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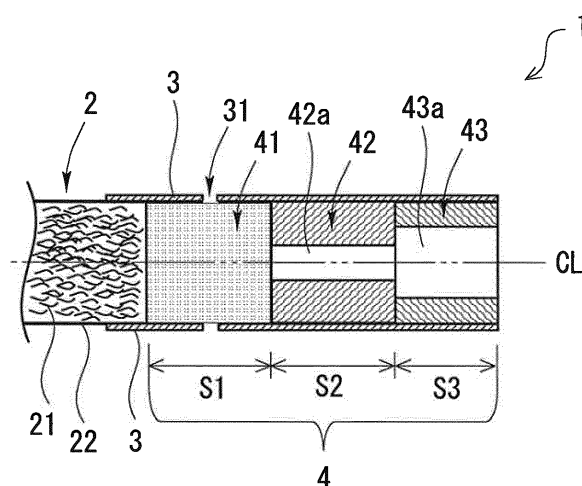
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(54) **CIGARETTE WITH FILTER**

(57) There is provided a technique of making tar contamination on a mouthpiece end surface less noticeable, and preventing insufficient hardness of a filter, in a filter cigarette. The filter cigarette includes: a tobacco rod containing cut tobacco; and a filter connected to an end of the tobacco rod via chip paper, wherein the filter includes a mouthpiece end section placed at a mouthpiece end and having a fiber bundle formed into a cylindrical shape

and a first smoke channel longitudinally extending through the fiber bundle, and a front section connected to a front end of the mouthpiece end section and having a fiber bundle formed into a cylindrical shape and a second smoke channel longitudinally extending through the fiber bundle, and a sectional area of the first smoke channel is larger than a sectional area of the second smoke channel.

FIG. 1



Description

Technical Field

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

Background Art

[0002] A filter cigarette is configured to adjust a balance between air dilution caused by ventilation air being introduced through a vent hole formed in an outer periphery of a filter, and filtration with a filtration material to control (adjust) components of smoke of the cigarette, such as tar, nicotine, or CO (carbon monoxide).

[0003] CO is a gas phase component and thus not filtered by a filtration material, and dilution with air reduces the concentration of CO in smoke. Meanwhile, tar is reduced by both filtration with a filtration material, and dilution with air. Thus, as a design method of a filter cigarette, low filtration and high dilution design is sometimes made including reducing a ratio of filtration with a filtration material and increasing a ratio of dilution. It is expected that the low filtration and high dilution design can reduce the ratio of CO to tar, and increase inhaling satisfaction to improve fragrance inhaling taste.

[0004] Various methods are used in order to achieve the low filtration and high dilution design. For example, a method is known in which a fiber diameter of a filtration material is increased to reduce density and thus reduce ventilation resistance of mainstream smoke, or a diameter of a vent hole through which ventilation air flows in is increased, thereby increasing a ratio of dilution. However, there is a limit in reducing ventilation resistance of a filtration material by the above method due to restriction in a circumferential length of a cigarette, a length of a filter, a material used for the filtration material, or the like.

[0005] Thus, there is proposed a design method of placing a section without a function of filtering mainstream smoke in a partial zone of a filter, for example, a design method of placing a center hole filter with a through hole at an axial center, or forming a recess, a cavity, or the like in a partial zone of the filter to achieve low filtration and high dilution.

[0006] Patent document 1: Japanese Patent Laid-Open No. 5-23158

Summary of Invention

Technical Problem

[0007] However, simply providing a non-filtering section without a function of filtering mainstream smoke in the partial zone of the filter can achieve low filtration and high dilution of mainstream smoke, but may cause problems described below. For example, in the case of using the center hole filter, tar easily locally adhere to a periphery of a center hole on a mouthpiece end surface, and tar contamination on the mouthpiece end surface is easily

noticeable after smoking. Meanwhile, in the case where a recess is formed on a mouthpiece end side of the filter, or a cavity is formed in a middle part, insufficient hardness of the filter is easily caused.

[0008] The present invention is achieved in view of the above described problems, and has an object to provide a technique of making tar contamination on a mouthpiece end surface less noticeable, and preventing insufficient hardness of a filter, in a filter cigarette.

Solution to Problem

[0009] To achieve the object, in the present invention, a penetration path is formed for causing mainstream smoke to flow through a mouthpiece end section placed at a mouthpiece end of a filter, and a front section connected to a front end of the mouthpiece end section, and a channel sectional area of the penetration path in the mouthpiece end section is larger than a channel sectional area of the penetration path in the front section.

[0010] More specifically, the present invention provides a filter cigarette including: a tobacco rod containing cut tobacco; and a filter connected to an end of the tobacco rod via chip paper, wherein the filter includes a mouthpiece end section placed at a mouthpiece end and provided with a fiber bundle having an axially formed penetration path through which mainstream smoke flows, and a front section connected to a front end of the mouthpiece end section and provided with a fiber bundle having an axially formed penetration path through which mainstream smoke flows, and a sectional area of the penetration path in the mouthpiece end section is larger than a sectional area of the penetration path in the front section.

[0011] According to the present invention, a flow velocity (flow rate) of the mainstream smoke flowing in a region on an outer peripheral side that does not axially overlap the penetration path of the front section is relatively slower (lower) as compared to a region on a central side that axially overlaps the penetration path of the front section in a cross sectional area of the penetration path in the mouthpiece end section. Thus, when the mainstream smoke is inhaled into a mouth from a rear end of the penetration path in the mouthpiece end section, a frequency (chance) of contact between the mouthpiece end surface of the filter and the mainstream smoke can be reduced. This prevents local tar adhesion to a periphery (edge) of the penetration path on the mouthpiece end surface. This can prevent tar contamination on the mouthpiece end surface of the filter and make the tar contamination less noticeable. Also, according to the present invention, there is no need to provide a section such as a cavity or a recess in the filter, thereby preventing insufficient hardness of the filter.

[0012] Also, in the present invention, a length of the mouthpiece end section may be shorter than a length of the front section. Such a configuration can more reliably prevent insufficient hardness of the filter from being man-

ifested.

[0013] Also, in the present invention, the respective penetration paths in the mouthpiece end section and the front section may be coaxially placed. Such a configuration can more satisfactorily make tar contamination on the mouthpiece end surface of the filter less noticeable.

[0014] Also, in the present invention, shred spilling preventing means for preventing the cut tobacco from entering the filter may be provided at a front end of the filter. Such a configuration can satisfactorily prevent the cut tobacco in the tobacco rod from entering the filter.

[0015] Also, in the present invention, a filtration material containing a fiber bundle that filters mainstream smoke may be provided at the front end of the filter, and the filtration material may also serve as the shred spilling preventing means. Such a configuration can reduce material cost for the filter, and also prevent complication of a manufacturing process of the filter.

[0016] Also, in the present invention, a vent hole through which outside air is introduced into the filter for dilution of mainstream smoke may be formed in the chip paper, and the vent hole may be placed upstream of the mouthpiece end section in the filter. Such a configuration allows the mainstream smoke to be easily directed toward the center in the front section.

[0017] Solutions to the problem in the present invention can be used in combination as much as possible.

Advantageous Effects of Invention

[0018] The present invention can provide a technique of making tar contamination on a mouthpiece end surface less noticeable, and preventing insufficient hardness of a filter, in a filter cigarette.

Brief Description of Drawings

[0019]

[Fig. 1] Fig. 1 is a vertical sectional view of a cigarette according to embodiment 1.

[Fig. 2] Fig. 2 is a perspective view of the cigarette according to embodiment 1.

[Fig. 3] Fig. 3 illustrates a manufacturing device for a center hole filter according to embodiment 1.

[Fig. 4] Fig. 4 is a vertical sectional view of a filter according to a comparative example.

[Fig. 5] Fig. 5 conceptually illustrates tar contamination on a mouthpiece end surface of the filter according to the comparative example.

[Fig. 6] Fig. 6 illustrates another variation of a position of a vent hole in the filter according to embodiment 1.

[Fig. 7] Fig. 7 is a vertical sectional view of a cigarette according to modification 1.

[Fig. 8] Fig. 8 is a vertical sectional view of a cigarette according to modification 2.

[Fig. 9] Fig. 9 is a vertical sectional view of a cigarette according to modification 3.

Description of Embodiments

[0020] Now, an embodiment of a filter cigarette according to the present invention will be described in detail with reference to the drawings. Dimensions, materials, shapes, relative arrangement, or the like of components described in this embodiment do not limit a technical scope of the invention unless otherwise specified.

<Embodiment 1>

[0021] Fig. 1 is a vertical sectional view of a cigarette 1 according to embodiment 1. Fig. 2 is a perspective view of the cigarette 1 according to Embodiment 1. The cigarette 1 is a filter cigarette including a tobacco rod 2, and a filter 4 connected to an end of the tobacco rod 2 via chip paper 3.

[0022] The tobacco rod 2 is formed such that cut(shredded) tobacco 21 is rolled by cigarette paper 22 into a cylindrical shape (rod shape), and also referred to as a "single roll". The filter 4 is a member for filtering smoke component contained in mainstream smoke generated during smoking of the cigarette 1 when the mainstream smoke passes therethrough, and formed into a cylindrical shape having substantially the same diameter as the tobacco rod 2.

[0023] The filter 4 is wrapped by the chip paper 3, and connected to a rear end side of the tobacco rod 2 via the chip paper 3. The chip paper 3 integrally wraps and connects (couples) the end of the tobacco rod 2 and the filter 4. Hereinafter, in a longitudinal direction (axial direction) of the tobacco rod 2, an end to be connected to the filter 4 is referred to as a "rear end", and an end opposite thereto is referred to as a "front end" (tip). Also, in a longitudinal direction (axial direction) of the filter 4, an end to be connected to the tobacco rod 2 is referred to as a "front end", and an end opposite to the front end is referred to as a "mouthpiece end". Also, a section in the longitudinal direction (axial direction) of the cigarette 1 (tobacco rod 2, filter 4) is defined as a "vertical section", and a section perpendicular thereto is defined as a "cross section". Also, reference character CL in Fig. 1 denotes a central axis of the cigarette 1 (tobacco rod 2, filter 4).

[0024] In the filter 4, a filtering section S1, a front section S2, and a mouthpiece end section S3 are arranged in this order from the front end side. In the filtering section S1, a filtration material 41 is provided such that a fiber bundle of cellulose acetate formed into a cylindrical shape is rolled by rolling paper. However, the filtration material 41 in this embodiment is not limited to the fiber bundle of cellulose acetate, but may be made of various materials.

[0025] In the front section S2 and the mouthpiece end section S3, center hole filters 42, 43, respectively, are placed such that fiber bundles of cellulose acetate formed into a cylindrical shape and axially provided with penetration paths are rolled by rolling paper. Hereinafter, the penetration path formed in the center hole filter 42 in the

front section S2 is referred to as a "first center hole 42a". Also, the penetration path formed in the center hole filter 43 in the mouthpiece end section S3 is referred to as a "second center hole 43a".

[0026] The first center hole 42a axially extends through the center of the center hole filter 42. Meanwhile, the second center hole 43a axially extends through the center of the center hole filter 43. The first center hole 42a and the second center hole 43a are smoke channels (passages) through which mainstream smoke flows (passes). In this embodiment, the first center hole 42a and the second center hole 43a are coaxially placed, and a sectional area of the second center hole 43a is larger than a sectional area of the first center hole 42a. In other words, a sectional area of the penetration path in the mouthpiece end section S3 is larger than a sectional area of the penetration path in the front section S2. Further, the mouthpiece end section S3 (center hole filter 43) in the filter 4 is shorter than the front section S2 (center hole filter 42). In this embodiment, the first center hole 42a and the second center hole 43a each have a circular sectional shape, but not limited to this.

[0027] The chip paper 3 that wraps the filter 4 has a vent hole 31 through which ventilation air (outside air) is introduced into the filter 4 for dilution of mainstream smoke. As illustrated in Fig. 1, the vent hole 31 is placed in a position corresponding to the filtering section S1 in the filter 4. During smoking, outside air flows through the vent hole 31 into the filter 4, and the air introduced through the vent hole 31 is mixed with the mainstream smoke flowing from the tobacco rod 2 into the filter 4 to dilute the mainstream smoke.

[0028] Next, an example of a manufacturing method of the center hole filters 42, 43 will be described. The center hole filters 42, 43 can be manufactured by various known methods. Fig. 3 illustrates a manufacturing device 100 of the center hole filter. The manufacturing device 100 includes a storage container 110 storing filter fiber (for example, acetate tow) 150, a plasticizer addition unit 120, a forming device 130, a wrapping device 140, or the like. The filter fiber 150 stored in the storage container 110 is fed along a predetermined feeding path. In the course of feeding, the filter fiber 150 is opened and expanded into a sheet shape. Then, the plasticizer addition unit 120 adds a plasticizer such as triacetin to the sheet-like filter fiber 150, and the sheet-like filter fiber 150 is supplied to the subsequent forming device 130.

[0029] The forming device 130 forms the sheet-like filter fiber 150 into a continuous filter of a hollow rod shape, and includes a mandrel (not illustrated) that is a tube-like forming path through which the sheet-like filter fiber 150 passes while being narrowed and is formed into a continuous filter of a hollow rod shape. The sheet-like filter fiber 150 supplied to the forming device 130 is formed into a rod shape around the mandrel and successively fed, and is withdrawn from the mandrel to form a center hole. The continuous filter having the center hole thus formed is supplied to the subsequent wrapping device

140. The continuous filter supplied to the wrapping device 140 is rolled by rolling paper to form a filter rod, and the filter rod is cut into a predetermined length, thereby manufacturing the center hole filters 42, 43.

[0030] Next, operations and effects of the cigarette 1 according to this embodiment will be described. If mainstream smoke generated in the tobacco rod 2 flows into the filter 4 during smoking of the cigarette 1, components of smoke such as tar or nicotine are filtered from the mainstream smoke when the mainstream smoke passes through the filtration material 41 in the filtering section S1. CO contained in the mainstream smoke is a gas phase component and thus not filtered by the filtration material 41. Since the vent hole 31 provided in the chip paper is placed in the filtering section S1 in the filter 4, air introduced through the vent hole 31 is mixed with the mainstream smoke passing through the filtering section S1. This causes dilution of components of the mainstream smoke, and reduces tar, nicotine, CO, or the like contained in the mainstream smoke.

[0031] The filter 4 according to this embodiment has low filtration and high dilution design so that a balance between dilution with air introduced through the vent hole 31 and filtration by the filtration material 41 provides so-called low filtration and high dilution. More specifically, the front section S2 and the mouthpiece end section S3 without a function of filtering the mainstream smoke are placed in a partial zone of the filter 4, thereby achieving low filtration and high dilution.

[0032] In the front section S2 and the mouthpiece end section S3, the center hole filters 42, 43 having the hollow first center hole 42a and the hollow second center hole 43a, respectively, are provided. In the cross section of the center hole filter 42, a region other than the hollow first center hole 42a is occupied by a compression formed fiber bundle. Thus, in the cross section of the center hole filter 42, ventilation resistance of the region occupied by the fiber bundle is extremely larger than ventilation resistance of the first center hole 42a. Similarly, in the cross section of the center hole filter 43, a region other than the hollow second center hole 43a is occupied by a compression formed fiber bundle. Thus, in the cross section of the center hole filter 43, ventilation resistance of the region occupied by the fiber bundle is extremely larger than ventilation resistance of the second center hole 43a. Thus, the mainstream smoke having passed through the filtering section S1 successively flows through the first center hole 42a and the second center hole 43a having extremely low ventilation resistance, and is eventually inhaled from the mouthpiece end into the mouth. As such, in the filter 4 according to this embodiment, only the filtering section S1 has a function of filtering the components of the mainstream smoke, and the subsequent front section S2 and mouthpiece end section S3 do not have the function of filtering the components of the smoke. This causes a balance between dilution and filtration of the mainstream smoke to be low filtration and high dilution, thereby reducing a ratio of CO to tar. This

can increase inhaling satisfaction of the cigarette 1 to improve fragrance inhaling taste thereof.

[0033] Further, in the cigarette 1 according to this embodiment, in terms of preventing local tar adhesion to the mouthpiece end surface of the filter 4 during smoking, a magnitude relation between the sectional areas of the penetration paths is determined so that the sectional area of the second center hole 43a in the mouthpiece end section S3 is larger than the sectional area of the first center hole 42a in the front section S2. With reference to comparative examples in Figs. 4 and 5, the filter 4 according to this embodiment will be described below.

[0034] Fig. 4 is a vertical sectional view of a filter 40 according to a comparative example. The filter 40 includes, from a front end side, a filtration material 410 and a center hole filter 430 connected to each other. The filtration material 410 and the center hole filter 430 in the filter 40 are substantially the same as the filtration material 41 and the center hole filter 43 in the filter 4 according to this embodiment. Specifically, the filter 40 according to the comparative example is substantially the same as a configuration of the filter 4 in Fig. 1 without the front section S2 (center hole filter 42).

[0035] In smoking a cigarette including the filter 40 according to the comparative example, mainstream smoke having flowed from the tobacco rod into the filter 40 successively flows through the filtration material 410 and the center hole 430a in the center hole filter 430 and is inhaled into the mouth. Fig. 5 conceptually illustrates local tar contamination on a mouthpiece end surface of the filter 40 according to the comparative example. During smoking of the cigarette according to the comparative example, tar easily locally adheres to a periphery (edge) of the center hole 430a on the mouthpiece end surface, and tar contamination on the mouthpiece end surface is easily noticeable.

[0036] Meanwhile, in the filter 4 according to this embodiment, the sectional area of the second center hole 43a in the mouthpiece end section S3 is larger than the sectional area of the first center hole 42a in the front section S2 connected immediately upstream of the mouthpiece end section S3, thereby making local tar contamination at the periphery (edge) of the second center hole 43a on the mouthpiece end surface less noticeable.

[0037] Specifically, as illustrated in Fig. 1, in the filter 4 according to this embodiment, a channel sectional area of the mainstream smoke increases (first center hole 42a → second center hole 43a) at a boundary position between the front section S2 and the mouthpiece end section S3 in a deeper position from the mouthpiece end surface. Then, the mainstream smoke flows from the first center hole 42a into the second center hole 43a at the boundary position between the front section S2 and the mouthpiece end section S3 while expanding in a cross sectional direction. This may cause local tar adhesion to the periphery (edge) of the first center hole 42a on the rear end surface of the center hole filter 42. However, as illustrated in Fig. 1, the rear end surface of the center

hole filter 42 is placed in a deeper position from the mouthpiece end surface by a length of the mouthpiece end section S3. Thus, even with local tar adhesion to the periphery of the first center hole 42a on the rear end surface of the center hole filter 42, the tar contamination is less visible from a smoker.

[0038] Next, a difference in flow velocity (flow rate) between mainstream smoke flowing on the central side and mainstream smoke flowing on the outer peripheral side of the second center hole 43a will be described. Since the cross sectional area of the second center hole 43a is larger than that of the first center hole 42a, the central side of the second center hole 43a axially overlaps the first center hole 42a, while the outer peripheral side does not axially overlap the first center hole 42a. Thus, the flow velocity (flow rate) of the mainstream smoke is relatively slower (lower) in a region on the outer peripheral side as compared to the central side of the second center hole 43a. As such, the flow velocity (flow rate) of the mainstream smoke flowing on the outer peripheral side of the second center hole 43a is reduced, thereby reducing the frequency of contact between mainstream smoke inhaled from the rear end of the second center hole 43a into the mouth and the mouthpiece end surface. This can prevent local tar adhesion to the periphery (edge) of the second center hole 43a on the mouthpiece end surface. This can prevent tar contamination on the mouthpiece end surface of the filter 4 and make the tar contamination less noticeable.

[0039] Further, according to this embodiment, low filtration and high dilution of the filter 4 can be achieved without providing a section such as a cavity or a recess with the entire cross section of the filter 4 being hollow (void). This can prevent insufficient hardness over the entire longitudinal zone of the filter 4. This can prevent inconvenience such as accidental deformation of the filter 4 before or during smoking. As described above, the cigarette 1 according to this embodiment can make tar contamination on the mouthpiece end surface of the filter 4 less noticeable, and satisfactorily prevent insufficient hardness of the filter 4.

[0040] Further, in the filter 4 according to this embodiment, the mouthpiece end section S3 is shorter than the front section S2. Since a thickness (wall thickness) of the center hole filter 43 is smaller than that of the center hole filter 42, the center hole filter 43 being shorter than the front section S2 can more reliably prevent insufficient hardness of the filter 4 from being manifested.

[0041] Also, in this embodiment, the first center hole 42a and the second center hole 43a in the filter 4 are coaxially placed. Such a configuration can more uniformly reduce the frequency of contact between the mainstream smoke flowing out through the second center hole 43a in the mouthpiece end surface and the mouthpiece end surface over the entire periphery of the second center hole 43a. This can more satisfactorily make the tar contamination on the mouthpiece end surface of the filter 4 less noticeable.

[0042] Further, in this embodiment, the filtration material 41 is provided in the filtering section S1 located at the front end of the filter 4, and thus the filtration material 41 can function as shred spilling preventing means for preventing the cut tobacco 21 in the tobacco rod 2 from entering (spilling into) the filter 4. Specifically, the filtration material 41 in the filtering section S1 also serves as the shred spilling preventing means. The shred spilling preventing means is not limited to the filtration material 41 as long as it has a function of preventing the cut tobacco 21 from entering the filter 4. For example, various configurations such as a metal or resin mesh material may be used as the shred spilling preventing means. However, as in this embodiment, the filtration material 4 also serving as the shred spilling preventing means can reduce material cost for the filter 4, and also prevent complication of a manufacturing process.

[0043] Further, in this embodiment, the vent hole 31 in the filter 4 is placed in a position corresponding to the filtering section S1. Using such a configuration allows ventilation air to be smoothly introduced through the vent hole 31 into the filter 4. Also, the vent hole 31 is placed in the filtering section S1. The vent hole 31 is placed upstream of the mouthpiece end section S3 as in this embodiment, and thus a flow of ventilation (dilution) air introduced through the vent hole 31 into the filter 4 allows passage of the mainstream smoke flowing through the first center hole 42a in the front section S2 while being directed toward the central side of the first center hole 42a. Specifically while the flow of air flowing through the vent hole 31 is directed toward the outer peripheral side of the first center hole 42a, and the flow of the mainstream smoke is directed toward the central side of the first center hole 42a, the flows can be caused to flow downward. Since the flows of the mainstream smoke and the dilution air are maintained while passing through the second center hole 43a in the mouthpiece end section S3, the frequency of contact between the mainstream smoke inhaled from the rear end of the second center hole 43a into the mouth and the mouthpiece end surface can be more effectively reduced. This can make the tar contamination on the mouthpiece end surface of the filter 4 much less noticeable. The above described operation of "allows passage of the mainstream smoke while being directed toward the central side of the first center hole 42a" can be obtained by placing the vent hole 31 upstream of the mouthpiece end section S3 in the filter 4.

[0044] Thus, instead of placing the vent hole 31 in the position corresponding to the filtering section S1, the vent hole 31 may be placed in a position corresponding to the front section S2 as in an exemplified configuration in Fig. 6. Fig. 6 illustrates another variation of the position of the vent hole 31. In the example in Fig. 6, the vent hole 31 is placed in the position corresponding to the front section S2 in the filter 4. As illustrated, the vent hole 31 extends through the chip paper 3, and also a side wall surrounding the second center hole 43a in the center hole filter 42. Similarly to the case where the vent hole 31 is placed in

the filtering section S1, the flow of the dilution air introduced through the vent hole 31 in the front section S2 into the second center hole 43a in the center hole filter 42 allows the mainstream smoke to flow while being directed toward the central side of the center hole 42a, and can make the tar contamination on the mouthpiece end surface of the filter 4 less noticeable. In the exemplified configuration in Fig. 6, the vent hole 31 opens in both the side wall of the center hole filter 42 and the chip paper 3, but may open in the chip paper 3 only. Also in this case, the air having passed through the center hole filter 42 can be introduced into the second center hole 43a.

[0045] Next, diameters and lengths of the first center hole 42a and the second center hole 43a in the filter 4 will be described for illustration. In this embodiment, as an example, the diameter of the first center hole 42a in the front section S2 (center hole filter 42) is within 26% to 39% of the diameter of the filter 4. For example, for a filter 4 of a usual size having a diameter of 7.7 mm, the diameter of the first center hole 42a may be 2 mm to 3 mm. Also, for a filter 4 of a thin size having a diameter of 5.3 mm, the diameter of the first center hole 42a may be 1.3 mm to 2 mm.

[0046] Meanwhile, as an example, the diameter of the second center hole 43a in the mouthpiece end section S3 (center hole filter 43) may be more than 39% to not more than 78% of the diameter of the filter 4. For example, for the filter 4 of a usual size having a diameter of 7.7 mm, the diameter of the second center hole 43a may be more than 3 mm to not more than 6 mm. Also, for example, for the filter 4 of a thin size having a diameter of 5.3 mm, the diameter of the second center hole 43a may be more than 2 mm to not more than 4.1 mm.

[0047] Also, the length of the front section S2 in which the center hole filter 42 is placed may be 7 mm or more, and the length of the mouthpiece end section S3 in which the center hole filter 43 is placed may be 5 mm to 10 mm. Also, a ratio of the diameter to the length (diameter/length) of the second center hole 43a in the mouthpiece end section S3 may be 0.3 to 1.2. In terms of making the local tar contamination on the rear end surface of the front section S2 (center hole filter 42) less visible, the ratio of the diameter to the length of the second center hole 43a is preferably 1.2 or less.

[0048] The sectional shapes of the first center hole 42a in the front section S2 and the second center hole 43a in the mouthpiece end section S3 are not limited to the circular shape, but may be various shapes. In the case where the first center hole 42a has a non-circular sectional shape, the first center hole 42a may be formed so that a diameter of a circumscribed circle the first center hole 42a is 2 mm to 3 mm. Also, in the case where the second center hole 43a has a non-circular sectional shape, the second center hole 43a may be formed so that a diameter of an inscribed circle in the second center hole 43a is more than 3 mm to not more than 6 mm.

<Modifications>

[0049] The filter 4 according to this embodiment can adopt different modifications. Modifications of the filter 4 according to this embodiment will be described below.

[0050] Fig. 7 is a vertical sectional view of a cigarette 1A according to modification 1. A filter 4A included in the cigarette 1A is similar to the filter 4 in Fig. 1 except that a charcoal (activated carbon) filtering section S0 including a charcoal adding filtration material 44 is placed in front of the filtering section S1. The charcoal filtering section S0, the filtering section S1, the front section S2, and the mouthpiece end section S3 are connected in this order from a front end side of the filter 4A. The charcoal adding filtration material 44 provided in the charcoal filtering section S0 is a charcoal filter such that a cellulose acetate fiber bundle to which activated carbon (for example, carbon derived from coconut shell of 20 to 80 mesh) is added is rolled by rolling paper. The charcoal (activated carbon) functions as an adsorbent that adsorbs components of mainstream smoke.

[0051] In this modification, the filtration material 41 of cellulose acetate fiber is connected to a rear end of the charcoal adding filtration material 44. Thus, the filtration material 41 placed subsequently to the charcoal adding filtration material 44 can function as activated carbon spilling preventing means for preventing the activated carbon added to the charcoal adding filtration material 44 from entering the first center hole 42a in the front section S2 (center hole filter 42). Instead of placing the filtration material 41 at the rear end of the charcoal filtering section S0, a metal or resin mesh material or the like that functions as the activated carbon spilling preventing means may be placed.

[0052] Also, for the filter 4 in Fig. 1, the example is disclosed in which the front section S2 and the mouthpiece end section S3 are placed as sections without a filtering function. However, a section without a filtering function, a section having a filtering function, or the like may be provided between the filtering section S1 and the front section S2. Specifically, in the filter 4 according to this embodiment, the sectional area of the second center hole 43a that is the penetration path in the mouthpiece end section S3 may be larger than the sectional area of the first center hole 42a that is the penetration path in the front section S2 immediately upstream of the mouthpiece end section S3, and different modifications may be used for a configuration upstream of the front section S2 in the filter 4.

[0053] Fig. 8 is a vertical sectional view of a cigarette 1B according to modification 2. A filter 4B included in the cigarette 1B according to modification 2 uses a structure in which center hole sections S4, S5 are additionally placed between the filtering section S1 and the front section S2 in the filter 4 in Fig. 1. In the center hole section S4, a center hole filter 45 having a third center hole 45a is provided, and in the center hole section S5, a center hole filter 46 having a fourth center hole 46a is provided.

In the filter 4B in Fig. 8, the third center hole 45a, the fourth center hole 46a, the first center hole 42a, and the second center hole 43a are coaxially placed. Also, channel sectional areas of mainstream smoke in the center holes increase stepwise in order of the third center hole 45a, the fourth center hole 46a, the first center hole 42a, and the second center hole 43a. In such a modification, the same advantage as of the filter 4 in Fig. 1, that is, the advantage of making tar contamination on the mouthpiece end surface of the filter less noticeable, and preventing insufficient hardness of the filter can be achieved.

[0054] Fig. 9 is a vertical sectional view of a cigarette 1C according to modification 3. In a filter 4C included in the cigarette 1C according to modification 3, the center hole sections S4 and S5 in the filter 4B in Fig. 8 change places. Specifically, in the filter 4C, the filtering section S1, the center hole section S5, the center hole section S4, the front section S2, and the mouthpiece end section S3 are connected in this order from the front end side. In the filter 4C according to modification 3, mainstream smoke having passed through the filtering section S1 flows into the fourth center hole 46a, successively passes through the third center hole 45a, the first center hole 42a, and the second center hole 43a, and is then inhaled by a smoker. Also in this modification, the sectional area of the second center hole 43a in the mouthpiece end section S3 is larger than the sectional area of the first center hole 42a in the front section S2 connected immediately upstream of the mouthpiece end section S3. This can make tar contamination on the mouthpiece end surface of the filter less noticeable, and prevent insufficient hardness of the filter similarly to the filter 4 in Fig. 1.

[0055] Favorable embodiments of the present invention have been described, but the filter cigarette according to the embodiment can accept various changes, improvements, and combinations.

Reference Signs List

[0056]

1, 1A, 1B, 1C	cigarette
2	tobacco rod
3	chip paper
4, 4A, 4B, 4C	filter
S1	filtering section
S2	front section
S3	mouthpiece end section
41	filtration material
42, 43	center hole filter
42a	first center hole
43a	second center hole

Claims

1. A filter cigarette comprising:

a tobacco rod containing cut tobacco; and
 a filter connected to an end of the tobacco rod
 via chip paper,
 wherein the filter includes

a mouthpiece end section placed at a mouth- 5
 piece end and provided with a fiber bundle hav-
 ing an axially formed penetration path through
 which mainstream smoke flows, and a front sec-
 tion connected to a front end of the mouthpiece 10
 end section and provided with a fiber bundle
 having an axially formed penetration path
 through which mainstream smoke flows, and
 a sectional area of the penetration path in the 15
 mouthpiece end section is larger than a section-
 al area of the penetration path in the front sec-
 tion.

2. The filter cigarette according to claim 1, wherein a 20
 length of the mouthpiece end section is shorter than
 a length of the front section.
3. The filter cigarette according to claim 1 or 2, wherein 25
 the respective penetration paths in the mouthpiece
 end section and the front section are coaxially
 placed.
4. The filter cigarette according to any one of claims 1 30
 to 3, wherein shred spilling preventing means for pre-
 venting the cut tobacco from entering the filter is pro-
 vided at a front end of the filter.
5. The filter cigarette according to claim 4, wherein a 35
 filtration material containing a fiber bundle that filters
 mainstream smoke is provided at the front end of the
 filter, and the filtration material also serves as the
 shred spilling preventing means.
6. The filter cigarette according to any one of claims 1 40
 to 5, wherein a vent hole through which outside air
 is introduced into the filter for dilution of mainstream
 smoke is formed in the chip paper, and
 the vent hole is placed upstream of the mouthpiece
 end section in the filter.

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FIG. 1

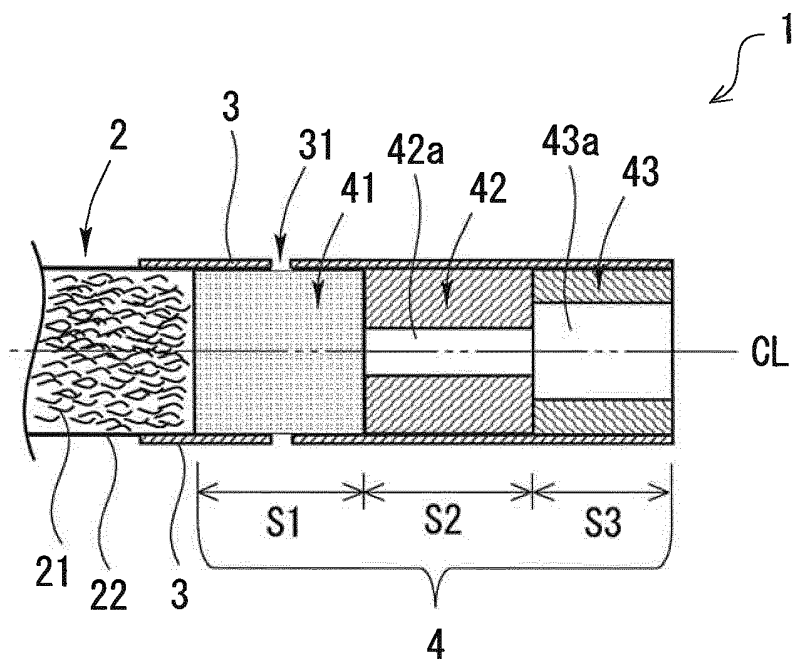


FIG. 2

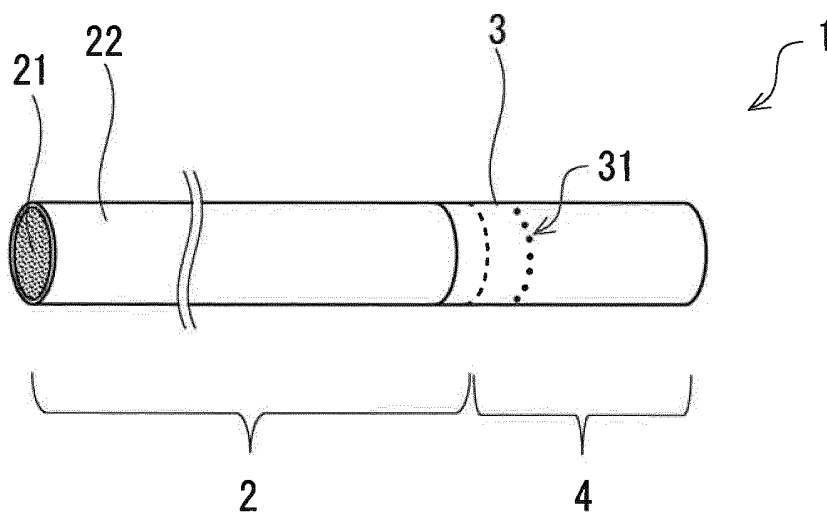


FIG. 3

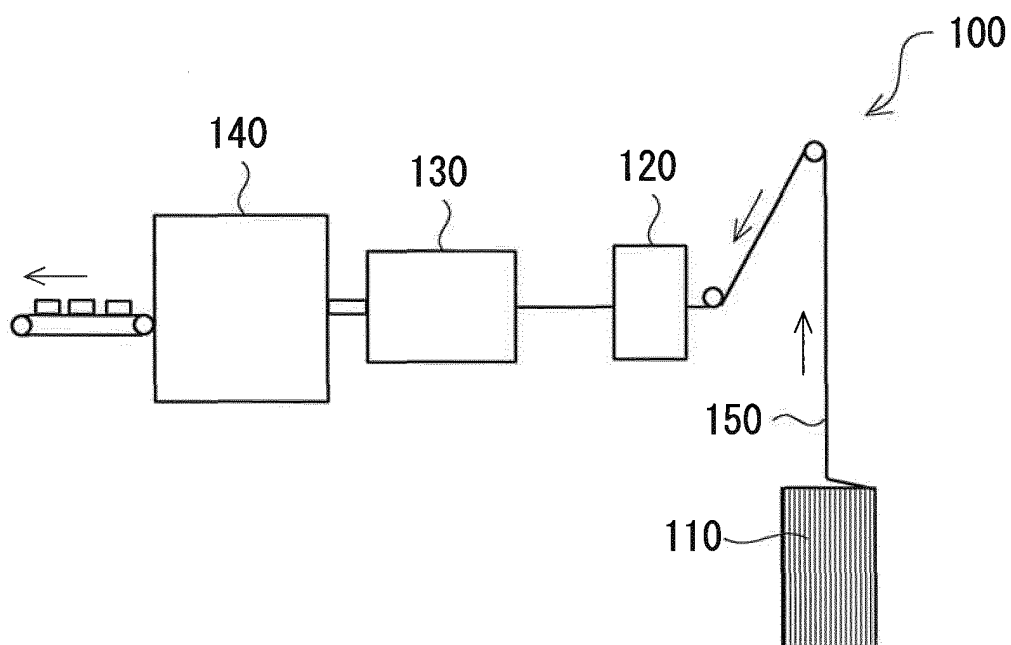


FIG. 4

COMPARATIVE EXAMPLE

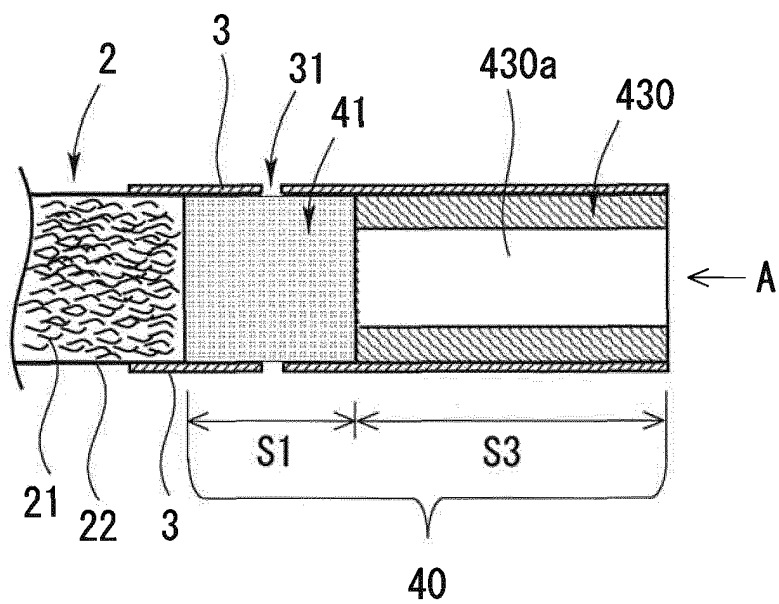


FIG. 5

COMPARATIVE EXAMPLE

VIEW IN DIRECTION OF ARROW A (AFTER SMOKING)

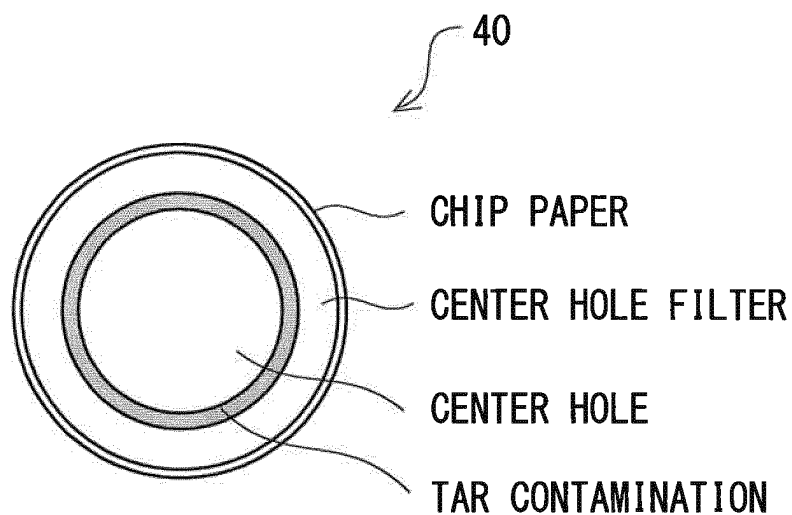


FIG. 6

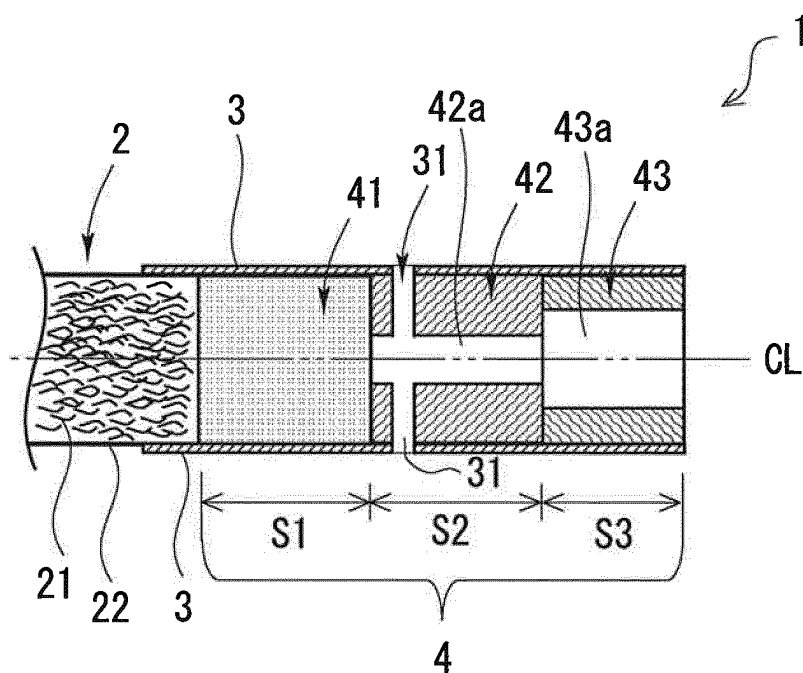


FIG. 7

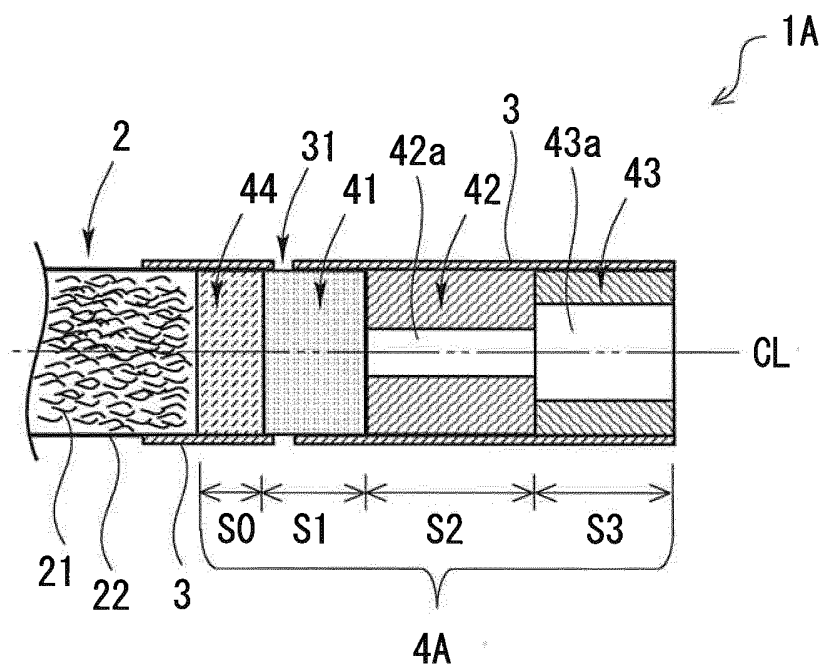


FIG. 8

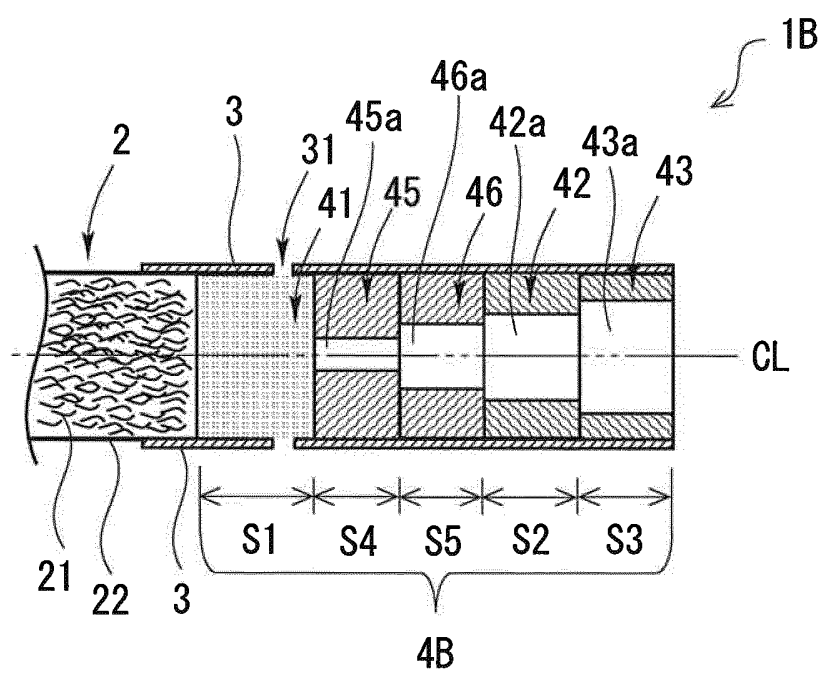
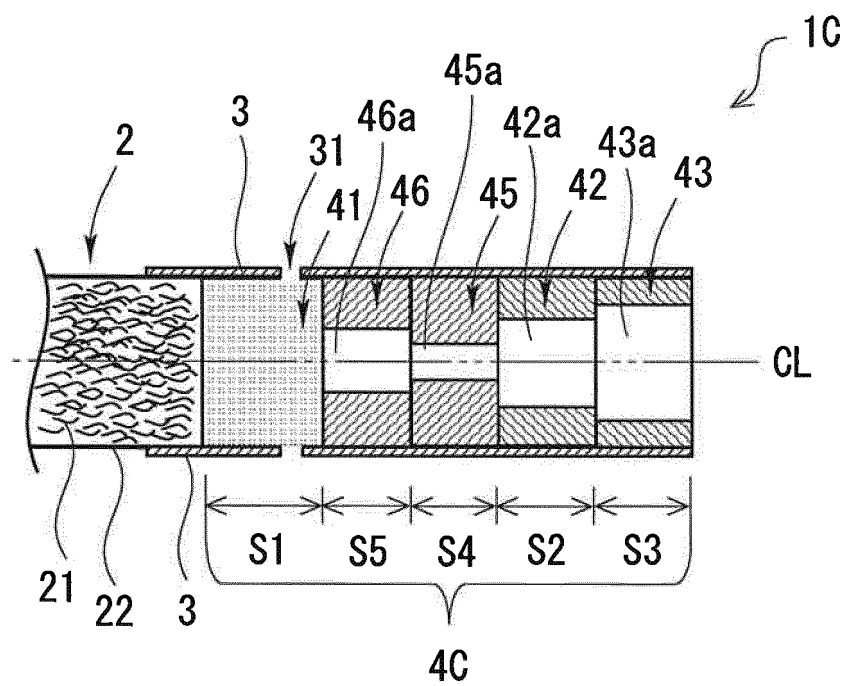


FIG. 9



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2014/070879

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

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2014
Kokai Jitsuyo Shinan Koho 1971-2014 Toroku Jitsuyo Shinan Koho 1994-2014

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2004/086888 A2 (PHILIP MORRIS PRODUCTS S.A.), 14 October 2004 (14.10.2004), entire text; all drawings	1-6
A	JP 59-203483 A (Mitsubishi Acetate Co., Ltd.), 17 November 1984 (17.11.1984), entire text; all drawings	1-6
A	US 4702263 A (Tobacco Research and Development Institute Ltd.), 27 October 1987 (27.10.1987), entire text; all drawings	1-6
A	JP 8-205844 A (Ning Baogang), 13 August 1996 (13.08.1996), entire text; all drawings	1-6

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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"&" document member of the same patent family

Date of the actual completion of the international search
20 October, 2014 (20.10.14)

Date of mailing of the international search report
28 October, 2014 (28.10.14)

Name and mailing address of the ISA/
Japanese Patent Office

Authorized officer

Facsimile No.

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/JP2014/070879

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		IE 57362 B1
		IT 1189533 B
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		CN 1128638 A

REFERENCES CITED IN THE DESCRIPTION

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- JP 5023158 A [0006]