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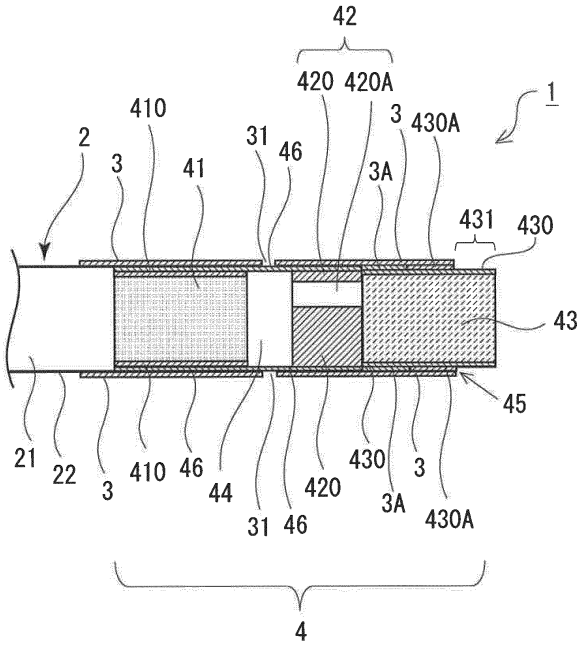
(54) FILTER FOR CIGARETTE AND CIGARETTE WITH FILTER

(57) A filter for a cigarette that is connected through tipping paper at one end of a rod unit in which tobacco shreds are wrapped in cigarette paper, the filter includes a throttle member that has a throttle member main body arranged so as to cover the lateral cross-section of the filter, and a through-passage which is formed through a part of the throttle member main body in the longitudinal direction of the filter and through which mainstream smoke flows, a rear-stage filter material that is disposed in the rear stage of the throttle member and filters the smoke components of mainstream smoke, and a turning mechanism that allows a relative turn of the rear-stage filter material and the throttle member around the longitudinal axis of the filter. The through-passage of the throttle member is formed so that the position at which the through-passage faces the front end face of the rear-stage filter material is changed according to the relative turn of the rear-stage filter material and the throttle member.

FIG. 2



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Description

Technical Field

[0001] The present invention relates to a filter for a cigarette and a cigarette with a filter.

Background Art

[0002] Conventionally, a technique is known in which, for the purpose of varying the mainstream smoke components of a cigarette etc., a throttle member having an orifice etc. with a narrowed flow passage cross-sectional area for mainstream smoke is arranged in the front stage (on the upstream side) of a filter material, and mainstream smoke at an increased flow velocity is caused to flow into the filter material so that the mainstream smoke is filtered while at a high flow velocity. In this specification, this technique will be described as a "high-speed filtration" technique.

[0003] [Patent document 1] Japanese Patent Laid-Open No. 8-205844

Summary of Invention

Technical Problem

[0004] However, when high-speed filtration of mainstream smoke is performed in the filter material, clogging is likely to occur in the front end face of the filter material. As a result, the airflow resistance of the filter material increases with each puff, i.e., each time a smoker inhales the mainstream smoke, which may make it difficult for the smoker to smoke.

[0005] Having been devised in view of the above situation, the present invention aims to provide a filter for a cigarette and a cigarette with a filter that can prevent the airflow resistance of the filter material from increasing with each puff, even in the case where the throttle member that narrows the flow passage cross-sectional area of mainstream smoke is arranged in the front stage of the filter material.

Solution to Problem

[0006] To solve the above problem, the present invention has adopted the following solutions. According to the present invention, there is provided a filter for a cigarette that is connected through tipping paper at one end of a rod unit in which tobacco shreds are wrapped in cigarette paper, the filter including: a throttle member that has a throttle member main body arranged so as to cover the lateral cross-section of the filter, and a through-passage which is formed through a part of the throttle member main body in the longitudinal direction of the filter and through which mainstream smoke flows; a rear-stage filter material that is disposed in the rear stage of the throttle member and filters the smoke components of mainstream smoke; and a turning mechanism that allows a relative turn of the rear-stage filter material and the throttle member around the longitudinal axis of the filter, wherein the through-passage of the throttle member is formed so that the position at which the through-passage faces the front end face of the rear-stage filter material is changed according to the relative turn of the rear-stage filter material and the throttle member.

[0007] According to the filter for a cigarette having the above configuration, mainstream smoke, which has been increased in flow velocity while flowing through the through-passage of the throttle member, is introduced into the rear-stage filter material, and high-speed filtration of the mainstream smoke is realized in the rear-stage filter material. As a result, the mainstream smoke components of a cigarette in which the filter according to the present invention is employed can be varied, and an effect of changing the flavor and taste characteristics of the cigarette can be obtained.

[0008] When mainstream smoke, for which the flow passage is narrowed in the throttle member, is introduced into the rear-stage filter material, clogging in the front end face of the rear-stage filter material is likely to occur as particulate matters contained in the mainstream smoke concentrate at the front end face of the rear-stage filter material. As a result, the airflow resistance increases each time a smoker makes an action of inhaling mainstream smoke, i.e., with each puff.

[0009] To address this point, the filter according to the present invention includes the turning mechanism, and is configured so that the position at which the through-passage faces the front end face of the rear-stage filter material is changed as the rear-stage filter material and the throttle member are relatively turned. Accordingly, when a smoker takes further puffs, the smoker can adjust the relative positional relation between the rear-stage filter material and the through-passage, using the turning mechanism at an appropriate timing, so that the through-passage faces a region of the lateral cross-section of the rear-stage filter material in which clogging is not occurring. As a result, an increase in airflow resistance of the rear-stage filter material can be prevented. It is therefore possible to prevent a smoker from having difficulties in inhaling mainstream smoke while smoking.

[0010] The through-passage may be formed in the lateral cross-section of the throttle member main body without forming a concentric circle centered at the central axis of the lateral cross-section. If the through-passage of the throttle member is thus formed, the position at which the through-passage faces the front end face of the rear-stage filter material can be favorably changed when the rear-stage filter material and the throttle member are relatively turned.

[0011] The turning mechanism may be configured as a mechanism that holds at least one of the rear-stage filter material and the throttle member so as to be turnable relative to the tipping paper. In this case, the rear-stage filter material may be arranged at the rearmost end of

the filter, and a grip unit that is used for performing a turning operation of the rear-stage filter material may be formed so as to protrude further on the rear side than the rear end of the tipping paper. Then, a smoker can easily perform a turning operation of the rear-stage filter material relative to the tipping paper by taking the grip unit of the rear-stage filter material between the fingers.

[0012] The outer surface of the grip unit and the tipping paper may have a mark that indicates a turning position of the rear-stage filter material relative to the tipping paper. Accordingly, when performing a turning operation of the rear-stage filter material relative to the tipping paper, a smoker can easily know the current turning position of the rear-stage filter material relative to the tipping paper. Moreover, on the basis of the relative positional relation between the mark provided on the grip unit side and the mark provided on the tipping paper side, a smoker can intuitively understand a guide for the amount of turn when turning the rear-stage filter material. Thus, it is possible to further enhance the convenience of the filter, as well as to provide a filter which is easy to handle for a smoker.

[0013] The rear-stage filter material and the tipping paper may have a structure of concave and convex shapes formed therein which fit with each other each time the turning angle of the rear-stage filter material relative to the tipping paper changes by a predetermined angle. Accordingly, when performing a turning operation of the rear-stage filter material, a smoker can easily know, on the basis of a sensation transmitted through the grip unit, that the turning angle of the rear-stage filter material relative to the tipping paper has changed by a predetermined angle from the position before the operation. Thus, it is possible to further enhance the convenience of the filter, as well as to provide a filter which is easy to handle for a smoker.

[0014] The rear end face of the throttle member and the front end face of the rear-stage filter material may be provided continuously along the longitudinal direction of the filter. Thus, after mainstream smoke has passed through the through-passage of the throttle member, the mainstream smoke can be guided to the rear-stage filter material while being maintained at a high flow velocity. As a result, high-speed filtration of the mainstream smoke in the rear-stage filter material can be realized more favorably.

[0015] The tipping paper may have a ventilation hole formed therein through which air for diluting mainstream smoke is introduced into the filter, and the ventilation hole may be provided in the tipping paper at a position corresponding to the front stage of the through-passage in the longitudinal direction of the filter. Accordingly, mainstream smoke after having joined with external air, which is introduced through the ventilation hole into the filter, can be guided to the through-passage. As a result, the linear velocity of the mainstream smoke flowing through the rear-stage filter material can be easily maintained at a high velocity, which contributes to realization of high-speed filtration of the mainstream smoke in the rear-stage filter material.

[0016] A front-stage filter material that filters the smoke components of mainstream smoke may be disposed in the front stage of the throttle member, and a cavity may be provided between the through-passage and the front-stage filter material. Thus, it is possible to reduce the airflow resistance of the mainstream smoke passing through the front-stage filter material by providing the cavity between the through-passage of the throttle member and the front-stage filter material. As a result, the mainstream smoke can be smoothly introduced into the through-passage of the throttle member. Moreover, if the cavity is provided in the front stage of the through-passage, a clearance can be formed between the rear end face of the front-stage filter material and the throttle member main body (through-passage), so that clogging in the rear end face of the front-stage filter material can be made less likely to occur. As a result, the effect of reducing the airflow resistance in the front-stage filter material can be further expected, and smooth introduction of the mainstream smoke into the through-passage can be more reliably performed.

[0017] The tipping paper may have a ventilation hole formed therein through which air for diluting mainstream smoke is introduced into the filter, and the ventilation hole may be provided in the tipping paper at a position corresponding to the cavity or the front-stage filter material in the longitudinal direction of the filter.

[0018] The present invention can also be regarded to have an aspect of a cigarette with a filter. According to the present invention, there is provided a cigarette with a filter including: a rod unit in which tobacco shreds are wrapped in cigarette paper; and a filter that is connected through tipping paper at one end of the rod unit, wherein the filter includes: a throttle member that has a throttle member main body arranged so as to cover the lateral cross-section of the filter, and a through-passage which is formed through a part of the throttle member main body in the longitudinal direction of the filter and through which mainstream smoke flows; a rear-stage filter material that is disposed in the rear stage of the throttle member and filters the smoke components of mainstream smoke; and a turning mechanism that allows a relative turn of the rear-stage filter material and the throttle member around the longitudinal axis of the filter, the through-passage of the throttle member being formed so that the position at which the through-passage faces the front end face of the rear-stage filter material is changed according to the relative turn of the rear-stage filter material and the throttle member.

[0019] The solutions of the present invention for solving the problem can be adopted in combination as far as possible.

Advantageous Effects of Invention

[0020] According to the present invention, it is possible to provide a filter for a cigarette and a cigarette with a

filter that can prevent the airflow resistance of the filter material from increasing with each puff, even in the case where the throttle member that narrows the flow passage cross-sectional area of mainstream smoke is arranged in the front stage of the filter material.

Brief Description of Drawings

[0021]

[Fig. 1] Fig. 1 is a view representing the schematic configuration of a cigarette according to an embodiment.
[Fig. 2] Fig. 2 is a cross-sectional view of the cigarette according to the embodiment.
[Fig. 3] Fig. 3 is a detailed structural view of a throttle member according to the embodiment.
[Fig. 4] Fig. 4 is a front view of the throttle member according to the embodiment.
[Fig. 5] Fig. 5 is a view illustrating a turning mechanism according to the embodiment.
[Fig. 6A] Fig. 6A is a view (1) representing an example of relative positions of the front end face of a rear-stage filter material and a through-passage.
[Fig. 6B] Fig. 6B is a view (2) representing an example of relative positions of the front end face of the rear-stage filter material and the through-passage.
[Fig. 7A] Fig. 7A is a view (1) representing a modified example of the through-passage in the throttle member.
[Fig. 7B] Fig. 7B is a view (2) representing a modified example of the through-passage in the throttle member.
[Fig. 8] Fig. 8 is a view illustrating a filter according to a first modified example.
[Fig. 9] Fig. 9 is a view illustrating a filter according to a second modified example.
[Fig. 10] Fig. 10 is a view illustrating a filter according to a third modified example.
[Fig. 11] Fig. 11 is a schematic view of a cigarette according to a comparative example.
[Fig. 12] Fig. 12 is a view representing measurement results of airflow resistance at each puff in an example and a comparative example.

Description of Embodiment

[0022] Here, an embodiment of a filter for a cigarette and a cigarette with a filter according to the present invention will be described on the basis of the drawings. Unless specifically described otherwise, the dimensions, materials, shapes, relative arrangement, etc. of the components described in this embodiment are not intended to limit the technical scope of the present invention only thereto.

[0023] Fig. 1 is a view representing the schematic configuration of a cigarette with a filter (hereinafter referred to simply as a "cigarette") 1 according to this embodiment. Fig. 2 is a cross-sectional view representing a part of the cigarette 1. Fig. 2 schematically represents the cross-section including the longitudinal axis (hereinafter referred to as a "longitudinal cross-section") of the cigarette 1. The cigarette 1 has a rod unit 2 and a filter 4 that is connected through tipping paper 3 at one end of this rod unit 2. The shreds rod 2 is composed of tobacco shreds 21 wrapped in cigarette paper 22, and has a circular columnar shape (rod shape). The rod unit 2 is sometimes called a "single-wrap unit". Fig. 2 represents mainly the cross-section of the filter 4. Hereinafter, the cross-section in a direction perpendicular to the longitudinal axis of the cigarette 1 (the rod unit 2, the filter 4) will be referred to as a "lateral cross-section".

[0024] The filter 4 is a member that filters smoke components contained in mainstream smoke when the mainstream smoke generated during smoking of the cigarette 1 passes through the filter 4. The filter 4 is shaped in a circular columnar shape having substantially the same diameter as the rod unit 2. The rod unit 2 and the filter 4 are coupled with each other through the tipping paper as mentioned above. Hereinafter, the end of the rod unit 2 connected with the filter 4 will be referred to as the "rear end", and the opposite end will be referred to as the "front end". The end of the filter 4 connected with the rod unit 2 will be referred to as the "front end" of the filter 4, and the opposite end will be referred to as the "inhalation end" (rear end).

[0025] On the inside of the filter 4, a front-stage filter material 41, a throttle member 42, a rear-stage filter material 43, etc. are disposed sequentially side by side from the front end side of the filter 4. The front-stage filter material 41 and the rear-stage filter material 43 are filtration materials that filter smoke components contained in mainstream smoke flowing from the side of the rod unit 2 into the filter 4 during smoking. With reference to the throttle member 42, the front-stage filter material 41 is provided in the front stage (on the upstream side) of the throttle member 42, and the rear-stage filter material 43 is provided in the rear stage (on the downstream side) of the throttle member 42.

[0026] While the front-stage filter material 41 and the rear-stage filter material 43 used for the cigarette 1 are not limited to a particular type, in this embodiment, for example, the front-stage filter material 41 is formed as a charcoal filter, and the rear-stage filter material 43 is formed as a cellulose acetate filter. Here, the cellulose acetate filter is a filter segment in which a bundle of cellulose acetate fibers shaped in a circular columnar shape is wrapped in wrapping paper 430. On the other hand, the charcoal filter is a filter segment in which a bundle of cellulose acetate fibers with an adsorbent, such as activated charcoal, dispersed therein is wrapped in wrapping paper 410. In addition to filtering mainstream smoke, the front-stage filter material 41 also functions to prevent the tobacco shreds 21 of the rod unit 2 from falling to the side of the filter 4.

[0027] Next, the details of the throttle member 42 will

be described. Fig. 3 represents the detailed structure of the throttle member 42 according to the embodiment. The throttle member 42 has a throttle member main body 420 formed of a smoke-impermeable material having smoke impermeability, and a through-passage 420A drilled in a part of the lateral cross-section of this throttle member main body 420. In this embodiment, the throttle member 42 is produced using a resin such as a plastic, but any other smoke-impermeable material, such as a metal or densely shaped cellulose acetate fibers, may be used. As represented in Fig. 2, the throttle member main body 420 of the throttle member 42 is a disc member having substantially the same diameter as the lateral cross-section of the filter 4, and is arranged so as to cover the lateral cross-section of the filter 4. The through-passage 420A of the throttle member 42 penetrates the throttle member main body 420 in the longitudinal direction of the filter 4, and extends along the longitudinal axis of the filter 4. The through-passage 420A of the throttle member main body 420 is a flow passage through which mainstream smoke flows and which narrows the flow passage cross-sectional area of mainstream smoke.

[0028] Fig. 4 is a front view of the throttle member 42 according to the embodiment. Here, the center of the throttle member main body 420 is defined as the "central axis" of the throttle member 42, and indicated by reference sign CA1 in Fig. 4. The through-passage 420A in this embodiment is formed in the lateral cross-section of the throttle member main body 420 without forming a concentric circle centered at the central axis CA1 of the throttle member main body 420. In the example represented in Fig. 4, the through-passage 420A is a through-hole that is arranged eccentrically to the central axis CA1 of the throttle member main body 420 and has a circular cross-section. That is, when the central axis of the through-passage 420A is represented by reference sign CA2, the central axis CA2 of the through-passage 420A is eccentric to the central axis CA1 of the throttle member main body 420, and does not form a concentric circle centered at the central axis CA1 of the throttle member main body 420.

[0029] The throttle member 42 according to this embodiment is arranged inside the filter 4 so that the central axis CA1 is coaxial with the longitudinal axis of the filter 4. In this specification, the "upstream" and the "downstream" inside the filter 4 are defined with reference to the direction in which mainstream smoke flowing from the rod unit 2 flows inside the filter 4. That is, the above-mentioned "inhalation end" of the filter 4 corresponds to the downstream end of the filter 4, and the "front end" of the filter 4 corresponds to the upstream end of the filter 4.

[0030] The throttle member main body 420 of the throttle member 42 is arranged so as to face the front end face of the rear-stage filter material 43. More specifically, the rear end face of the throttle member main body 420 of the throttle member 42 and the front end face of the rear-stage filter material 43 are provided continuously along the longitudinal direction of the filter 4. Thus, the rear-stage filter material 43 and the throttle member main body 420 are arranged continuously so that no clearance is left between the front end face of the rear-stage filter material 43 and the rear end face of the throttle member main body 420.

[0031] On the other hand, a cavity 44 is provided between the front end face of the throttle member main body 420 of the throttle member 42 and the rear end face of the front-stage filter material 41. That is, the front-stage filter material 41 and the throttle member 42 in the filter 4 are arranged across the cavity 44, at a distance from each other in the longitudinal direction of the filter 4. The through-passage 420A is provided in the throttle member main body 420, hence the cavity 44 is provided in the front stage (on the upstream side) of the through-passage 420A. The front-stage filter material 41 and the throttle member 42 are integrated by being wrapped in common wrapping paper 46. This wrapping paper 46 has air permeability.

[0032] In a region of the tipping paper 3 that covers around the filter 4, ventilation holes 31, through which external air (air) for diluting mainstream smoke is introduced into the filter 4, is perforated. These ventilation holes 31 are introduction holes for so-called ventilating external air, and the plurality of ventilation holes 31 are provided in the tipping paper 3. The ventilation holes 31 in the tipping paper 3 are provided at positions corresponding to the front stage of the through-passage 420A of the throttle member 42 in the longitudinal direction of the filter 4. That is, the ventilation holes 31 are formed in the tipping paper 3 at positions on the upstream side relative to the through-passage 420A of the throttle member 42. More specifically, the ventilation holes 31 in the tipping paper 3 are provided at positions corresponding to the cavity 44 in the longitudinal direction of the filter 4. Since the wrapping paper 46 has air permeability as mentioned above, external air from the ventilation holes 31 of the tipping paper 3 passes through the wrapping paper 46 and is introduced into the filter 4.

[0033] The ventilation holes 31 may be opened in advance at specified positions of the tipping paper 3 before the tipping paper 3 is wrapped around the rod unit 2 and the filter 4. Alternatively, the ventilation holes 31 may be formed after the tipping paper 3 is wrapped around the rod unit 2 and the filter 4. The ventilation holes 31 may be perforated in the tipping paper 3, for example, by using laser etc. or using other means. In this embodiment, the plurality of ventilation holes 31 are arranged at regular intervals along the circumferential direction of the tipping paper 3, but the arrangement pattern of the ventilation holes 31 in the tipping paper 3 is a design item that can be appropriately changed.

[0034] Next, a turning mechanism 45 for the rear-stage filter material 43 provided in the filter 4 will be described. Fig. 5 is a view illustrating the turning mechanism 45 according to the embodiment. Fig. 5 represents mainly the rear-stage filter material 4 of the filter 4. The turning mechanism 45 in this embodiment is a mechanism that

allows a relative turn of the rear-stage filter material 43 and the throttle member 42 around the longitudinal axis of the filter 4. More specifically, the turning mechanism 45 is configured as a mechanism that holds at least one of the rear-stage filter material 43 and the throttle member 42 so as to be turnable relative to the tipping paper 3 in the circumferential direction.

[0035] In the configuration example represented in Fig. 5, the throttle member 42 is fixedly arranged inside the filter 4. Specifically, the wrapping paper 46, which is wrapped around the outer circumferential surface of the throttle member 42 (throttle member main body 420), i.e., around the outer circumference of the throttle member 42, is bonded with an adhesive to the inner circumferential surface of the tipping paper 3. In Fig. 5, the application regions of the adhesive are indicated by reference sign BD with thick lines.

[0036] As can be seen from Fig. 5, the adhesive is not applied between the wrapping paper 430, which forms the outer circumferential surface of the rear-stage filter material 43 arranged at the rearmost end of the filter 4, and the tipping paper 3. That is, the rear-stage filter material 43 is not bonded to the tipping paper 3, but is held so as to be freely slidable and turnable in the circumferential direction along the inner surface of the tipping paper 3. As represented in Fig. 5, the rear-stage filter material 43 is inserted inside the tube formed by the tipping paper 3, and the rear-stage filter material 43 is held so that a part thereof on the rear end side protrudes further on the rear side than the rear end of the tipping paper 3. That is, the rear-stage filter material 43 is freely turnably held by the tipping paper 3 so that the rear end side thereof protrudes from the tipping paper 3 and is thereby exposed to the outside. Hereinafter, the part of the rear-stage filter material 43 that protrudes from the tipping paper 3 and is thereby exposed to the outside will be referred to as a "grip unit" 431. For example, a smoker can easily perform a turning operation of the rear-stage filter material 43 by taking the grip unit 431 of the rear-stage filter material 43 between the fingers.

[0037] Moreover, the turning mechanism 45 of the filter 4 is configured so as to prevent the rear-stage filter material 43 from slipping out of the tipping paper 3. More specifically, slip-out prevention pieces 3A, 430A engaging with each other are formed at the rear end of the tipping paper 3 and the front end of the wrapping paper 430 of the rear-stage filter material 43. As represented in Fig. 5, the slip-out prevention convex portion 3A is provided on the inner surface of the tipping paper 3, and the slip-out prevention convex piece 430A is provided on the outer surface of the wrapping paper 430. The slip-out prevention piece 3A is formed in an annular and belt-like shape along the circumferential direction of the inner surface of the tipping paper 3. The slip-out prevention piece 3A is formed, for example, by sticking a paper material forming the tipping paper 3 in two layers through an adhesive BD, but the present invention is not limited to this example. Similarly, the slip-out prevention convex piece 430A is formed in an annular and belt-like shape along the circumferential direction of the outer surface of the wrapping paper 430. The slip-out prevention piece 430A is formed, for example, by sticking a paper material forming the wrapping paper 430 in two layers through the adhesive BD, but the present invention is not limited to this example.

[0038] As represented in Fig. 5, the slip-out prevention convex piece 3A on the side of the tipping paper 3 and the slip-out prevention convex piece 430A on the side of the rear-stage filter material 43 (wrapping paper 430) catch on and thereby engage with each other. Thus, relative movement of the rear-stage filter material 43 in the longitudinal direction of the filter 4, i.e., slip-out of the rear-stage filter material 43 is prevented. Since the rear-stage filter material 43 is not bonded to the tipping paper 3, the rear-stage filter material 43 can be freely relatively turned around the central axis (longitudinal axis) along the longitudinal direction of the filter 4. In other words, the rear-stage filter material 43 can be freely slid along the inner circumferential surface of the tipping paper 3.

[0039] Next, the details of the through-passage 420A of the throttle member 42 will be described. As described with reference to Fig. 4, the through-passage 420A is formed without forming a concentric circle centered at the central axis CA1 in the lateral cross-section of the throttle member 42 (throttle member main body 420). If the through-passage 420A is thus formed, the position at which the through-passage 420A faces the front end face of the rear-stage filter material 43 can be changed when the rear-stage filter material 43 and the throttle member 42 are relatively turned using the turning mechanism 45. That is, the through-passage 420A of the throttle member 42 is formed so that the position at which the through-passage 420A faces the front end face of the rear-stage filter material 43 is changed according to the relative turn of the rear-stage filter material 43 and the throttle member 42.

[0040] Next, the actions of the filter 4 and the effects achieved thereby in this embodiment will be described with reference mainly to Fig. 2. When a smoker smokes the cigarette 1, the mainstream smoke flowing from the rod unit 2 into the filter 4 flows through the front-stage filter material 41, the throttle member 42, and the rear-stage filter material 43, and is inhaled into the oral cavity from the inhalation end of the filter 4. The particulate matters contained in the mainstream smoke are collected by sequentially passing through the front-stage filter material 41 and the rear-stage filter material 43. Meanwhile, external air is introduced into the filter 4 through the ventilation holes 31 opened in the tipping paper 3, and joins with the mainstream smoke. Then, the mainstream smoke having joined with the external air introduced through the ventilation holes 31 passes through the through-passage 420A of the throttle member 42, which functions as a so-called orifice by narrowing the flow passage cross-sectional area of the mainstream smoke, and is thereby increased in flow velocity.

[0041] The mainstream smoke flowing at a high velocity out of the through-passage 420A flows into the rear-stage filter material 43. Here, since the cross-sectional area of the through-passage 420A is smaller than the size of the lateral cross-section of the rear-stage filter material 43, the mainstream smoke passes through a part of the lateral cross-section of the rear-stage filter material 43. Thus, as the effective filtration area of the rear-stage filter material 43 is reduced, the linear velocity of the mainstream smoke flowing through the rear-stage filter material 43 is maintained at a high velocity. Accordingly, high-speed filtration of mainstream smoke is realized in the rear-stage filter material 43, and the filtration characteristics can be changed. Then, it is possible to change the mainstream smoke components of the cigarette 1 and obtain an effect of changing the flavor and taste characteristics of the cigarette 1 by performing high-speed filtration of the rear-stage filter material 43.

[0042] When the mainstream smoke having increased in flow velocity while passing through the through-passage 420A flows into the rear-stage filter material 43, the particulate matters contained in the mainstream smoke concentrate at the front end face of the rear-stage filter material 43. Therefore, when high-speed filtration of the rear-stage filter material 43 is performed, clogging is likely to occur in the front end face of the rear-stage filter material 43, which causes an increase in airflow resistance each time a smoker makes an action of inhaling the mainstream smoke, i.e., with each puff.

[0043] To address this point, the filter 4 according to this embodiment includes the turning mechanism 45 that allows a relative turn of the rear-stage filter material 43 and the throttle member 42, so that the above inconvenience can be resolved. The actions of the filter 4 using the turning mechanism 45 will be described below.

[0044] Fig. 6A and Fig. 6B are views illustrating relative positions of the front end face of the rear-stage filter material 43 and the through-passage 420A before and after a turning operation of the rear-stage filter material 43 is performed. Fig. 6A and Fig. 6B represent the relative positional relation of the through-passage 420A in the throttle member 42 with reference to the front end face (indicated by the oblique hatching in Fig. 6) of the rear-stage filter material 43.

[0045] For example, it is assumed that a smoker inhales mainstream smoke in a state represented in Fig. 6A and that clogging is occurring in the region of the lateral cross-section of the rear-stage filter material 43 which faces the through-passage 420A of the throttle member 42. Even if the smoker tries to inhale the mainstream smoke in this state, it may be difficult to inhale the mainstream smoke due to the high airflow resistance. In this regard, since the filter 4 according to this embodiment includes the turning mechanism 45, the smoker can turn the rear-stage filter material 43 by taking the grip unit 431 of the rear-stage filter material 43 between the fingers.

[0046] As described above, the through-passage 420A of the throttle member 42 is formed in the lateral cross-section of the throttle member main body 420 without forming a concentric circle centered at the central axis CA1 of the throttle member main body 420. Therefore, as the rear-stage filter material 43 turns along the inner circumferential surface of the tipping paper 3, the position at which the through-passage 420A faces the front end face of the rear-stage filter material 43 can be changed as represented in Fig. 6B. Fig. 6A and Fig. 6B represent an example where the smoker sets the turning angle (amount of turning operation) of the rear-stage filter material 43 to 90°. Thus, by performing a turning operation of the rear-stage filter material 43 at an arbitrary timing, the smoker can adjust the relative positional relation between the rear-stage filter material 43 and the through-passage 420A so that the through-passage 420A faces a region of the lateral cross-section of the rear-stage filter material 43 in which clogging is not occurring. As a result, even if the number of puffs increases during smoking of the cigarette 1, it is possible to prevent the airflow resistance of the rear-stage filter material 43 from increasing with each puff by performing a turning operation of the rear-stage filter material 43 at an appropriate timing. It is therefore possible to prevent the smoker from having difficulties in inhaling mainstream smoke while smoking the cigarette 1.

[0047] In this embodiment, the rear end face of the throttle member main body 420 of the throttle member 42 and the front end face of the rear-stage filter material 43 are continuously provided in the longitudinal direction of the filter 4, and no clearance is provided between the front end face of the rear-stage filter material 43 and the rear end face of the throttle member main body 420A. Accordingly, after mainstream smoke has passed through the through-passage 420A of the throttle member 42, the mainstream smoke can be guided to the rear-stage filter material 43 while being maintained at a high flow velocity. As a result, high-speed filtration of the mainstream smoke in the rear-stage filter material 43 can be realized more favorably.

[0048] In this embodiment, the ventilation holes 31, through which ventilating external air is introduced into the filter 4, are arranged at positions further on the upstream side than the throttle member main body 420 of the throttle member 42 in the longitudinal direction of the filter 4. More specifically, the ventilation holes 31 of the tipping paper 3 are provided at positions corresponding to the second cavity 44 in the longitudinal direction of the filter 4. Accordingly, it is possible to guide the mainstream smoke, which has joined with the external air introduced through the ventilation holes 31 into the filter 4, to the through-passage 420A. This is effective in maintaining the linear velocity of the mainstream smoke, which flows sequentially through the through-passage 420A and the rear-stage filter material 43, at a high velocity, which contributes to realization of high-speed filtration of the mainstream smoke in the rear-stage filter material 43. From the viewpoint of favorably realizing high-speed filtration

in the rear-stage filter material 43, the ventilation holes 31 of the tipping paper 3 should be arranged further on the upstream side than the throttle member main body 420 (through-passage 420A) of the throttle member 42. Therefore, for example, the ventilation holes 31 may be arranged at positions corresponding to the front-stage filter material 41 in the longitudinal direction of the filter 4. In this embodiment, from the viewpoint of favorably realizing high-speed filtration in the rear-stage filter material 43, the ventilation holes 31 of the tipping paper 3 are arranged further on the upstream side than the throttle member main body 420 (through-passage 420A) of the throttle member 42, but this is not to hinder opening the ventilation holes 31 at positions further on the downstream side than the throttle member 42 in the tipping paper 3. Moreover, the ventilation holes 31 of the tipping paper 3 are not an essential component in the filter 4 according to this embodiment.

[0049] According to the filter 4 of this embodiment, the cavity 44 is arranged in the front stage, i.e., on the upstream side, of the through-passage 420A of the throttle member 42, and the front-stage filter material 41 and the throttle member main body 420 (through-passage 420A) are arranged across this cavity 44 at a distance from each other. Accordingly, first, the airflow resistance of the filter 4 can be reduced. As a result, the airflow resistance during smoking can be favorably manipulated. Secondly, since a clearance can be formed between the rear end face of the front-stage filter material 41 and the throttle member main body 420 (through-passage 420A), clogging can be made less likely to occur in the rear end face of the front-stage filter material 41. Thus, as clogging is less likely to occur in the front-stage filter material 41, the effect of reducing the airflow resistance in the front-stage filter material 41 can be further expected, and smooth introduction of mainstream smoke into the through-passage 420A becomes more reliable.

[0050] In the configuration example having been described so far, the turning mechanism 45 has been described as the mechanism that fixes the throttle member 42 on the tipping paper 3 and holds the rear-stage filter material 43 so as to be turnable relative to the tipping paper 3, but the present invention is not limited to this example. The turning mechanism 45 of the filter 4 may hold the throttle member 42, instead of the rear-stage filter material 43, so as to be turnable relative to the tipping paper 3. Alternatively, the turning mechanism 45 may be configured as a mechanism that holds both the rear-stage filter material 43 and the throttle member 42 so as to be turnable relative to the tipping paper 3. These configurations can also achieve an effect similar to that of the turning mechanism 45 described with reference to Fig. 5.

[0051] With the turning mechanism 45 according to this embodiment, it is easy to perform a turning operation of the rear-stage filter material 43, since a part of the rear-stage filter material 43 arranged at the rearmost end of the filter 4 is formed as the grip unit 431 so as to protrude further on the rear side than the rear end of the tipping paper 3. That is, it is possible to enhance the ease of handling when activating the turning mechanism 45, and to improve the convenience.

[0052] In the filter 4 according to this embodiment, the through-passage 420A of the throttle member 42 is formed in the lateral cross-section of the throttle member main body 420 without forming a concentric circle centered at the central axis CA1 of the throttle member main body 420. Thus, it is possible to freely relatively turn the rear-stage filter material 43 and the throttle member 42 around the longitudinal axis of the filter 4 by forming the through-passage 420A so as to assume a non-concentric circular shape relative to the central axis CA1 of the throttle member main body 420.

[0053] In the example represented in Fig. 4, the through-passage 420A of the throttle member 42 is formed as a circular through-hole that is eccentric to the central axis CA1 of the throttle member main body 420, but various modified examples can be adopted. That is, as long as the through-passage 420A of the throttle member 42 is formed in a shape other than a concentric circle centered at the central axis CA1 of the throttle member main body 420, the through-passage 420A may be, for example, formed as a through-hole having one or more rectangular cross-sections as represented in Fig. 7A and Fig. 7B.

[0054] Next, a modified example of the filter 4 according to this embodiment will be described. A filter 4A according to a first modified example represented in Fig. 8 has a built-in throttle member 42A. The throttle member 42A is different from the above-described throttle member 42 in that the throttle member 42A has a tubular wall 421 which is provided so as to rise from the throttle member main body 420. The tubular wall 421 of the throttle member 42A is a cylindrical sleeve (cylindrical wall) provided so as to rise perpendicularly from the throttle member main body 420 along the circumferential edge of the throttle member main body 420, and has an outer diameter substantially equal to that of the lateral cross-section of the filter 4. The inside of the tubular wall 421 is hollow. Hereinafter, the hollow space defined by the inner circumferential surface of the tubular wall 421 and the surface of the throttle member main body 420 will be called a second cavity 422.

[0055] As represented in Fig. 8, inside the filter 4A, the tubular wall 421 is arranged further on the upstream side than the throttle member main body 420 of the throttle member 42A. The throttle member 42A is arranged so that the front end face of the tubular wall 421 butts against the rear end face of the front-stage filter material 41. In this modified example, the ventilation holes 31 formed in the tipping paper 3 are provided at positions corresponding to the front-stage filter material 41 in the longitudinal direction of the filter 4. The front-stage filter material 41 and the throttle member 42A are integrated by being wrapped in the wrapping paper 46. In the modified example thus configured, the effect of reducing the airflow

resistance of the filter 4 can also be obtained, since the second cavity 422 is provided between the rear end face of the front-stage filter material 41 and the front end face of the throttle member main body 420. In this modified example, the throttle member 42A is arranged so that the front end face of the tubular wall 421 butts against the rear end face of the front-stage filter material 41, but the front end face of the tubular wall 421 and the rear end face of the front-stage filter material 41 may be separated from each other. In this modified example, the wrapping paper 410 of the front-stage filter material 41 and the wrapping paper 46 wrapping the front-stage filter material 41 and the throttle member 42A have air permeability. Accordingly, external air from the ventilation holes 31 penetrates the wrapping paper 410 and the wrapping paper 46 and is introduced into the front-stage filter material 41, and then flows sequentially through the front-stage filter material 41, the second cavity 422, the through-passage 420A, and the rear-stage filter material 43, before being guided into the oral cavity.

[0056] Fig. 9 is a view illustrating a filter 4B according to a second modified example. In the filter 4B, the outer surface of the tipping paper 3 at the rear end carries a cursor 32 for positioning. On the other hand, the outer surface (wrapping paper 430) of the grip unit 431 of the rear-stage filter material 43 carries a scale 432. The scale 432 includes marks such as a plurality of bar lines, but the present invention is not limited to this aspect, and the scale 432 may include signs such as letters, numbers, and symbols.

[0057] The cursor 32 of the tipping paper 3 and the scale 432 of the rear-stage filter material 43 function as marks indicating the turning position of the rear-stage filter material 43 relative to the tipping paper 3. Accordingly, when performing a turning operation of the rear-stage filter material 43 relative to the tipping paper 3, a smoker can easily know the current turning position of the rear-stage filter material 43 relative to the tipping paper 3. Moreover, on the basis of the intervals between the scale lines constituting the scale 432, a smoker can intuitively understand a guide for the amount of turn when turning the rear-stage filter material 43. Thus, it is possible to provide a filter that is highly convenient and easy to handle for a smoker. In the example of Fig. 9, the tipping paper 3 carries the cursor 32 and the rear-stage filter material 43 carries the scale 432, but the cursor and the scale may be arranged vice versa.

[0058] Fig. 10 is a view illustrating a filter 4C according to a third modified example. In the filter 4C, the outer circumferential surface (wrapping paper 430) of the rear-stage filter material 43 and the inner circumferential surface of the tipping paper 3 have a structure of concave and convex shapes formed therein which fit with each other each time the turning angle of the rear-stage filter material 43 relative to the tipping paper 3 changes by a predetermined angle. Specifically, as represented in Fig. 10, a plurality of concave portions 433 are provided on the outer circumferential surface (wrapping paper 430) of the rear-stage filter material 43 at regular intervals along the circumferential direction. On the other hand, a plurality of convex portions 33 are provided on the inner circumferential surface of the tipping paper 3 at regular intervals along the circumferential direction. The concave portions 433 on the side of the rear-stage filter material 43 and the convex portions 33 on the side of the tipping paper 3 are formed at positions coinciding with each other in the longitudinal direction of the filter 4, and turning the rear-stage filter material 43 relative to the tipping paper 3 alternately switches the concave portions 433 and the convex portions 33 between a fitted state and a non-fitted state.

[0059] For example, in the example represented in Fig. 10, the convex portions 33 are provided at 45° intervals along the circumferential direction of the tipping paper 3, and the concave portions 433 are provided at 45° intervals along the circumferential direction of the rear-stage filter material 43. In such a filter 4C, the convex portions 33 and the concave portions 433 fit with each other each time the turning angle of the rear-stage filter material 43 relative to the tipping paper 3 changes by a predetermined angle (45° in the example represented in Fig. 10) when a turning operation of the rear-stage filter material 43 is performed. Accordingly, when performing a turning operation of the rear-stage filter material 43, a smoker can easily know that the turning angle of the rear-stage filter material 43 relative to the tipping paper 3 has changed by a predetermined angle from the position before the operation on the basis of a sensation transmitted through the grip unit 431 (a sensation of the convex portions 33 fitting into the concave portions 433, or a sensation of this fitting being released). It is therefore possible to provide a filter that is highly convenient and easy to handle for a smoker. In the example represented in Fig. 10, the convex portions 33 are provided on the inner circumferential surface of the tipping paper 3 and the concave portions 433 are provided on the outer circumferential surface of the rear-stage filter material 43, but the convex portions 33 and the concave portions 433 may be arranged vice versa. Moreover, the intervals between the convex portions 33 and the intervals between the concave portions 433 can be changed freely.

[0060] Next, the present invention will be described more specifically with an example and a comparative example, but the present invention is not limited to this example.

[Example]

[0061] In the example, the cigarette 1 described with Fig. 1 to Fig. 5 was produced by the following procedure. The front-stage filter material 41 was produced by wrapping a bundle of cellulose acetate fibers, with activated charcoal dispersed therein, in the wrapping paper 410. The rear-stage filter material 43 was produced by wrapping a bundle of cellulose acetate fibers in the wrapping paper 430. Both the front-stage filter material 41 and the

rear-stage filter material 43 were 7.8 mm in diameter and 10 mm in length.

[0062] The throttle member 42 was produced by drilling the through-passage 420A having a circular cross-section so as to penetrate the plastic throttle member main body 420 having a disc shape. The throttle member main body 420 was 5 mm in thickness and 7.8 mm in diameter. The diameter of the through-passage 420A was 1.5 mm, and the eccentric dimension between the center of the throttle member main body 420 and the center of the through-passage 420A was 1.75 mm.

[0063] The rod unit 2 in which the tobacco shreds 21 were wrapped in the cigarette paper 22, and the tipping paper 3 with the ventilation holes 31 formed therein in advance were prepared. Then, the front-stage filter material 41 and the throttle member 42 integrally wrapped in the wrapping paper 46, the rod unit 2, and the rear-stage filter material 43 were lined up, and these components were integrally wrapped in the tipping paper 3 to produce the cigarette 1. The rod unit 2 was produced by wrapping the tobacco shreds 21 in the cigarette paper 22. The wrapping paper 46 used had air permeability of 1300 to 20000 Coresta units.

[0064] When the front-stage filter material 41 and the throttle member 42 were wrapped in the wrapping paper 46, the front end face of the throttle member 42 was arranged 2 mm away from the rear end face of the front-stage filter material 41, and the cavity 44 was formed between the front-stage filter material 41 and the throttle member 42. The rear end face of the throttle member 42 and the front end face of the rear-stage filter material 43 were arranged so as to butt against each other. The tipping paper 3 was wrapped with the cigarette paper of the rod unit 2 and the wrapping paper 46 bonded with an adhesive to the inner circumferential surface of the tipping paper 3, and without the wrapping paper 430 of the rear-stage filter material 43 bonded to the inner circumferential surface of the tipping paper 3. Thus, the filter 4, in which the rear-stage filter material 43 was held so as to be relatively turnable along the inner circumferential surface of the tipping paper 3, and the cigarette 1 including this filter 4 were obtained. In the cigarette 1 produced, the length of the rod 2 was 57 mm, and the length of the filter 4 was 27 mm.

[0065] Measurement of airflow resistance at each puff was performed on the cigarette 1 according to the example that was produced in the above procedure. The measurement results are represented in Fig. 12. In the test, the cigarette 1 according to the example was burned by a smoking machine, and after the rod unit 2 was cut off, the airflow resistance of the filter 4 was measured. The smoking machine used in the smoking test was "RGA-System R26" (by Burghart). The cigarette 1 according to the example was set in the smoking tool, and smoked in accordance with the standard smoking conditions of International Organization for Standardization (ISO). The standard smoking conditions of ISO provide that smoke is inhaled (a puff is taken) once every 60 seconds. More specifically, it is provided that 35 ml of smoke is inhaled in two seconds per puff, and that the interval from the end of one puff to the start of the next puff is 58 seconds.

[0066] An airflow resistance measuring instrument used for the measurement of airflow resistance was "Model TT-300" (by Tamaki Seisakusho). For the measurement of airflow resistance, the rod unit 2 was cut away to eliminate the influence of the tobacco shreds on the airflow resistance, and the airflow resistance of the filter 4 (the front-stage filter material 41, the throttle member 42, and the rear-stage filter material 43) was measured. The airflow resistance of the filter 4 was measured with the ventilation holes 31 of the filter 4 covered with a commercially available cellophane tape (Sellotape (R). For the smoking test, six of the cigarette 1 to be subjected to the test were prepared, and the airflow resistance of the filter 4 as the number of puffs was increased from zero to five was measured. In the smoking test, after each puff of the cigarette 1, the rear-stage filter material 43 was turned 60° in the circumferential direction of the filter 4 relative to the tipping paper 3. That is, the airflow resistance when the number of puff was zero was obtained by cutting away the rod unit 2 of a non-smoked cigarette 1 and measuring the airflow resistance of the filter 4 with the airflow resistance measuring instrument. The airflow resistance when the number of puffs was one was measured by taking one puff using the smoking machine, and after cutting away the rod unit 2, measuring the airflow resistance of the filter 4. Next, the airflow resistance when the number of puffs was two was obtained by taking the first puff using the smoking machine, turning the rear-stage filter material 43 by 60° and taking the second puff using the smoking machine again, then cutting away the rod unit 2, and measuring the airflow resistance of the filter 4. By this procedure, the airflow resistance at each puff as the number of puffs was increased from zero to five was measured.

[Comparative example]

[0067] Fig. 11 is a schematic view of a cigarette 100 according to a comparative example. The cigarette 100 according to the comparative example was different from the cigarette 1 according to the example in the through-passage of the throttle member and the condition of fixation of the rear-stage filter material to the tipping paper, while the other conditions were the same. In the cigarette 100 according to the comparative example, reference sign 42' in Fig. 11 denotes the "throttle member", 420' denotes the "throttle member main body", and 420A' denotes the "through-passage". The throttle member 42' was produced by drilling the through-passage 420A' having a circular cross-section so as to penetrate the plastic throttle member main body 420' having a disc shape. The throttle member main body 420' was 5 mm in thickness and 7.8 mm in diameter. The diameter of the through-passage 420A' was 1.5 mm, and the center of the throttle member main body 420' and the center of the

through-passage 420A were arranged coaxially.

[0068] For the cigarette 100 according to the comparative example, the rod unit 2 and the tipping paper 3, which were the same as those of the cigarette 1 according to the example, were prepared. Then, the front-stage filter material 41 and the throttle member 42' integrally wrapped in the wrapping paper 46, the rod unit 2, and the rear-stage filter material 43 were lined up, and these components were integrally wrapped in the tipping paper 3 to produce the cigarette 1. The wrapping paper 46 used for integrally wrapping the front-stage filter material 41 and the throttle member 42' had air permeability of 1300 to 20000 Coresta units. When the front-stage filter material 41 and the throttle member 42' were integrally wrapped in the wrapping paper 46, the front end face of the throttle member 42' was arranged 2 mm away from the rear end face of the front-stage filter material 41, and the cavity 44 was formed between the front-stage filter material 41 and the throttle member 42'. The rear end face of the throttle member 42' and the front end face of the rear-stage filter material 43 were arranged so as to butt against each other. The tipping paper 3 was wrapped with the outer circumferential surfaces of the cigarette paper of the rod unit 2, the wrapping paper 46 integrally wrapping the front-stage filter material 41 and the throttle member 42', and the wrapping paper of the rear-stage filter material 43 bonded with an adhesive to the inner surface of the tipping paper 3. In the cigarette 100 produced, the length of the rod 2 was 57 mm, and the length of a filter 400 was 27 mm.

[0069] Measurement of airflow resistance at each puff was performed on the cigarette 100 according to the comparative example that was produced by the above procedure. The measurement results are represented in Fig. 12. In the smoking test on the cigarette 100 according to the comparative example, the same conditions were used as the smoking test according to the example except that the turning operation of the rear-stage filter material 43 after each puff was not performed.

[0070] As represented in Fig. 12, in the cigarette 100 according to the comparative example, the airflow resistance increased as further puffs were taken (the number of puffs increased), and after the fifth puff, the airflow resistance increased to as high as 390 mmH2O versus the initial resistance of 130 mmH2O. This shows that, with the cigarette 100 according to the comparative example, it becomes difficult for a smoker to inhale mainstream smoke as the number of puffs increases. By contrast, in the cigarette 1 according to the example, even when the number of puffs increased, the airflow resistance shifted stably, with almost no change from the initial resistance of 130 mmH2O. This indicates that, with the cigarette 1 according to the example, it is possible to prevent an excessive increase in airflow resistance during smoking by relatively turning the rear-stage filter material 43 and the throttle member 42 around the longitudinal axis of the filter 4 and positioning the rear-stage filter material 43 and the throttle member 42 so that the through-passage 420A faces a portion of the lateral cross-section of the rear-stage filter material 43 in which clogging is not occurring. These results demonstrate that the cigarette 1 according to the example makes it possible to provide a cigarette that is easy for a smoker to inhale to the last.

[0071] While the preferred embodiment of the present invention has been described, it is obvious to those skilled in the art that various modifications, improvements, combinations, etc. can be implemented with the filter for a cigarette and the cigarette with a filter according to the present invention.

Reference Signs List

[0072]

1 ...	Cigarette
2 ...	Rod unit
3 ...	Tipping paper
4 ...	Filter
21 ...	Tobacco shred
22 ...	Cigarette paper
31 ...	Ventilation hole
41 ...	Front-stage filter material
42 ...	Throttle member
43 ...	Rear-stage filter material
44 ...	Cavity
420 ...	Throttle member main body
420A ...	Through-passage

Claims

1. A filter for a cigarette that is connected through tipping paper at one end of a rod unit in which tobacco shreds are wrapped in cigarette paper, the filter comprising:

   a throttle member that has a throttle member main body arranged so as to cover the lateral cross-section of the filter, and a through-passage which is formed through a part of the throttle member main body in the longitudinal direction of the filter and through which mainstream smoke flows;

   a rear-stage filter material that is disposed in the rear stage of the throttle member and filters the smoke components of mainstream smoke; and

   a turning mechanism that allows a relative turn of the rear-stage filter material and the throttle member around the longitudinal axis of the filter, wherein

   the through-passage of the throttle member is formed so that the position at which the through-passage faces the front end face of the rear-stage filter material is changed according to the relative turn of the rear-stage filter material and

the throttle member.

2. The filter for a cigarette according to claim 1, wherein the through-passage is formed in the lateral cross-section of the throttle member main body without forming a concentric circle centered at the central axis of the lateral cross-section.

3. The filter for a cigarette according to claim 1 or 2, wherein the turning mechanism is configured as a mechanism that holds at least one of the rear-stage filter material and the throttle member so as to be turnable relative to the tipping paper.

4. The filter for a cigarette according to claim 3, wherein the rear-stage filter material is arranged at the rearmost end of the filter, and a grip unit that is used for performing a turning operation of the rear-stage filter material is formed so as to protrude further on the rear side than the rear end of the tipping paper.

5. The filter for a cigarette according to claim 4, wherein the outer surface of the grip unit and the tipping paper have a mark that indicates a turning position of the rear-stage filter material relative to the tipping paper.

6. The filter for a cigarette according to claim 4 or 5, wherein the rear-stage filter material and the tipping paper have a structure of concave and convex shapes formed therein which fit with each other each time the turning angle of the rear-stage filter material relative to the tipping paper changes by a predetermined angle.

7. The filter for a cigarette according to any one of claims 1 to 6, wherein the rear end face of the throttle member and the front end face of the rear-stage filter material are provided continuously along the longitudinal direction of the filter.

8. The filter for a cigarette according to any one of claims 1 to 7, wherein
the tipping paper has a ventilation hole formed therein through which air for diluting mainstream smoke is introduced into the filter, and
the ventilation hole is provided in the tipping paper at a position corresponding to the front stage of the through-passage in the longitudinal direction of the filter.

9. The filter for a cigarette according to any one of claims 1 to 8, wherein a front-stage filter material that filters the smoke components of mainstream smoke is disposed in the front stage of the throttle member, and a cavity is provided between the through-passage and the front-stage filter material.

10. The filter for a cigarette according to claim 9, wherein
the tipping paper has a ventilation hole formed therein through which air for diluting mainstream smoke is introduced into the filter, and
the ventilation hole is provided in the tipping paper at a position corresponding to the cavity or the front-stage filter material in the longitudinal direction of the filter.

11. A cigarette with a filter comprising:

a rod unit in which tobacco shreds are wrapped in cigarette paper; and
a filter that is connected through tipping paper at one end of the rod unit, wherein

the filter includes:

a throttle member that has a throttle member main body arranged so as to cover the lateral cross-section of the filter, and a through-passage which is formed through a part of the throttle member main body in the longitudinal direction of the filter and through which mainstream smoke flows;
a rear-stage filter material that is disposed in the rear stage of the throttle member and filters the smoke components of mainstream smoke; and
a turning mechanism that allows a relative turn of the rear-stage filter material and the throttle member around the longitudinal axis of the filter, and
the through-passage of the throttle member is formed so that the position at which the through-passage faces the front end face of the rear-stage filter material is changed according to the relative turn of the rear-stage filter material and the throttle member.

FIG. 1

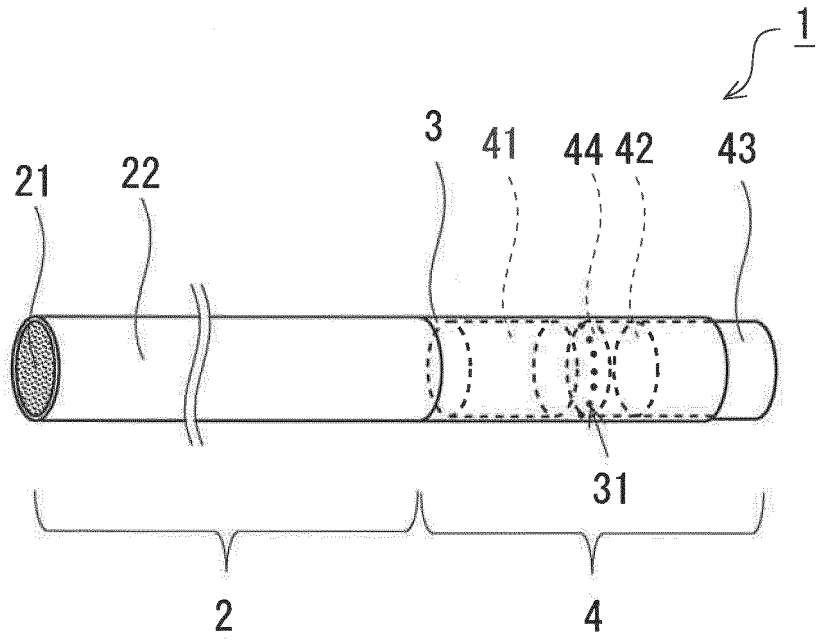

FIG. 2

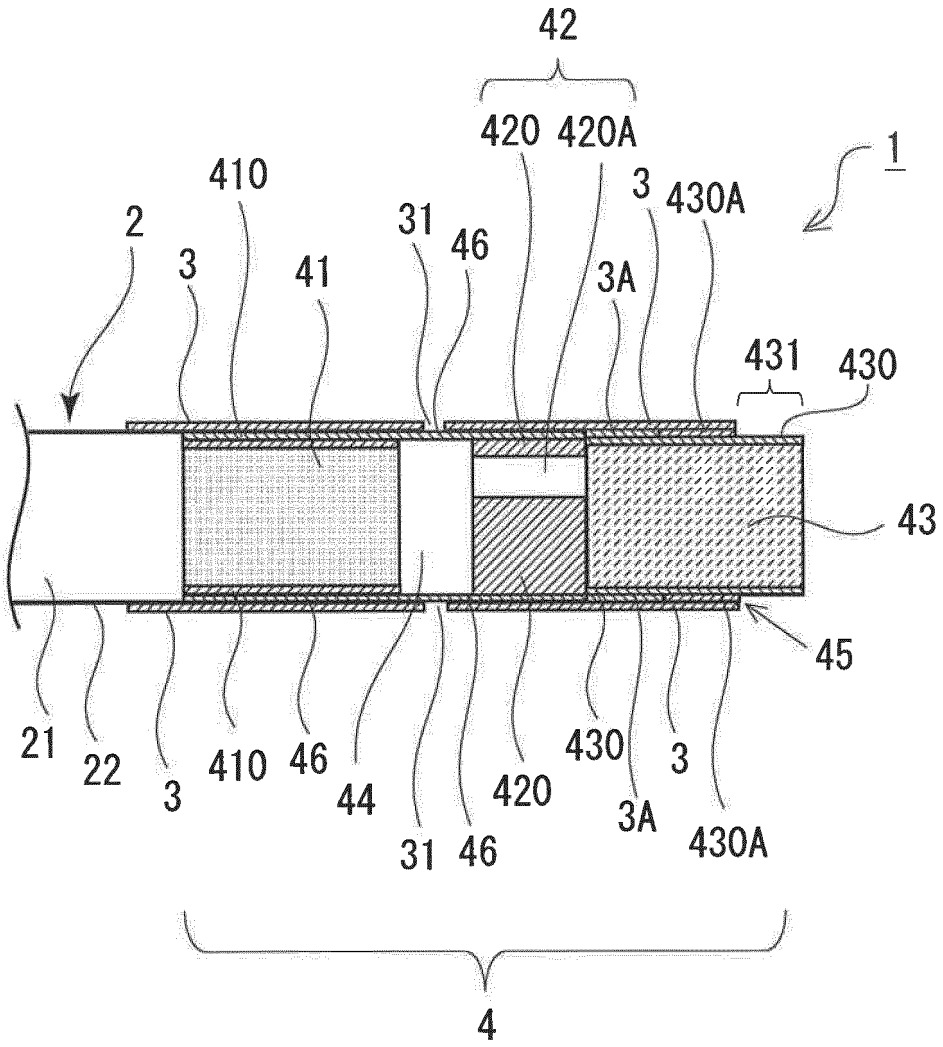
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FIG. 3

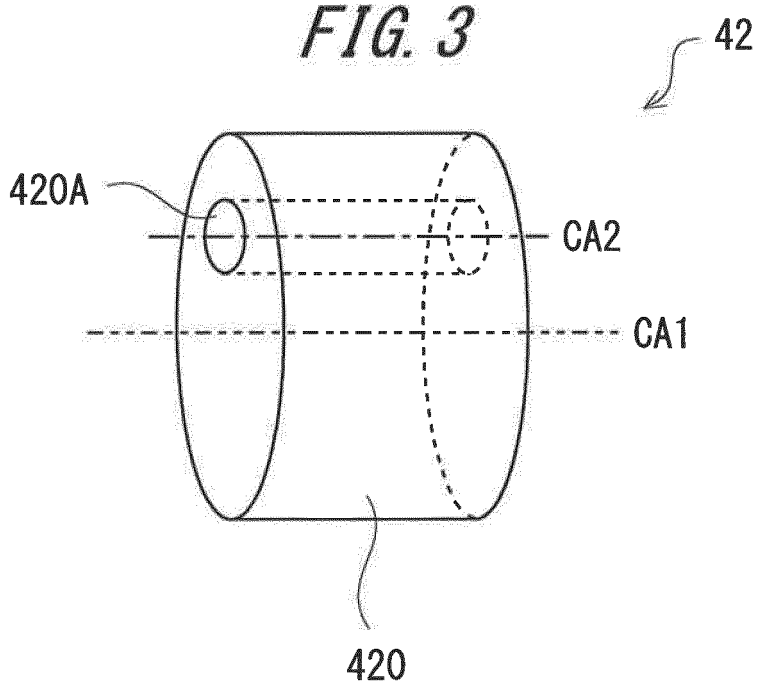


FIG. 4

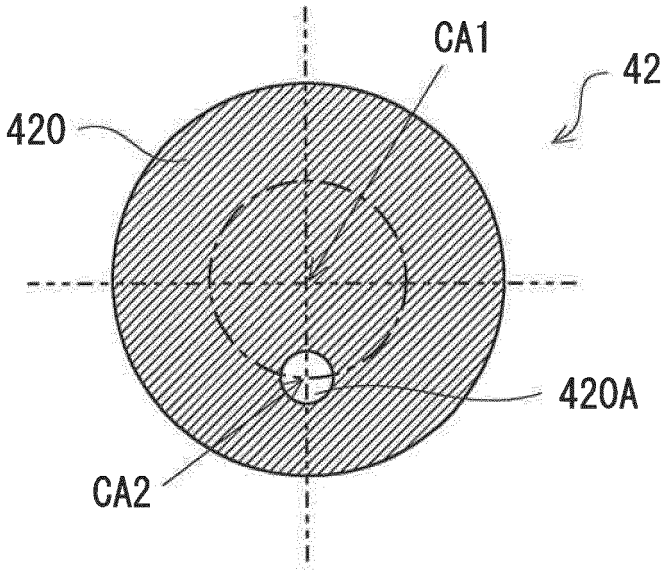
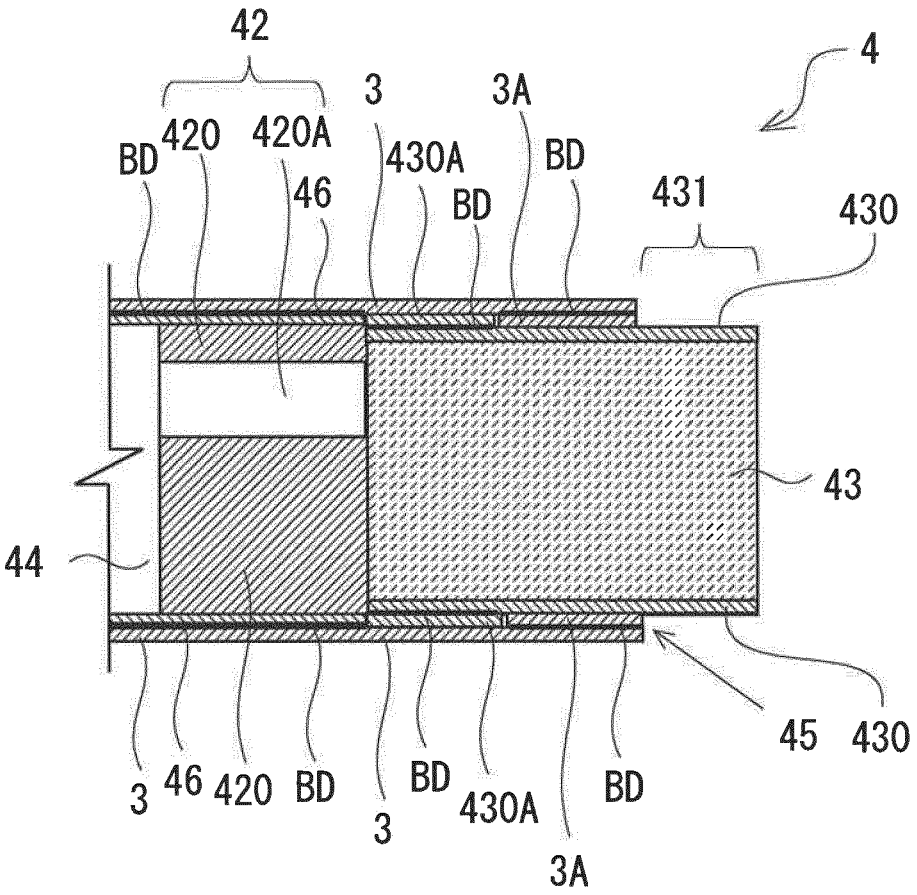


FIG. 5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3A
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420A
BD
430A
BD
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BD
3A

FIG. 6A

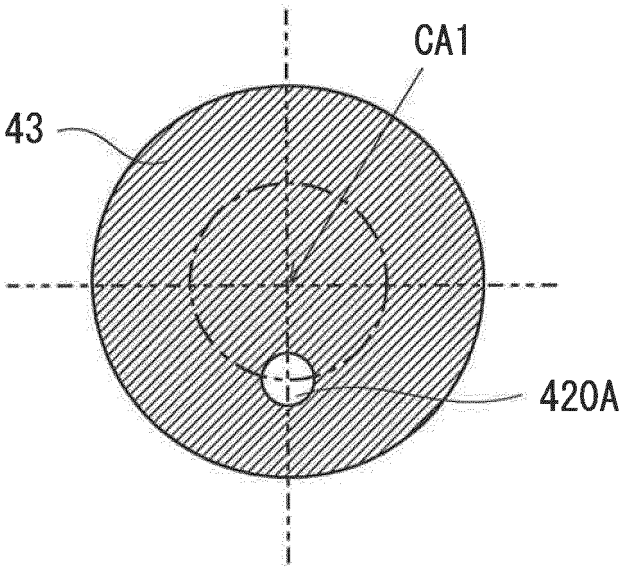


FIG. 6B

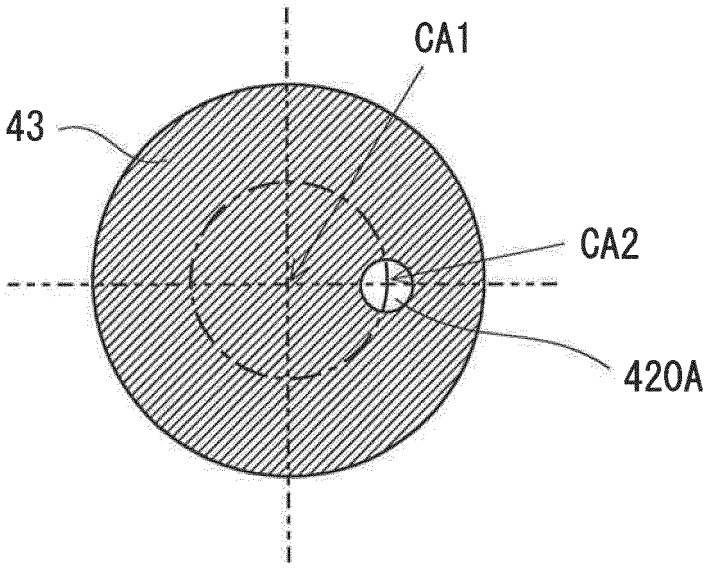


FIG. 7A

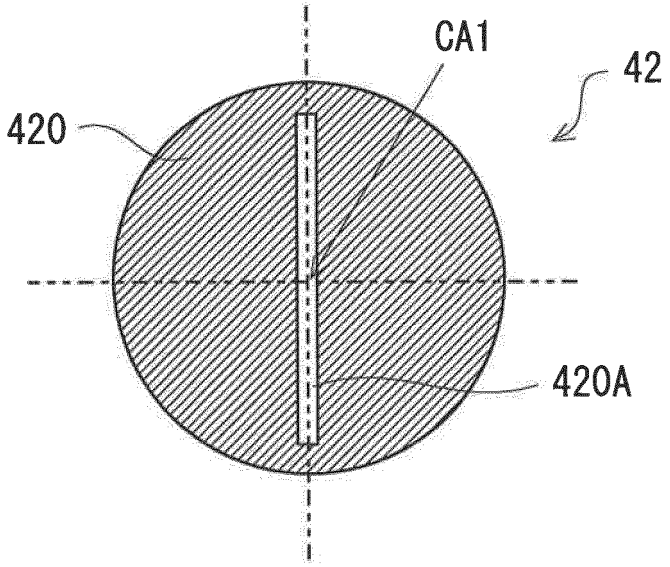


FIG. 7B

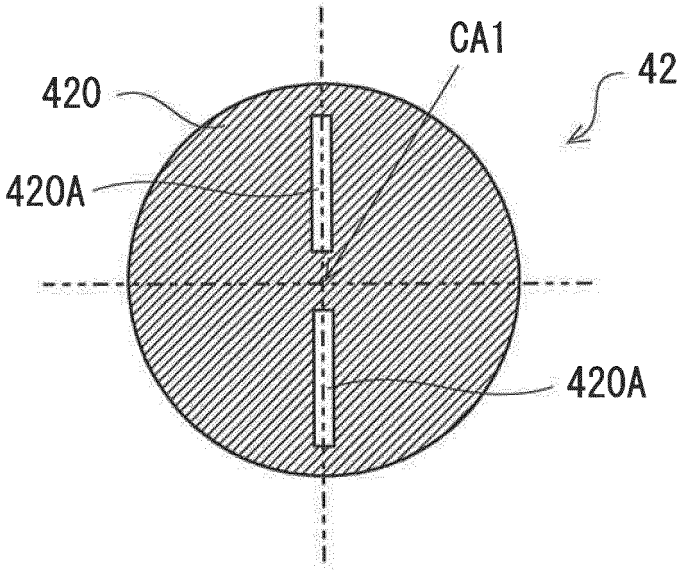


FIG. 8

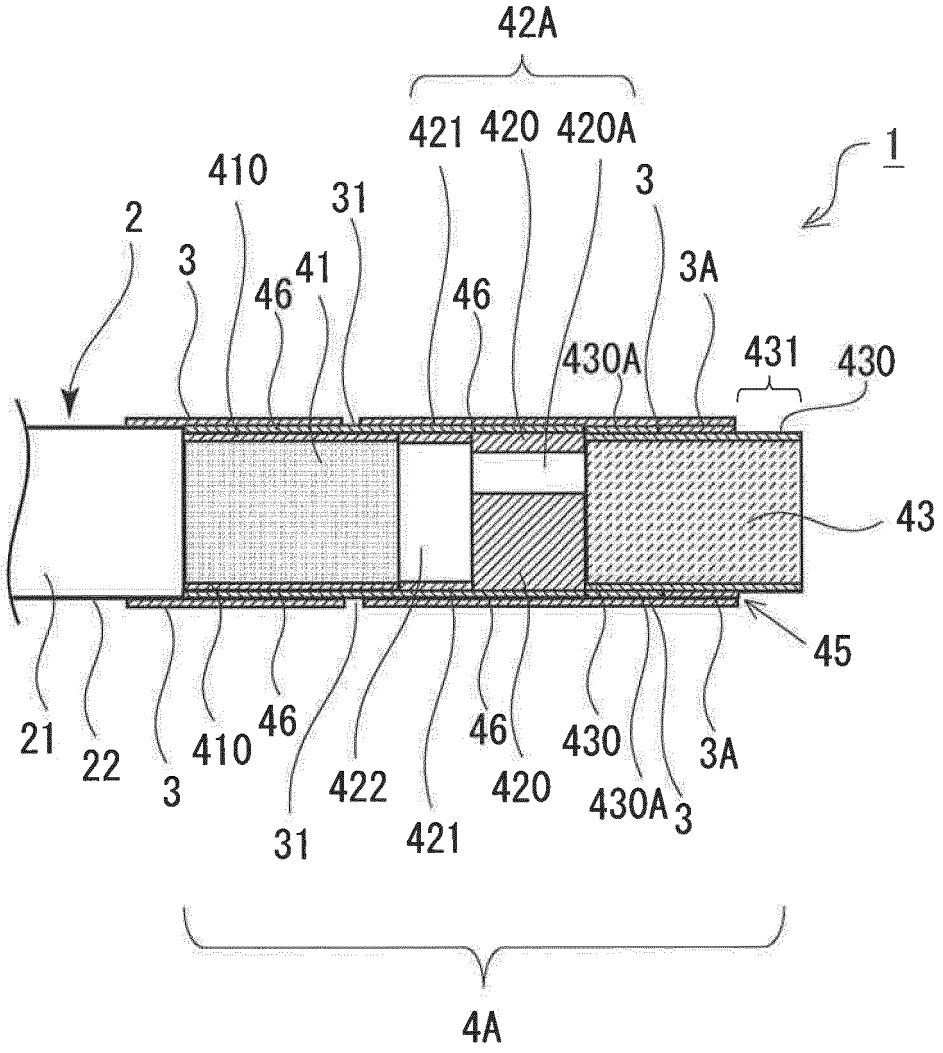

42A
421
420
420A
1
410
31
3
2
3
41
46
46
3A
430A
431
430
43
45
21
22
3
410
46
422
31
421
46
420
430
430A
3
3A
4A

FIG. 9

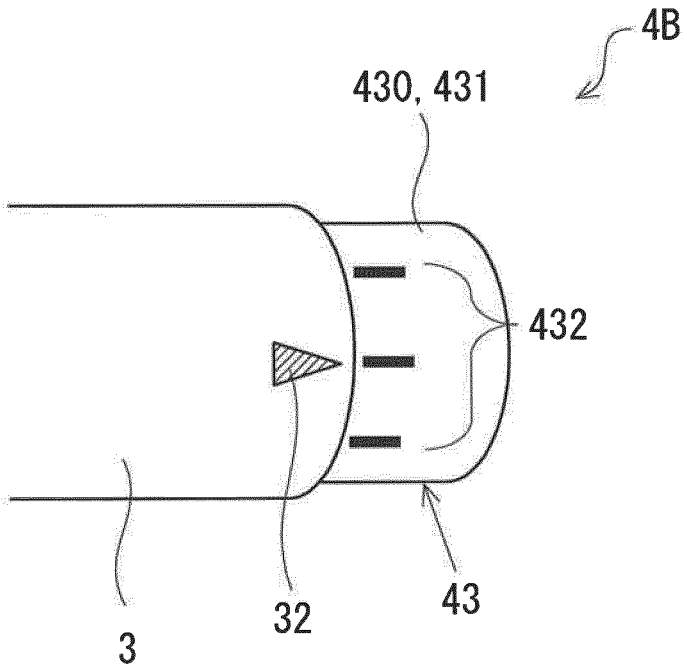

4B
430, 431
432
3
32
43

FIG. 10

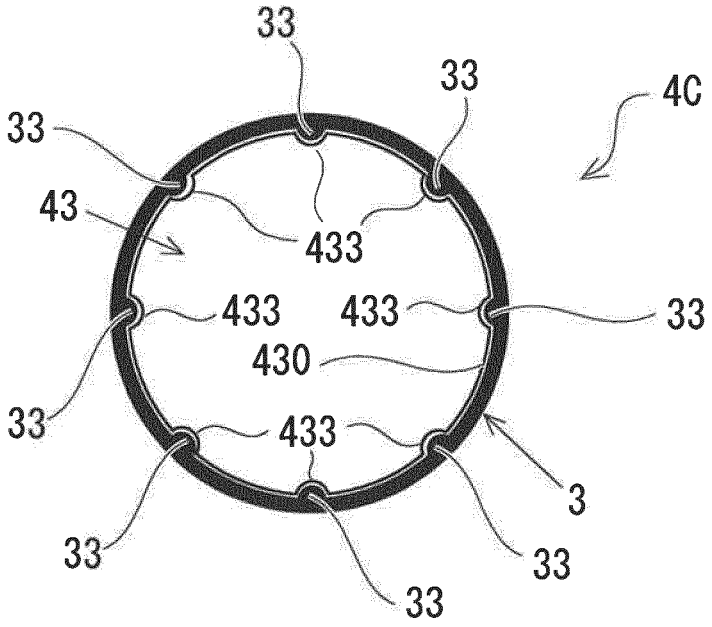

33
33
33
4C
43
433
433
433
33
430
33
433
3
33
33
33

FIG. 11

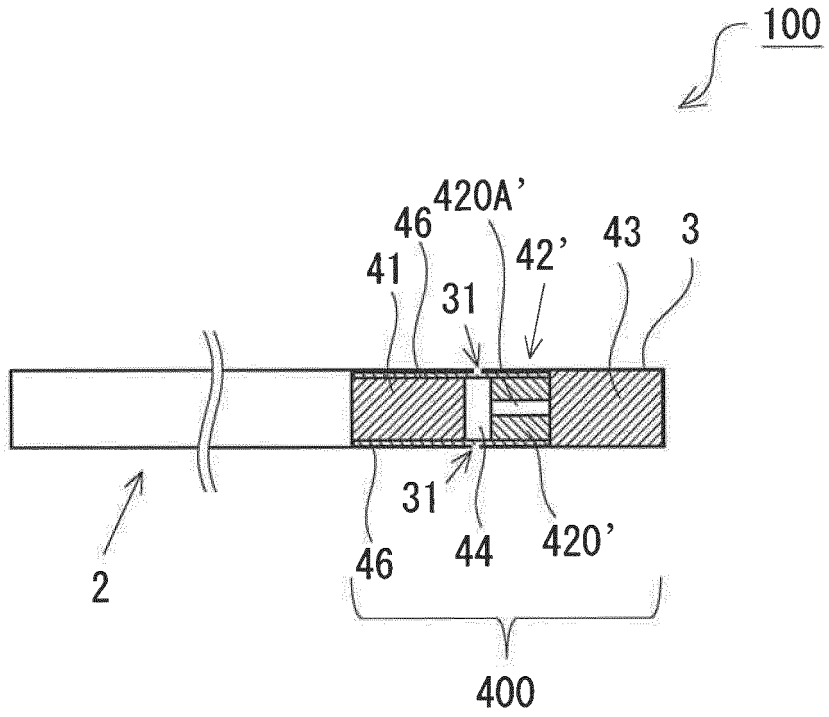
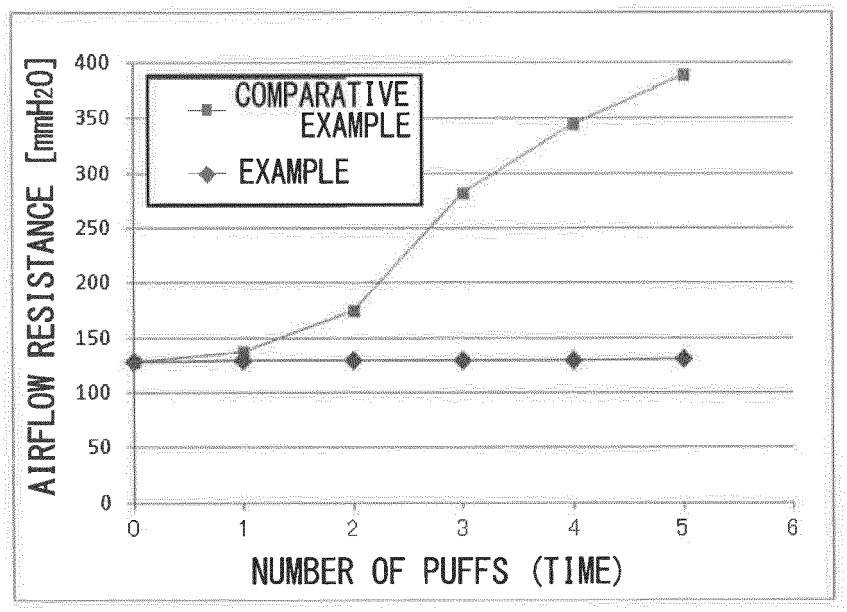

100
420A'
46
41
31
42'
43
3
31
46
44
420'
2
400

FIG. 12


AIRFLOW RESISTANCE [mmH2O]
400
350
300
250
200
150
100
50
0
0
1
2
3
4
5
6
NUMBER OF PUFFS (TIME)
COMPARATIVE EXAMPLE
EXAMPLE

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2013/068265

A. CLASSIFICATION OF SUBJECT MATTER
A24D3/04(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)
A24D3/04, A24F13/06

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 1996-2013
Kokai Jitsuyo Shinan Koho 1971-2013 Toroku Jitsuyo Shinan Koho 1994-2013

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	US 3428050 A (Walter R.Kandel), 18 February 1969 (18.02.1969), entire text; all drawings (Family: none)	1-3,7,11 4-6,8
Y	JP 02-028318 B2 (Philip Morris Products, Inc.), 22 June 1990 (22.06.1990), entire text; all drawings & JP 59-501443 A & JP 1-273575 A & US 4600027 A & US 4570649 A & US 4526183 A & US 4638818 A & EP 100215 A2 & EP 247702 A2 & WO 1984/000478 A1 & DE 3382668 A & DE 3378400 D & DE 3382668 T & DE 100215 T & AU 1725983 A & BR 8307447 A & CA 1210297 A	4-6,8

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

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"P" document published prior to the international filing date but later than the priority date claimed
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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
27 September, 2013 (27.09.13)	08 October, 2013 (08.10.13)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2013/068265

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2013-509161 A (Tobacco Research and Development Institute (Proprietary) Ltd.), 14 March 2013 (14.03.2013), entire text; all drawings & US 2012/0272977 A1 & EP 2493339 A & WO 2011/051115 A1 & AR 80346 A & CA 2777895 A & AU 2010311721 A & MX 2012004956 A & CN 102770035 A & KR 10-2012-0101423 A	6,8
Y	JP 47-018639 B1 (Lawrence Murry Riegel), 29 May 1972 (29.05.1972), entire text; all drawings & US 3503406 A	8
A	JP 08-205844 A (Ning Baogang), 13 August 1996 (13.08.1996), entire text; all drawings & GB 2294861 A & CN 1109304 A & CN 1128638 A	1-11

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 8205844 A **[0003]**