" when feeling that they cannot say either, "3" when feeling a little dislike, "2" when feeling dislike, and "1" when feeling very disgusting, and the values were averaged.

[0095] As clarified from the results of Table 1, in the test samples according to Examples 1 to 7 in which the arithmetic mean roughness of the outer circumferential surface of the outer wrapper is less than $2.0 \mu\text{m}$ and the compression recovery is 60% or more, the sensory evaluation was a high value between 4.0 and 5.1. All the test samples according

to Examples 1 to 7 have the recovery angle after folded on the outer wrapper of 100 degrees or more. In addition, in Examples 1, 4 and 6 in which the hardness of the test samples is less than 90%, of Examples 1 to 7, the sensory evaluation was a particularly high numerical value of 4.6 to 5.1. In particular, in Example 1 in which the arithmetic mean roughness is 0.7 μ or less, the compression recovery is 61%, the hardness is 89%, and the recovery angle after folded is 100 degrees, the compression recovery was a value of 5.1, i.e., the highest value.

[0096] In contrast, in Comparative Examples 1 to 4 in which the arithmetic mean roughness is 2.0 or more, the sensory evaluation was a low numerical value of less than 4.0. In Comparative Examples 1 to 4, all the recovery angles after folded of the outer wrappers were less than 60 degrees.

[0097] As described above, it was represented that the test samples according to Examples 1 to 7 having an arithmetic mean roughness of less than 2.0 μ m on the outer circumferential surface of the outer wrapper and a compression recovery of 60% or more are highly evaluated in the sensory evaluation and their attraction is improved.

[0098] While certain embodiments have been described, these embodiments have been presented by way of example only, and are not intended to limit the scope of the invention as defined by the appended claims. Indeed, these embodiments described herein may be embodied in a variety of other forms; furthermore, various changes in the form of the embodiment described herein may be made without departing from the scope of the invention as defined by the appended claims.

Reference Signs List

[0099] 1 ... smoking article provided with a filter according to first embodiment, 11 ... aerosol generation member (cigarette rod), 111 ... shredded tobacco, 112 ... cigarette paper, 12, 22 ... filter, 121 ... filter material, 13, 23 ... outer wrapper, 2 ... smoking article provided with a filter according to third embodiment, 22a ... first filter segment, 22b ... second filter segment, 221a ... first filter material, 221b ... second filter material, 222a ... first inner filter wrapper, 222b ... second inner filter wrapper, 22c ... outer filter wrapper.

Claims

1. A smoking article (1) provided with a filter (12) comprising:

an aerosol generating member (11);

a filter (12) comprising a filter material (121) and one or more filter wrappers (122) wound around an outer circumferential surface of the filter material; and

an outer wrapper (13) wound around the outer circumferential surfaces of an end part of the aerosol generating member and the filter; **characterised in that** the outer circumferential surface of the outer wrapper has an arithmetic mean roughness of less than 2.0 μ m, and the filter wound with the outer wrapper has a compression recovery of 60% or more after a compression load of 2.5 N is applied to a range of a length of 10 mm in the diameter direction thereof.

2. The smoking article provided with a filter of Claim 1, **characterized in that** the arithmetic mean roughness of the outer circumferential surface of the outer wrapper is 1.0 μ m or less.

3. The smoking article provided with a filter of Claim 1 or 2, **characterized in that** a recovery angle after folded of the outer wrapper or the one or more filter wrappers is 60 degrees or more.

4. The smoking article provided with a filter of Claim 3, **characterized in that** the recovery angle after folded of the outer wrapper or the one or more filter wrappers is 100 degrees or more.

5. The smoking article provided with a filter of Claim 4, **characterized in that** the recovery angle after folded of the outer wrapper or the one or more filter wrappers is 100 degrees or more and 120 degrees or less.

6. The smoking article provided with a filter of any one of Claims 1 to 5, **characterized in that** the outer wrapper is a sheet including a plurality of layers.

7. The smoking article provided with a filter of Claim 6, **characterized in that** the sheet including the plurality of layers comprises a base layer composed of a film containing polyolefin or polyester as a main component.

8. The smoking article provided with a filter of Claim 7, **characterized in that** the base layer is a biaxially-drawn film.

9. The smoking article provided with a filter of Claim 7 or 8, **characterized in that** the sheet including the plurality of layers further comprises a surface layer provided on one surface or both surfaces of the base layer.
- 5 10. The smoking article provided with a filter of Claim 9, **characterized in that** the surface layer contains an inorganic filler.
11. The smoking article provided with a filter of any one of Claims 1 to 10, **characterized in that** a hardness of the filter wound with the outer wrapper is less than 90%.
- 10 12. The smoking article provided with a filter of any one of Claims 1 to 11, **characterized in that** a basis weight of the outer wrapper is 100 g/m² or more.
13. The smoking article provided with a filter of any one of Claims 1 to 12, **characterized in that** a thickness of the outer wrapper is 100 μm or more.
- 15 14. The smoking article provided with a filter of any one of Claims 1 to 11, **characterized in that** the one or more filter wrappers are films containing polyolefin as a main component or films containing polyester as a main component.
15. The smoking article provided with a filter of Claim 14, **characterized in that** the one or more filter wrappers are biaxially-drawn films.
- 20 16. The smoking article provided with a filter of Claim 14 or 15, **characterized in that** a total basis weight of the one or more filter wrappers is 100 g/m² or more.
- 25 17. The smoking article provided with a filter of any one of Claims 14 to 16, **characterized in that** a total thickness of the one or more filter wrappers is 100 μm or more.

Patentansprüche

- 30 1. Rauchartikel (1), der mit einem Filter (12) bereitgestellt wird, Folgendes umfassend:
- ein Aerosol erzeugendes Element (11);
 einen Filter (12), der ein Filtermaterial (121) und eine oder mehrere Filterhüllen (122) umfasst, die um eine Außenumfangsoberfläche des Filtermaterials herumgewickelt sind; und
 35 eine Außenhülle (13), die um die Außenumfangsoberflächen eines Endteils des Aerosol erzeugenden Elements und den Filter herumgewickelt ist;
dadurch gekennzeichnet, dass
 die Außenumfangsoberfläche der Außenhülle eine arithmetische mittlere Rauheit von weniger als 2,0 μm aufweist, und
 40 der mit der Außenhülle umwickelte Filter eine Kompressionsrückstellkraft von 60% oder mehr aufweist, nachdem eine Kompressionslast von 2,5 N auf einen Bereich einer Länge von 10 mm in der Durchmesserichtung davon aufgebracht wird.
2. Rauchartikel, der mit einem Filter bereitgestellt wird, nach Anspruch 1, **dadurch gekennzeichnet, dass** die arithmetische mittlere Rauheit der Außenumfangsoberfläche der Außenhülle 1,0 μm oder weniger beträgt.
- 45 3. Rauchartikel, der mit einem Filter bereitgestellt wird, nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** der Wiederherstellungswinkel nach dem Falten der Außenhülle oder der einen oder mehrerer Filterhüllen 60 Grad oder mehr beträgt.
- 50 4. Rauchartikel, der mit einem Filter bereitgestellt wird, nach Anspruch 3, **dadurch gekennzeichnet, dass** der Wiederherstellungswinkel nach dem Falten der Außenhülle oder der einen oder mehrerer Filterhüllen 100 Grad oder mehr beträgt.
- 55 5. Rauchartikel, der mit einem Filter bereitgestellt wird, nach Anspruch 4, **dadurch gekennzeichnet, dass** der Wiederherstellungswinkel nach dem Falten der Außenhülle oder der einen oder mehrerer Filterhüllen 100 Grad oder mehr und 120 Grad oder weniger beträgt.

6. Rauchartikel, der mit einem Filter bereitgestellt wird, nach einem der Ansprüche 1 bis 5, **dadurch gekennzeichnet, dass** die Außenhülle ein Blatt ist, das eine Vielzahl von Schichten beinhaltet.
- 5 7. Rauchartikel, der mit einem Filter bereitgestellt wird, nach Anspruch 6, **dadurch gekennzeichnet, dass** das Blatt, das die Vielzahl von Schichten beinhaltet, eine Grundschicht umfasst, die sich aus einer Folie zusammensetzt, die Polyolefin oder Polyester als eine Hauptkomponente enthält.
8. Rauchartikel, der mit einem Filter bereitgestellt wird, nach Anspruch 7, **dadurch gekennzeichnet, dass** die Grundschicht eine biaxial gezogene Folie ist.
- 10 9. Rauchartikel, der mit einem Filter bereitgestellt wird, nach Anspruch 7 oder 8, **dadurch gekennzeichnet, dass** das Blatt, das die Vielzahl von Schichten beinhaltet, weiter eine Oberflächenschicht umfasst, die auf einer Oberfläche oder beiden Oberflächen der Grundschicht bereitgestellt wird.
- 15 10. Rauchartikel, der mit einem Filter bereitgestellt wird, nach Anspruch 9, **dadurch gekennzeichnet, dass** die Oberflächenschicht einen anorganischen Füllstoff enthält.
11. Rauchartikel, der mit einem Filter bereitgestellt wird, nach einem der Ansprüche 1 bis 10, **dadurch gekennzeichnet, dass** eine Härte des mit der Außenhülle umwickelten Filters weniger als 90% beträgt.
- 20 12. Rauchartikel, der mit einem Filter bereitgestellt wird, nach einem der Ansprüche 1 bis 11, **dadurch gekennzeichnet, dass** ein Grundgewicht der Außenhülle 100 g/m² oder mehr beträgt.
13. Rauchartikel, der mit einem Filter bereitgestellt wird, nach einem der Ansprüche 1 bis 12, **dadurch gekennzeichnet, dass** eine Dicke der Außenhülle 100 µm oder mehr beträgt.
- 25 14. Rauchartikel, der mit einem Filter bereitgestellt wird, nach einem der Ansprüche 1 bis 11, **dadurch gekennzeichnet, dass** die eine oder mehrere Filterhüllen Folien sind, die Polyolefin als eine Hauptkomponente enthalten, oder Folien, die Polyester als eine Hauptkomponente enthalten.
- 30 15. Rauchartikel, der mit einem Filter bereitgestellt wird, nach Anspruch 14, **dadurch gekennzeichnet, dass** die eine oder mehrere Filterhüllen biaxial gezogene Folien sind.
16. Rauchartikel, der mit einem Filter bereitgestellt wird, nach Anspruch 14 oder 15, **dadurch gekennzeichnet, dass** ein Gesamtgrundgewicht der einen oder mehrerer Filterhüllen 100 g/m² oder mehr beträgt.
- 35 17. Rauchartikel, der mit einem Filter bereitgestellt wird, nach einem der Ansprüche 14 bis 16, **dadurch gekennzeichnet, dass** eine Gesamtdicke der einen oder mehrerer Filterhüllen 100 µm oder mehr beträgt.

Revendications

1. Article à fumer (1) doté d'un filtre (12), comprenant :

45 un élément générateur d'aérosol (11) ;
un filtre (12) comprenant un matériau de filtre (121) et une ou plusieurs enveloppes de filtre (122) enroulées autour d'une surface circonférentielle extérieure du matériau de filtre ; et
une enveloppe extérieure (13) enroulée autour des surfaces circonférentielles extérieures d'une partie d'extrémité de l'élément générateur d'aérosol et du filtre ;

50 **caractérisé en ce que**

la surface circonférentielle extérieure de l'enveloppe extérieure présente une rugosité moyenne arithmétique inférieure à 2,0 µm, et
le filtre enroulé avec l'enveloppe extérieure présente une récupération de compression de 60 % ou plus après qu'une charge de compression de 2,5 N a été appliquée à une plage d'une longueur de 10 mm dans la direction de diamètre de celui-ci.

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2. Article à fumer doté d'un filtre selon la revendication 1, **caractérisé en ce que** la rugosité moyenne arithmétique de la surface circonférentielle extérieure de l'enveloppe extérieure est de 1,0 µm ou moins.

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3. Article à fumer doté d'un filtre selon la revendication 1 ou 2, **caractérisé en ce qu'**un angle de récupération après le pliage de l'enveloppe extérieure ou des une ou plusieurs enveloppes de filtre est de 60 degrés ou plus.
- 5 4. Article à fumer doté d'un filtre selon la revendication 3, **caractérisé en ce que** l'angle de récupération après le pliage de l'enveloppe extérieure ou des une ou plusieurs enveloppes de filtre est de 100 degrés ou plus.
- 10 5. Article à fumer doté d'un filtre selon la revendication 4, **caractérisé en ce que** l'angle de récupération après le pliage de l'enveloppe extérieure ou des une ou plusieurs enveloppes de filtre est de 100 degrés ou plus et de 120 degrés ou moins.
- 15 6. Article à fumer doté d'un filtre selon l'une quelconque des revendications 1 à 5, **caractérisé en ce que** l'enveloppe extérieure est une feuille incluant une pluralité de couches.
- 20 7. Article à fumer doté d'un filtre selon la revendication 6, **caractérisé en ce que** la feuille incluant la pluralité de couches comprend une couche de base composée d'un film contenant de la polyoléfine ou du polyester en tant que composant principal.
- 25 8. Article à fumer doté d'un filtre selon la revendication 7, **caractérisé en ce que** la couche de base est un film étiré biaxialement.
- 30 9. Article à fumer doté d'un filtre selon la revendication 7 ou 8, **caractérisé en ce que** la feuille incluant la pluralité de couches comprend en outre une couche de surface fournie sur une surface ou les deux surfaces de la couche de base.
- 35 10. Article à fumer doté d'un filtre selon la revendication 9, **caractérisé en ce que** la couche de surface contient une charge inorganique.
- 40 11. Article à fumer doté d'un filtre selon l'une quelconque des revendications 1 à 10, **caractérisé en ce qu'**une dureté du filtre enroulé avec l'enveloppe extérieure est inférieure à 90%.
- 45 12. Article à fumer doté d'un filtre selon l'une quelconque des revendications 1 à 11, **caractérisé en ce qu'**un poids de base de l'enveloppe extérieure est de 100 g/m² ou plus.
- 50 13. Article à fumer doté d'un filtre selon l'une quelconque des revendications 1 à 12, **caractérisé en ce qu'**une épaisseur de l'enveloppe extérieure est de 100 μm ou plus.
- 55 14. Article à fumer doté d'un filtre selon l'une quelconque des revendications 1 à 11, **caractérisé en ce que** les une ou plusieurs enveloppes de filtre sont des films contenant de la polyoléfine en tant que composant principal ou des films contenant du polyester en tant que composant principal.
15. Article à fumer doté d'un filtre selon la revendication 14, **caractérisé en ce que** les une ou plusieurs enveloppes de filtre sont des films étirés biaxialement.
16. Article à fumer doté d'un filtre selon la revendication 14 ou 15, **caractérisé en ce qu'**un poids de base total des une ou plusieurs enveloppes de filtre est de 100 g/m² ou plus.
17. Article à fumer doté d'un filtre selon l'une quelconque des revendications 14 à 16, **caractérisé en ce qu'**une épaisseur totale des une ou plusieurs enveloppes de filtre est de 100 μm ou plus.

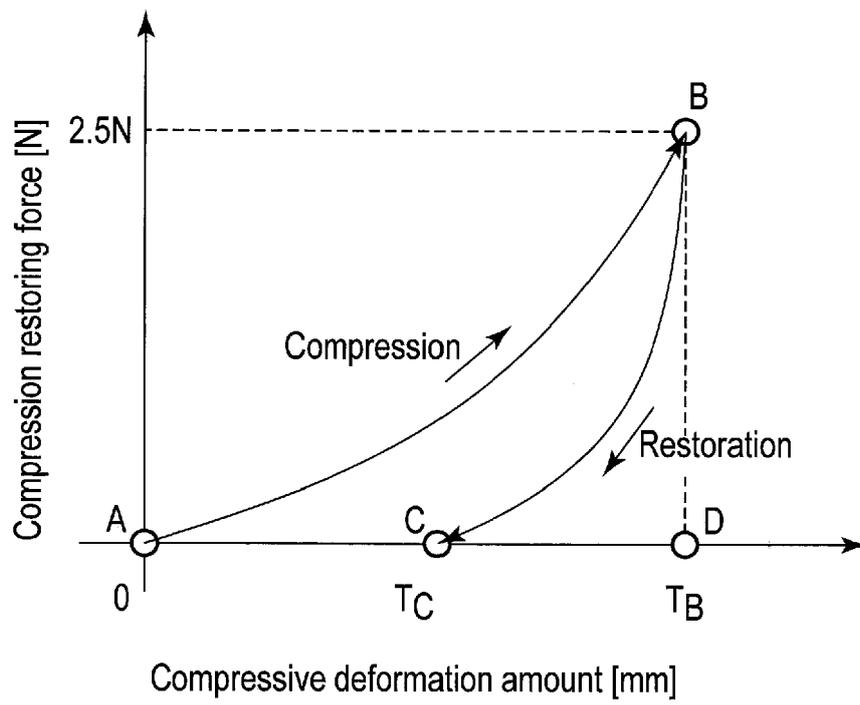


FIG. 1

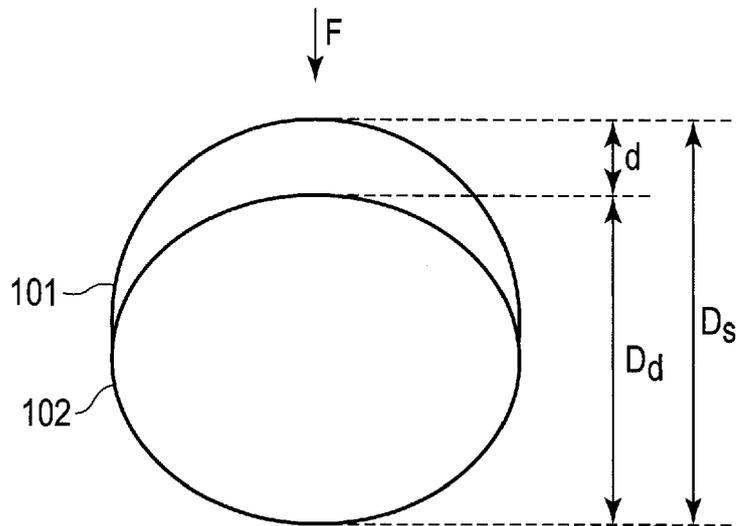


FIG. 2

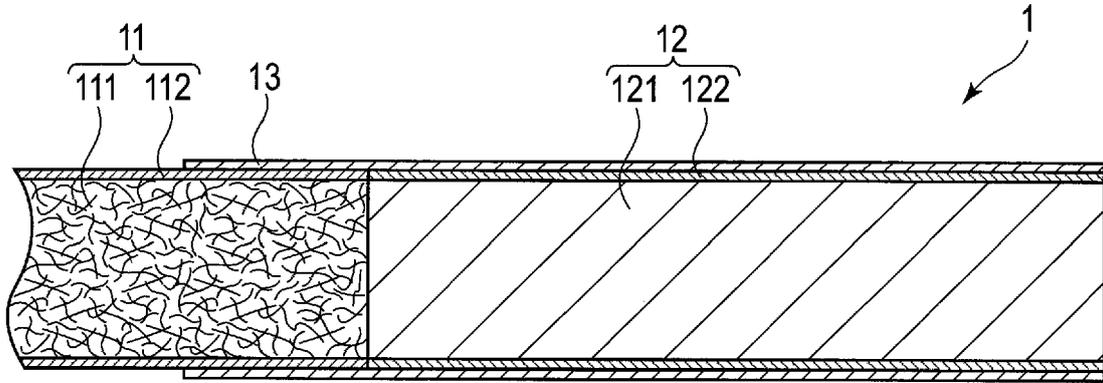


FIG. 3

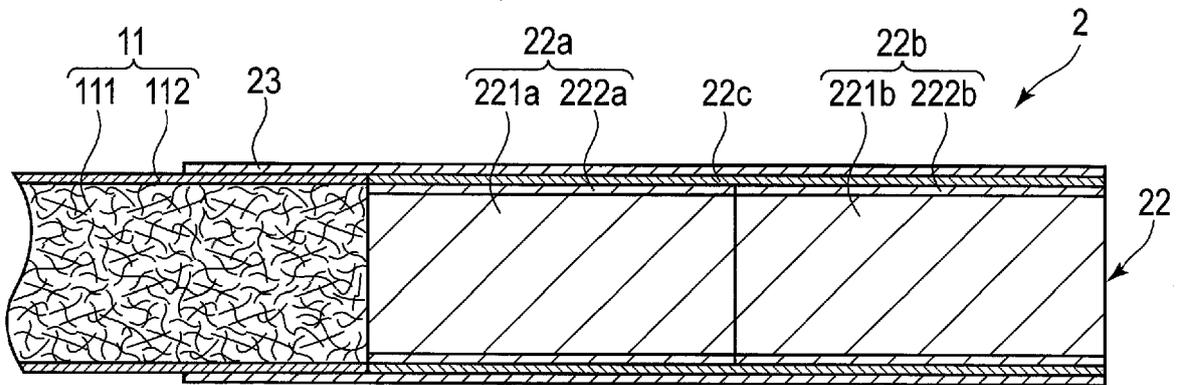


FIG. 4

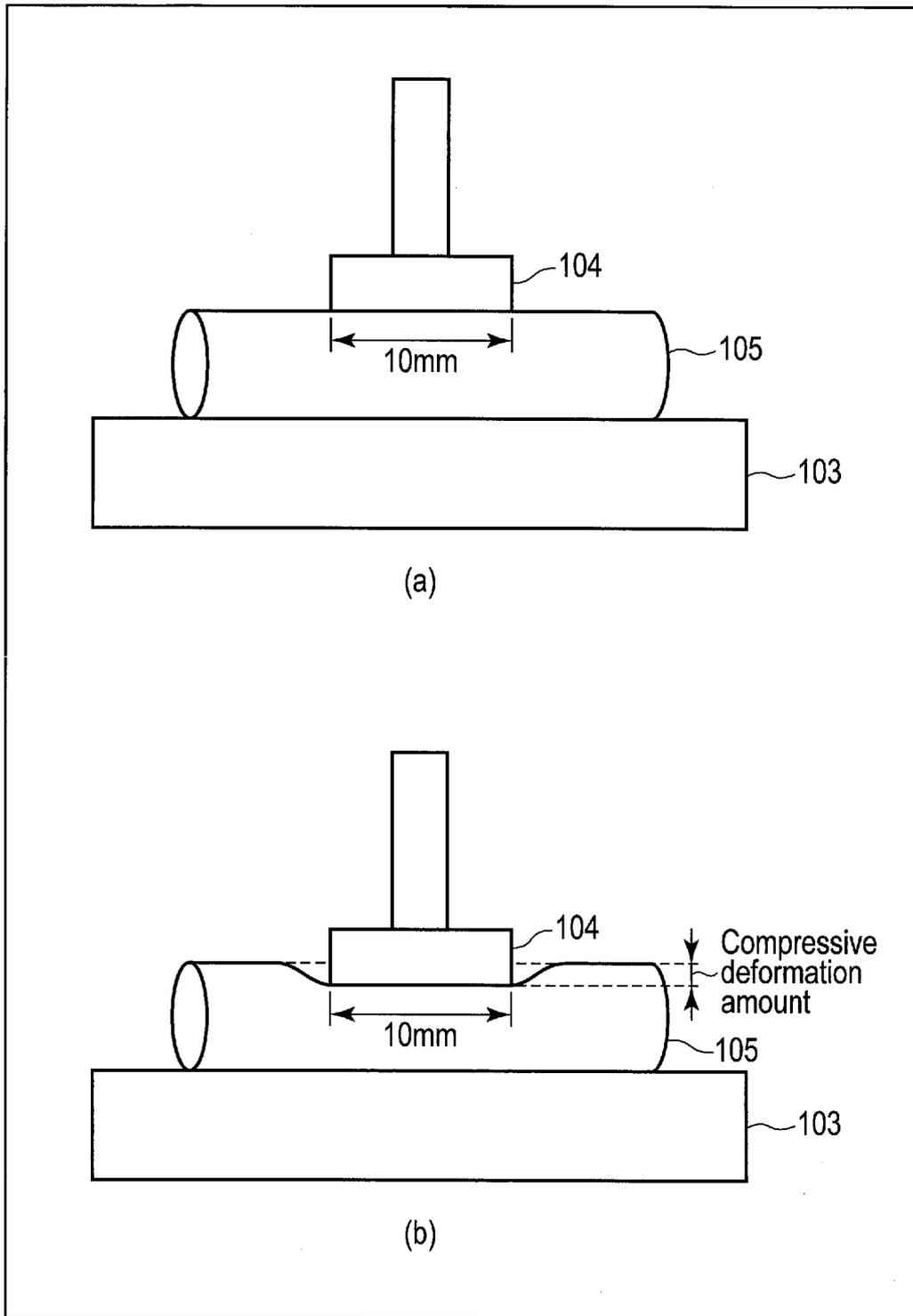


FIG. 5

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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