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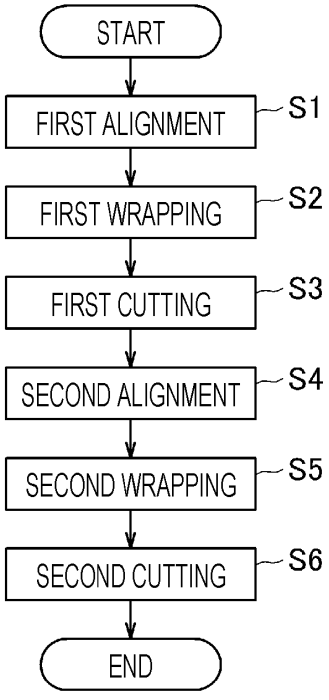
(54) **METHOD FOR PRODUCING SMOKING ARTICLE**

(57) A method for producing a smoking article 1 comprises: a first arrangement step of forming a first connected body 13 in which a rolling member 2, a heat source 3, a flavor source material 12, a heat source 3, and a rolling member 2 are arranged in a line in the stated order; a first rolling step of forming a first continuous body 14 by integrally rolling the first connected body 13 with a first rolling paper 6; a first cutting step of forming two intermediate rods 15 in which the rolling member 2, the heat source 3, and a flavor source 4 formed by halving the flavor source material 12 are arranged in a line in the stated order; a second arrangement step of forming a second connected body 18 in which the intermediate rod 15, a filter member material 16, and the intermediate rod 15 are arranged in a line in the stated order; a second rolling step of forming a second continuous body 19 by integrally rolling the second connected body 18 with a second rolling paper 7; and a second cutting step of cutting the second continuous body 19 into two parts at the filter member material 16 to form two smoking articles 1 in which the rolling member 2, the heat source 3, the flavor source 4, a filter member 5 formed by halving the filter member material 16 are arranged in a line in the stated order.

FIG. 2



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Description

Technical Field

[0001] The present invention relates to a smoking article manufacturing method.

Background Art

[0002] Patent Literature 1 discloses a smoking article formed by wrapping a first multi-segment component and a second multi-segment component in an outer wrapper (wrapping paper). The first multi-segment component includes a combustible carbonaceous heat source, an aerosol-source material, and an airflow directing element (annular member) that are wrapped in a wrapper (wrapping paper). The second multi-segment component includes an expansion chamber and a mouthpiece. A removable cap is disposed at an end of the smoking article in such a manner as to be adjacent to the heat source. The cap is wrapped in a portion of the wrapper for the first multi-segment component.

[0003] A series of first multi-segment components, which are continuously wrapped, is cut by a cutter at an airflow directing element, so that a cap is formed of the same material as the airflow directing element. The resulting first multi-segment components are each combined with a second multi-segment component to produce a smoking article.

[0004] Segments constituting the first and second multi-segment components, which do not include caps, are fed by a hopper onto a moving delivery path and formed into a coupled body by a compactor.

Citation List

Patent Literature

[0005] PTL 1: Japanese Unexamined Patent Application Publication (Translation of PCT Application) No. 2015-536673

Summary of Invention

Technical Problem

[0006] In the technique disclosed in Patent Literature 1, segments constituting the multi-segment components, not including caps, are fed after being cut and molded into shapes appropriate for forming a smoking article. Even when the segments have a small segment length and a small aspect ratio (length to width ratio), it is required that they be placed and fed in a proper position onto the moving delivery path.

[0007] Even after being placed on the delivery path, such small segments need to be conveyed in the initial position and be prevented from rolling during the conveyance. If the segments lose the balance and roll during feeding or conveyance, the quality of smoking articles eventually produced may be affected. To prevent this, equipment with a complex mechanism needs to be prepared to avoid rolling of small segments. This affects productivity in making smoking articles.

[0008] The cap is formed by cutting the airflow directing element in the process of manufacturing the smoking articles. The cutting step is carried out only for the purpose of forming the cap. This also affects productivity in making the smoking articles.

[0009] When a coupled body formed by a cap and other components, with the cap being positioned at an end, is wrapped in wrapping paper to manufacture smoking articles, the cap positioned at the end serves as a segment that determines machinability (or ability with which the periphery of an object to be wrapped can be uniformly wrapped in a balanced manner) when the coupled body is wrapped in the wrapping paper. However, Patent Literature 1 does not specifically consider the case of using such a manufacturing technique. When the cap serving as an airflow directing element, or simply as a tubular member, is used, machinability may be affected, and this may lead to lower quality of the smoking articles.

[0010] The present invention has been made in view of the problems described above. An object of the present invention is to provide a smoking article manufacturing method that can improve both quality of, and productivity in making, smoking articles.

Solution to Problem

[0011] A smoking article manufacturing method of the present invention is provided to achieve the object described above. The smoking article manufacturing method includes a first alignment step of feeding two wrapping members, two heat sources, and one flavor source material and aligning the wrapping member, the heat source, the flavor source material, the heat source, and the wrapping member in a row in the stated order to form a first coupled body; a first wrapping step of integrally wrapping the first coupled body in a first wrapping paper to form a first continuous body; a first cutting step of cutting the first continuous body at the flavor source material into two intermediate rods, each including the wrapping member, the heat source, and a flavor source aligned in a row in the stated order, the flavor source being one of two flavor sources into which the flavor source material is divided; a second alignment step of feeding a filter member material and aligning the intermediate rod, the filter member material, and the intermediate rod in a row in the stated order, with the flavor sources of the two intermediate rods facing respective ends of the filter member material, to form a second coupled body; a second wrapping step of integrally wrapping the second coupled body in a second wrapping paper to form a second continuous body; and a second cutting step of cutting the second continuous body at the filter member material into two smoking articles, each including the wrapping member,

the heat source, the flavor source, and a filter member aligned in a row in the stated order, the filter member being one of two filter members into which the filter member material is divided.

Advantageous Effects of Invention

[0012] The smoking article manufacturing method of the present invention can improve both quality of, and productivity in making, smoking articles.

Brief Description of Drawings

[0013]

[Fig. 1] Fig. 1 is a cross-sectional view schematically illustrating, in an axial direction, a smoking article manufactured by a manufacturing method according to a first embodiment of the present invention.
[Fig. 2] Fig. 2 is a flowchart illustrating a process of manufacturing smoking articles.
[Fig. 3] Fig. 3 is a diagram illustrating a first alignment step (step S1).
[Fig. 4] Fig. 4 is a diagram illustrating a first wrapping step (step S2).
[Fig. 5] Fig. 5 is a diagram illustrating a first cutting step (step S3).
[Fig. 6] Fig. 6 is a diagram illustrating a second alignment step (step S4).
[Fig. 7] Fig. 7 is a diagram illustrating a second wrapping step (step S5).
[Fig. 8] Fig. 8 is a diagram illustrating a second cutting step (step S6).
[Fig. 9] Fig. 9 is a diagram illustrating the smoking article, with a wrapping member separated.
[Fig. 10] Fig. 10 is a flowchart illustrating a hardness evaluation process.
[Fig. 11] Fig. 11 is a lateral view of a hardness measuring unit.
[Fig. 12] Fig. 12 is a sectional view of a sample to be measured, which is observed before and after application of a load thereto for hardness measurement.
[Fig. 13] Fig. 13 is a flowchart illustrating a restoration rate evaluation process.
[Fig. 14] Fig. 14 is a lateral view of a restoration-rate measuring unit.
[Fig. 15] Fig. 15 is a sectional view of a sample to be measured, which is observed before and after application of a load thereto for ellipticity measurement.
[Fig. 16] Fig. 16 is a diagram illustrating a part of a smoking article according to a second embodiment of the present invention.
[Fig. 17] Fig. 17 is a diagram illustrating a part of a smoking article according to a third embodiment of the present invention.
[Fig. 18] Fig. 18 is a diagram illustrating a part of a smoking article according to a fourth embodiment of the present invention.
[Fig. 19] Fig. 19 is a plan view of first wrapping paper of a smoking article according to a fifth embodiment of the present invention, as viewed from an inner periphery of the first wrapping paper.
[Fig. 20] Fig. 20 is a sectional view of a first continuous body that includes the first wrapping paper illustrated in Fig. 19.
[Fig. 21] Fig. 21 is a diagram illustrating a part of a smoking article according to a sixth embodiment of the present invention.
[Fig. 22] Fig. 22 is a diagram illustrating a part of a smoking article which is a modification of the smoking article illustrated in Fig. 21.
[Fig. 23] Fig. 23 is a diagram illustrating a part of a smoking article according to a seventh embodiment of the present invention.
[Fig. 24] Fig. 24 is a diagram illustrating a smoking article according to an eighth embodiment of the present invention.
[Fig. 25] Fig. 25 is a diagram illustrating a smoking article according to a ninth embodiment of the present invention. Description of Embodiments

[0014] A smoking article manufacturing method according to embodiments of the present invention will now be described on the basis of the drawings.

<First Embodiment>

[0015] Fig. 1 is a sectional view schematically illustrating, in an axial direction X, a smoking article 1 according to a first embodiment of the present invention. The smoking article 1 is a heat-source type cigarette formed by aligning a wrapping member 2, a heat source 3, a flavor source 4, and a filter member 5 in a row in the stated order in the axial direction X.

[0016] The smoking article 1 includes first wrapping paper 6 in which the wrapping member 2, the heat source 3, and the flavor source 4 are integrally wrapped, and also includes second wrapping paper 7 in which the wrapping member 2, the heat source 3, and the flavor source 4 wrapped in the first wrapping paper 6 are wrapped integrally with the filter member 5. Additionally, the smoking article 1 includes an adhesive portion 8 that bonds the wrapping member 2, a part of the heat source 3, and the flavor source 4 to the first wrapping paper 6, and also includes a non-adhesive portion 9 that does not bond the remaining part of the heat source 3 to the first wrapping paper 6 on one side of the heat source 3 adjacent to the wrapping member 2. Before use of the smoking article 1, the wrapping member 2 is separated off at the non-adhesive portion 9 to expose at least part of the heat source 3 in such a manner that it can be heated by ignition.

[Wrapping Member]

[0017] The wrapping member 2 according to the

present embodiment is, for example, a paper tube. The wrapping member 2 is a component that serves to improve machinability in a first wrapping step (described below) in which a first coupled body 13 formed in a first alignment step (described below) is wrapped in the first wrapping paper 6. The wrapping member 2 also serves as a protective member that covers the heat source 3 during manufacture and before use of the smoking article 1.

[0018] Machinability refers to the ability with which the periphery of an object to be wrapped can be uniformly wrapped in a balanced manner. With the wrapping member 2, it is possible to minimize defects in the smoking article 1 associated with wrapping in the first wrapping paper 6. The wrapping member 2 does not necessarily need to be a paper tube, and may be made of any material. To improve machinability, however, the wrapping member 2 preferably has substantially the same hardness as the flavor source 4. This also improves so-called separability that facilitates tactile separation of only the wrapping member 2 from the smoking article 1.

[0019] Also, to improve adhesion of the first wrapping paper 6 to the first coupled body 13, the wrapping member 2 and the flavor source 4 preferably have substantially the same ellipticity (i.e., restoration rate) after being deformed by a load applied thereto. The reasons for which the machinability, separability, and adhesion are improved will be described in detail later on below. The wrapping member 2 may be formed by wrapping a hollow filter tow in rolling paper, or by wrapping a solid filter tow in rolling paper.

[0020] For the user to easily pull out or pluck the wrapping member 2 with fingers, the length of the wrapping member 2 in the axial direction X is preferably in the 5 mm to 20 mm range, and more preferably in the 10 mm to 15 mm range. This enhances separability of the smoking article 1.

[Heat Source]

[0021] The heat source 3 is a solid molded component of a columnar shape, and is, for example, a carbon heat source. In the present embodiment, the heat source 3 has a hollow portion 3a penetrating therethrough in the axial direction X. The heat source 3 burns and generates heat by ignition. By allowing air to pass through the hollow portion 3a, the heat source 3 can efficiently generate a heated air flow. The air heated by the heat source 3 passes through the flavor source 4, where an aerosol containing flavor components is efficiently generated.

[Flavor Source]

[0022] The flavor source 4 is a molded component of a columnar shape. The flavor source 4 is obtained by wrapping at least, for example, tobacco flakes, a molded body formed by molding tobacco ingredients into any shape (e.g., granular or sheet form), plants other than tobacco, or other flavors, in rolling paper 4a. An aerosol-source material is contained in the flavor source 4.

[0023] The user inhales the aerosol that is generated after the air heated in the heat source 3 passes through the flavor source 4. The user can thus take in some substances from the flavor source 4. The flavor source 4 is formed by dividing a flavor source material 12 (described below) into two parts, which are of the same material. Accordingly, in the following description, the term "flavor source 4" and the term "flavor source material 12" may be used interchangeably.

[Filter Member]

[0024] The filter member 5 is formed by aligning a tube 10 and a filter element 11 in a row in the stated order, with the tube 10 being closer to the flavor source 4, in the axial direction X. The tube 10 is provided to rectify the flow of air in the smoking article 1. The tube 10 is, for example, a paper tube or may be a plastic tube. The filter element 11 is formed, for example, by wrapping a filter fiber bundle of acetate in rolling paper 11a.

[0025] The filter fiber bundle may either be solid or hollow. Activated carbon particles or hydrotalcite-like compound particles may be added to the filter fiber bundle, or a capsule filled with a content fluid may be embedded in a breakable shell. The content fluid includes, for example, a flavor and an edible oil serving as a solvent for dissolving the flavor. The filter element 11 may be a so-called multi-segment filter formed by joining a plurality of filter plugs.

[First Wrapping Paper]

[0026] The first wrapping paper 6 is formed by a cigarette paper material of relatively low air permeability (including metal-laminated paper, such as aluminum-laminated paper). The first wrapping paper 6 allows an extremity of the wrapping member 2 to protrude from an end thereof. This makes it easy to visually recognize the presence of the wrapping member 2 to be separated off.

[Second Wrapping Paper]

[0027] The second wrapping paper 7 is made of cigarette paper of low air permeability. The second wrapping paper 7 is wrapped around a region extending over the filter member 5 and part of the flavor source 4 adjacent thereto. An adhesive portion (not shown) is formed in a region where the filter member 5 and the flavor source 4 can be coupled together by the second wrapping paper 7.

[0028] With reference to Fig. 2 to Fig. 8, a process of manufacturing the smoking article 1 will be described. Fig. 2 is a flowchart illustrating a process of manufacturing the smoking article 1. Fig. 3 to Fig. 8 are diagrams for explaining step S 1 to step S6 shown in Fig. 2.

[First Alignment step] (Step S1)

[0029] Upon starting the process of manufacturing the smoking article 1, first, as in Fig. 3, two wrapping members 2, two heat sources 3, and one flavor source material 12 are fed to form the first coupled body 13, which is a row of the wrapping member 2, the heat source 3, the flavor source material 12, the heat source 3, and the wrapping member 2 aligned in this order in the axial direction X. The flavor source material 12 is substantially twice as long as the flavor source 4 in the axial direction X.

[0030] Specifically, the materials forming the first coupled body 13 are fed by a feeding unit (not shown). The materials fed by the feeding unit are arranged in the order illustrated in Fig. 3. The materials are each sucked in by a suction drum and every time each material reaches an appropriate section, it is positioned while allowing sufficient space for another material to be fed. Materials required for each step may be fed, aligned, and processed in one place.

[First Wrapping Step] (Step S2)

[0031] Next, as illustrated in Fig. 4, the first coupled body 13 is wrapped in the first wrapping paper 6 in the axial direction X to form a first continuous body 14. Specifically, a wrapping unit (not shown) with wrapping rollers is used here. After the first wrapping paper 6 is fed to the wrapping unit, the first coupled body 13 is placed on the first wrapping paper 6, and the first wrapping paper 6 is wrapped around the first coupled body 13 while being pressed by the wrapping rollers substantially uniformly over the entire region of the first coupled body 13 in the axial direction X.

[0032] With the wrapping members 2 positioned at respective ends of the first coupled body 13 during this wrapping operation, the first coupled body 13 is prevented from being crushed at both ends thereof. The first wrapping paper 6 can thus be uniformly wrapped around the periphery of the first coupled body 13 in a balanced manner. Improved machinability of the first coupled body 13 is thus achieved. As described above, the wrapping rollers are configured to press the entire region of the first coupled body 13. Therefore, the presence of not only the wrapping members 2 but also the flavor source material 12 in the first coupled body 13 contributes to improved machinability of the first coupled body 13.

[0033] The heat sources 3, which have a slightly smaller diameter than the wrapping members 2 and the flavor source material 12, are not in contact with the wrapping rollers during the wrapping operation. This means that hardness and other properties of the heat sources 3 do not affect the machinability. Also, undesired gaps in the first continuous body 14 and surface irregularities of the first continuous body 14 are reduced by being wrapped in the first wrapping paper 6. The first continuous body 14 is thus produced, which conforms to quality requirements pertaining to wrapping of the smoking article 1.

[0034] When the first coupled body 13 is wrapped in the first wrapping paper 6, the adhesive portion 8 and the non-adhesive portion 9 are created. The adhesive portion 8 bonds the first coupled body 13 to the first wrapping paper 6, and the non-adhesive portion 9 is not bonded to at least part of each heat source 3 on one side of the heat source 3 adjacent to the wrapping member 2.

[0035] More specifically, in the first continuous body 14, an adhesive is applied to a continuous region of the inner periphery (the entire or part of the periphery) of the first wrapping paper 6 extending in the axial direction X and facing the wrapping member 2, part of the heat source 3, and the flavor source material 12. The adhesive portion 8 is formed by wrapping the first coupled body 13 in the first wrapping paper 6.

[0036] On the other hand, no adhesive is applied to a continuous region of the inner periphery (the entire or part of the periphery) of the first wrapping paper 6 extending in the axial direction X and facing part of the heat source 3 and the wrapping member 2. The non-adhesive portion 9 is formed by wrapping the first coupled body 13 in the first wrapping paper 6. Before use of the smoking article 1, at least part of the wrapping member 2 is separated off at the non-adhesive portion 9 to expose at least part of the heat source 3 in such a manner that it can be heated by ignition.

[0037] With the non-adhesive portion 9, the adhesive portion 8 does not necessarily need to be formed over the entire region adjacent to the wrapping member 2. Also, the first wrapping paper 6 does not necessarily need to allow the extremity of the wrapping member 2 to protrude from each end thereof.

[First Cutting Step] (Step S3)

[0038] Next, as illustrated in Fig. 5, the first continuous body 14 is cut into two intermediate rods 15 by a cutter (not shown) at a position indicated by a broken line in the flavor source material 12. The two intermediate rods 15 each include the wrapping member 2, the heat source 3, and the flavor source 4 aligned in a row in the stated order in the axial direction X. The flavor source 4 is one of two flavor sources 4 into which the flavor source material 12 is divided.

[Second Alignment step] (Step S4)

[0039] Next, as illustrated in Fig. 6, the two intermediate rods 15 are spaced apart in the axial direction X to allow a filter member material 16 to be fed in between the intermediate rods 15. This step does not involve reversing the orientation of the two intermediate rods 15. That is, the two intermediate rods 15 are kept in the same orientation as when they were formed by cutting in step S3. The filter member material 16 includes a filter element material 17 and tubes 10 disposed at respective ends of the filter element material 17. The filter element material 17 is substantially twice as long as the filter element 11

in the axial direction X.

[0040] The filter member material 16 may be fed after aligning the tube 10, the filter element material 17, and the tube 10 in a row in the stated order in the axial direction X, or may be fed as the filter member material 16 by individually feeding the tube 10, the filter element material 17, and the tube 10 and aligning them. The intermediate rod 15, the filter member material 16, and the intermediate rod 15 are aligned in a row in the stated order in the axial direction X, with the flavor sources 4 of the two intermediate rods 15 facing the respective ends of the filter member material 16, to form a second coupled body 18.

[Second Wrapping Step] (Step S5)

[0041] Next, as illustrated in Fig. 7, the second coupled body 18 is wrapped in the second wrapping paper 7 to form a second continuous body 19. Specifically, as in the case of step S2, the second wrapping paper 7 is fed to the wrapping unit and the second coupled body 18 is placed on the second wrapping paper 7. Then, the second wrapping paper 7 is wrapped around the second coupled body 18 while being pressed by the wrapping rollers substantially uniformly over a continuous region extending over the filter member material 16 in the axial direction X to reach the flavor sources 4 of the two intermediate rods 15.

[0042] With the flavor sources 4 positioned at respective ends of the second coupled body 18 during this wrapping operation, the second wrapping paper 7 can be uniformly wrapped around the periphery of the filter member material 16 and the flavor sources 4 of the intermediate rods 15 in a balanced manner. Improved machinability of the second coupled body 18 is thus achieved. The second continuous body 19 is thus produced, which conforms to quality requirements pertaining to wrapping of the smoking article 1.

[0043] In the second continuous body 19, the second wrapping paper 7 allows at least part of the heat source 3 of the intermediate rod 15 to protrude from each end thereof. This eliminates the need for tearing the second wrapping paper 7 to separate the wrapping member 2 in the smoking article 1, and facilitates separation of the wrapping member 2.

[0044] The second coupled body 18 is appropriately bonded at an adhesive portion (not shown) when wrapped in the second wrapping paper 7. This enhances coupling of the filter member material 16 and the intermediate rods 15 in the second continuous body 19.

[Second Cutting Step] (Step S6)

[0045] Next, as illustrated in Fig. 8, the second continuous body 19 is cut into two smoking articles 1 by a cutter (not shown) at a position indicated by a broken line in the filter member material 16. The two smoking articles 1 each include the wrapping member 2, the heat source 3, the flavor source 4, and the filter member 5 aligned in a row in the stated order in the axial direction X. The filter member 5 is one of two filter members 5 into which the filter member material 16 is divided. The process of manufacturing the smoking article 1 ends here.

[0046] Fig. 9 illustrates the smoking article 1, with the wrapping member 2 separated. Before use of the smoking article 1, the user pulls the wrapping member 2 in the axial direction X to tear the first wrapping paper 6 at the non-adhesive portion 9 in the circumferential direction. The user can thus pluck and separate the wrapping member 2 from the smoking article 1. As illustrated in Fig. 9, this exposes the heat source 3 at the extremity of the smoking article 1 and allows the heat source 3 to be ignited. The process of manufacturing the smoking article 1 may include the step of separating the wrapping member 2. In this case, the smoking article 1 obtained by separating the wrapping member 2 therefrom is treated as a final product.

[0047] To ensure separation of only the wrapping member 2 from the smoking article 1 at the non-adhesive portion 9, the user often relies on the sense of touch of fingers. That is, when using the smoking article 1, if the user cannot easily tactilely identify the presence of the wrapping member 2 or the boundary (i.e., the position of the non-adhesive portion 9) between the wrapping member 2 and the heat source 3, the user may separate off not only the wrapping member 2, but also the heat source 3 and even the intermediate rod 15 including the flavor source 4 together.

[0048] Accordingly, a hardness evaluation process is performed in the present embodiment to evaluate the hardness of the smoking article 1. This is intended not only to further improve machinability in the smoking article 1, but also to provide the smoking article 1 with separability, which facilitates tactile separation of only the wrapping member 2 from the smoking article 1.

[0049] The hardness evaluation process will now be described with reference to the flowchart of Fig. 10 which illustrates a hardness evaluation process.

[Hardness Measurement] (Step S11)

[0050] Upon starting the hardness evaluation process, a hardness measurement is performed first, which measures the hardnesses of the wrapping member 2, the heat source 3, and the flavor source material 12.

[0051] Fig. 11 is a lateral view of a hardness measuring unit 20 used for the hardness measurement.

[0052] The hardness measuring unit 20 includes a base 21, a pair of support walls 22, two lower rods 23, two upper rods 24, and an elevating device 25. The support walls 22 stand parallel to each other on the base 21 and extend in the depth direction in Fig. 11. The two lower rods 23 are disposed between the support walls 22, secured to the base 21, and extend parallel to the support walls 22. The two upper rods 24 are disposed above and opposite the two lower rods 23, and are supported by the elevating device 25 in such a manner as to be able to

move upward and downward.

[0053] First, one of the wrapping member 2, the heat source 3, and the flavor source material 12 (hereinafter also referred to as a sample to be measured or "sample A") is placed to extend over each pair of the support wall 22 and the lower rod 23. Many samples A may be placed along the direction in which the support wall 22 and the lower rod 23 extend, so that the hardnesses of many (e.g., 20) samples A are measured at the same time. Since the flavor source 4 obtained by halving the flavor source material 12 has the same hardness as the flavor source material 12, the smoking article 1 or the flavor source 4 included therein may be used as the sample A.

[0054] When the elevating device 25 is started and the upper rods 24 are lowered in the direction of arrow in Fig. 11, each sample A is held between the upper rod 24 and the lower rod 23 and subjected to a load. The sample A may be shifted in the axial direction X to allow the load to be applied at a desired position of the sample A. To measure the hardness of the sample A, the load is preferably applied to a center portion of the sample A in the longitudinal direction.

[0055] The hardness measurement is made on the basis of the average deformation of 20 samples A measured when a load of 19.6 N is continuously applied thereto for 20 seconds.

[0056] Referring to Fig. 12, a dot-and-dash line represents a cross-sectional shape of a sample A observed before application of a load F thereto, and a solid line represents a cross-sectional shape of the sample A observed after application of the load F thereto. Before application of the load F, the sample A has a circular cross-section with an initial height H1 (= diameter of sample A). When the load F is applied, the sample A has an elliptical cross-section with a residual height H2.

[0057] In the present embodiment, the hardness of the sample A is calculated on the basis of the following equation:

- $$\text{Hardness (\%)} = (H2/H1) \times 100$$

[0058] The equation determines the hardness of each sample A on the basis of the ratio (in percentage) of the residual height H2 to the initial height H1. The present evaluation calculates the average of the determined hardnesses of the 20 samples A and defines the resulting average value as the hardness of the sample A, that is, the hardness of one of the wrapping member 2, the heat source 3, and the flavor source material 12. The same applies to the following.

[0059] The smaller the difference (ΔH) obtained by subtracting the residual height H2 from the initial height H 1, the larger the value of hardness and therefore, the greater the hardness of the sample A. When the heat source 3 was a carbon heat source and the hardness of the sample A was determined as that of the carbon heat source, the residual height H2 was equal to the initial height H1 and the hardness actually measured was 100%. The following description is thus made on the basis that the hardness of the heat sources 3 is 100%.

[0060] Experiments conducted by the present inventors found that to improve both machinability and separability, when the hardness Hh of the heat source 3 is defined as 100%, the hardness Hw of the wrapping member 2 and the hardness Hf of the flavor source material 12 are preferably greater than or equal to 60% and less than or equal to 95%, and more preferably greater than or equal to 65% and less than or equal to 80%, and still more preferably, the difference between the hardness Hw of the wrapping member 2 and the hardness Hf of the flavor source material 12 is less than or equal to 30%, and even more preferably, this difference in hardness is less than or equal to 15%. In the present embodiment, therefore, at least one of the determination steps S12 to S14, described below, is performed to evaluate the hardness.

[First Hardness Determination] (Step S 12)

[0061] As illustrated in Fig. 10, when the hardness Hh of the heat source 3 is defined as 100%, a determination is made as to whether the hardness Hw of the wrapping member 2 and the hardness Hf of the flavor source material 12 are greater than or equal to 60% and less than or equal to 95%. If the determination is Yes, since the smoking article 1 has some difference ((Hh-Hw) and (Hh-Hf)) in hardness between the heat source 3 and each of the wrapping member 2 and the flavor source material 12, which are adjacent to the respective sides of the heat source 3, it is possible to ensure required machinability. At the same time, since the wrapping member 2 and the flavor source material 12 are softer than the heat source 3 and this allows the user to easily tactilely identify the boundary between the wrapping member 2 and the heat source 3, it is possible to ensure required separability. The process thus proceeds to step S 15, where an acceptance determination is made, and then the process ends.

[0062] On the other hand, if the determination is No, the wrapping member 2 and the flavor source material 12 are too soft to ensure machinability, or alternatively, since the wrapping member 2 and the flavor source material 12 are substantially as hard as the heat source 3, the wrapping member 2 and the heat source 3 or even the entire intermediate rod 15 may be separated off and it is difficult to ensure appropriate separability. The process thus proceeds to step S16, where a rejection determination is made, and then the process ends.

[Second Hardness Determination] (Step S13)

[0063] A determination is made as to whether, when the hardness Hh of the heat source 3 is defined as 100%,

the difference between the hardness Hw of the wrapping member 2 and the hardness Hf of the flavor source material 12 is less than or equal to 30%. If the determination is Yes, since the difference (|Hw-Hf| (absolute value)) in hardness between the wrapping member 2 and the flavor source material 12 is relatively small and the wrapping member 2 and the flavor source material 12 are close in hardness, a further improvement in machinability is achievable. At the same time, since the hardness of the heat source 3 sandwiched between the wrapping member 2 and the flavor source 4 is further enhanced and this allows the user to more easily tactilely identify the boundary between the wrapping member 2 and the heat source 3, a further improvement in separability is achievable. The process thus proceeds to step S 15, where an acceptance determination is made, and then the process ends.

[0064] On the other hand, if the determination is No, the difference in hardness between the wrapping member 2 and the flavor source material 12 is too large to ensure machinability. Also, if the difference in hardness is created because either the wrapping member 2 or the flavor source material 12 is as hard as the heat source 3, the wrapping member 2 and the heat source 3 or even the entire intermediate rod 15 may be separated off and it is difficult to ensure appropriate separability. The process thus proceeds to step S 16, where a rejection determination is made, and then the process ends.

[Third Hardness Determination] (Step S14)

[0065] A determination is made as to whether, when the hardness Hh of the heat source 3 is defined as 100%, the difference between the hardness Hw of the wrapping member 2 and the hardness Hf of the flavor source material 12 is less than or equal to 15%. If the determination is Yes, since the difference (|Hw-Hf|) in hardness between the wrapping member 2 and the flavor source 4 is even smaller and the wrapping member 2 and the flavor source material 12 are even closer in hardness, a still further improvement in machinability is achievable. At the same time, since the hardness of the heat sources 3 sandwiched between the wrapping member 2 and the flavor source 4 is even further enhanced and this allows the user to even more easily tactilely identify the boundary between the wrapping member 2 and the heat source 3, a still further improvement in separability is achievable. The process thus proceeds to step S 15, where an acceptance determination is made, and then the process ends.

[0066] On the other hand, if the determination is No, the difference in hardnesses between the wrapping member 2 and the flavor source 4 are slightly too large to reliably ensure machinability, or it is difficult to eliminate the possibility that the wrapping member 2 and the flavor source 4, or even the entire intermediate rod 15, may be separated off and is therefore difficult to reliably ensure appropriate separability. The process thus proceeds to step S16, where a rejection determination is made, and then the process ends.

[0067] To uniformly bond the first coupled body 13 to the first wrapping paper 6 at the adhesive portion 8 in the first wrapping step, it is important to ensure that the wrapping member 2 and the flavor source material 12 have a sufficient level of compressive strength. This is because there is a possibility that the wrapping member 2 and the flavor source material 12 may be crushed during manufacture of the smoking article 1. That is, if the first wrapping step is performed while the wrapping member 2 and the flavor source material 12 are in a crushed state, the machinability will obviously be affected. Moreover, the resulting formation of gaps in the adhesive portion 8 may lead to adhesion failure not only in the first coupled body 13 but also in the smoking article 1.

[0068] Accordingly, a restoration rate evaluation process is performed in the present embodiment to evaluate the restoration rate of the smoking article 1. This is intended not only to further improve machinability in the smoking article 1, but also to provide the smoking article 1 with so-called adhesion, which enables appropriate bonding of the first coupled body 13 and the first wrapping paper 6 at the adhesive portion 8.

[0069] The restoration rate evaluation process will now be described with reference to the flowchart of Fig. 13 which illustrates a restoration rate evaluation process.

[Restoration Rate Measurement] (Step S21)

[0070] Upon starting the restoration rate evaluation process, a restoration rate measurement is performed first, which measures the restoration rates of the wrapping member 2 and the flavor source material 12.

[0071] Fig. 14 is a lateral view of a restoration-rate measuring unit 30 used for the restoration rate measurement.

[0072] The restoration-rate measuring unit 30 includes a base 31, a disk 32, and an elevating device 33. The disk 32 is disposed with a circular surface thereof facing the base 31, and is supported by the elevating device 33 in such a manner as to be able to move upward and downward.

[0073] First, the wrapping member 2 or the flavor source material 12 (hereinafter also referred to as a sample to be measured or "sample B") is placed on the base 31. Then, the elevating device 33 is started and the disk 32 is lowered as illustrated in Fig. 14. The sample B is held between the disk 32 and the base 31 and subjected to a load. Since the flavor source 4 obtained by halving the flavor source material 12 has the same restoration rate as the flavor source material 12, the flavor source 4 may be used as the sample B.

[0074] The restoration rate measurement is made on the basis of ellipticity measured after the sample B is subjected to a load for one minute and left to stand for five minutes. The load applied here is capable of compressing the sample B to half its diameter.

[0075] Referring to Fig. 15, a dot-and-dash line represents a cross-sectional shape of the sample B observed before application of a load F thereto, and a solid line represents a cross-sectional shape of the sample B observed immediately after being left to stand following the application of the load F thereto.

[0076] Before application of the load F, the sample B is substantially circular in cross-section, and immediately after being left to stand following the application of the load F, the sample B has an elliptical cross-section with a major axis Da and a minor axis Db.

[0077] In the present embodiment, the ellipticity of the sample B is calculated on the basis of the following equation:

•

$$\text{Ellipticity } (\%) = 2(Da\text{-}Db)/(Da+Db) \times 100$$

[0078] This equation shows that the smaller the difference obtained by subtracting the minor axis Db from the major axis Da, the smaller the value of ellipticity or in other words, the greater the restoration rate of the sample B.

[0079] Experiments conducted by the present inventors found that, to improve both machinability and adhesion, the ellipticity Ew of the wrapping member 2 and the ellipticity Ef of the flavor source material 12 are preferably less than or equal to 40% and more preferably, the numerical difference between the ellipticity Ew of the wrapping member 2 and the ellipticity Ef of the flavor source material 12 is less than or equal to 30%, and still more preferably, this numerical difference in ellipticity is less than or equal to 15%. In the present embodiment, therefore, at least one of the determination steps S22 to S24, described below, is performed to evaluate the ellipticity.

[First Ellipticity Determination] (Step S22)

[0080] As illustrated in Fig. 13, a determination is made as to whether the ellipticity Ew of the wrapping member 2 and the ellipticity Ef of the flavor source material 12 are less than or equal to 40%. If the determination is Yes, then since the restoration rates of the wrapping member 2 and the flavor source material 12 are relatively high, it is possible to ensure required machinability. At the same time, the first coupled body 13 can be uniformly bonded to the first wrapping paper 6 at the adhesive portion 8 in the first wrapping step. The process thus proceeds to step S25, where an acceptance determination is made, and then the process ends.

[0081] On the other hand, if the determination is No, the restoration rates of the wrapping member 2 and the flavor source material 12 are too small to ensure machinability. Also, dents formed in the wrapping member 2 or the flavor source material 12 during manufacture may create non-adhesive regions in the adhesive portion 8, or may cause the first wrapping paper 6 to come off in the adhesive portion 8, and it is difficult to ensure adhesion. The process thus proceeds to step S26, where a rejection determination is made, and then the process ends.

[Second Ellipticity Determination] (Step S23)

[0082] Next, a determination is made as to whether the difference between the ellipticity Ew of the wrapping member 2 and the ellipticity Ef of the flavor source material 12 is less than or equal to 30%. If the determination is Yes, since the difference (|Ew-Ef| (absolute value)) in ellipticity between the wrapping member 2 and the flavor source material 12 is relatively small and the wrapping member 2 and the flavor source material 12 have close restoration rates, a further improvement in machinability is achievable. At the same time, since it is less likely that there will be a significant difference in the state of bonding in the adhesive portion 8 between the wrapping member 2 and the flavor source material 12, a further improvement in adhesion is achievable. The process thus proceeds to step S25, where an acceptance determination is made, and then the process ends.

[0083] On the other hand, if the determination is No, the difference in restoration rate between the wrapping member 2 and the flavor source material 12 is too large to ensure machinability. Also, a difference in the state of bonding in the adhesive portion 8 between the wrapping member 2 and the flavor source material 12 may cause adhesion failure, and it is difficult to ensure adhesion. The process thus proceeds to step S26, where a rejection determination is made, and then the process ends.

[Third Ellipticity Determination] (Step S24)

[0084] Next, a determination is made as to whether the difference between the ellipticity Ew of the wrapping member 2 and the ellipticity Ef of the flavor source material 12 is less than or equal to 15%. If the determination is Yes, since the difference (|Ew-Ef|) in ellipticity between the wrapping member 2 and the flavor source material 12 is even smaller and the wrapping member 2 and the flavor source material 12 have closer restoration rates, a still further improvement in machinability is achievable. At the same time, since it is even less likely that there will be a significant difference in the state of bonding in the adhesive portion 8 between the wrapping member 2 and the flavor source material 12, a still further improvement in adhesion is achievable. The process thus proceeds to step S25, where an acceptance determination is made, and then the process ends.

[0085] On the other hand, if the determination is No, the restoration rates of the wrapping member 2 and the flavor source material 12 are slightly too large to reliably ensure machinability, or it is difficult to eliminate the risk of adhesion failure in the wrapping member 2 and the flavor source material 12 and is therefore difficult to reliably ensure adhesion. The process thus proceeds to step

S26, where a rejection determination is made, and then the process ends.

[0086] In the present embodiment, where the smoking article 1 is manufactured in accordance with step S1 to step S6 as described above, a segment (component) with a large segment length and a large aspect ratio can be used to make the smoking article 1. This means that during manufacture, there is no need to precisely control the positions of segments to prevent rolling of the segments, and therefore no need to prepare special equipment for it. An improvement in both the quality of, and productivity in making, the smoking article 1 is thus achieved.

[0087] The first cutting step involves cutting the first continuous body 14 in the flavor source material 12 to form two intermediate rods 15, and the second cutting step involves cutting the second continuous body 19 in the filter member material 16 to form two smoking articles 1. In other words, a right-left symmetrical, continuous body is divided into two identical components in the axial direction X. Therefore, as compared to the cases where many small, pre-cut or pre-molded segments are individually fed to form a coupled body and then a continuous body, to manufacture the smoking article 1, the smoking article 1 is produced more efficiently, and higher productivity in making the smoking article 1 is achieved.

[0088] In the series of steps S1 to S6 described above, the wrapping members 2 are normally positioned at both ends of each of the coupled bodies 13 and 18, a pair of intermediate rods 15, and each of the continuous bodies 14 and 19. When the first coupled body 13 is wrapped in the first wrapping paper 6 to form the first continuous body 14, an improvement in machinability of the smoking article 1 achieved by positioning the wrapping members 2 at both ends is particularly significant, and a further improvement in the quality of the smoking article 1 is achieved.

[0089] In the first wrapping step, the adhesive portion 8 and the non-adhesive portion 9 are created, as described above. The adhesive portion 8 bonds the first coupled body 13 to the first wrapping paper 6, and the non-adhesive portion 9 is not bonded to at least part of each heat source 3 on one side of the heat source 3 adjacent to the wrapping member 2. Thus, before use, at least part of the wrapping member 2 is separated off at the non-adhesive portion 9, and at least part of the heat source 3 is exposed in such a manner that it can be heated by ignition.

[0090] By performing the hardness evaluation process, machinability in the smoking article 1 is further improved and higher separability is achieved in the smoking article 1. Specifically, the hardness evaluation process measures the hardnesses of the wrapping member 2, the heat source 3, and the flavor source material 12, each on the basis of the ratio of the residual height H2 to the initial height H1 obtained by continuously applying a load of 19.6 N for 20 seconds to the wrapping member 2, the heat source 3, and the flavor source material 12. Then, the first hardness determination is made, which accepts the wrapping member 2 and the flavor source material 12 only when they are softer than the heat source 3, capable of allowing the user to easily tactilely identify the boundary between the wrapping member 2 and the heat source 3, and thus capable of ensuring separability.

[0091] Additionally, the second and third hardness determinations are made, which accept the wrapping member 2 and the flavor source material 12 only when they are close enough in hardness to further improve machinability, also to further enhance the hardness of the heat source 3 sandwiched between the wrapping member 2 and the flavor source 4 in the smoking article 1, allow the user to more easily tactilely identify the boundary between the wrapping member 2 and the heat source 3, and thus to further improve separability. Note that instead of making all of the first to third hardness determinations, the process may make at least one of the first to third hardness determinations, or may make the first to third hardness determinations in sequence. Even in this case, machinability and separability of the smoking article 1 are improved.

[0092] By performing the restoration rate evaluation process, machinability in the smoking article 1 is further improved and higher adhesion is achieved in the smoking article 1. Specifically, the restoration rate evaluation process determines the restoration rates of the wrapping member 2 and the flavor source material 12, each on the basis of ellipticity measured after the wrapping member 2 or the flavor source material 12 is subjected to a load for one minute and left to stand for five minutes. The load applied here is capable of compressing the wrapping member 2 or the flavor source material 12 to half its diameter. Then, the first ellipticity determination is made, which accepts the wrapping member 2 and the flavor source material 12 only when they have relatively high restoration rates that can not only ensure required machinability but also provide adhesion that allows the first coupled body 13 and the first wrapping paper 6 to be uniformly bonded at the adhesive portion 8 in the first wrapping step.

[0093] Additionally, the second and third ellipticity determinations are made, which accept the wrapping member 2 and the flavor source material 12 only when they are close enough in restoration rate to further improve machinability, and also to further improve adhesion because it is less likely that there will be a significant difference in the state of bonding in the adhesive portion 8 between the wrapping member 2 and the flavor source material 12. Note that instead of making all of the first to third ellipticity determinations, the process may make at least one of the first to third ellipticity determinations, or may make the first to third ellipticity determinations in sequence. Even in this case, machinability and adhesion of the smoking article 1 are improved.

[0094] With the wrapping member 2, the smoking article 1 of the present embodiment improves its machinability. Additionally, by evaluating the hardnesses of the wrapping member 2 and the flavor source material 12, it

is possible not only to further improve machinability, but also to improve separability. Also, by evaluating the restoration rates of the wrapping member 2 and the flavor source material 12, it is possible not only to further improve machinability, but also to improve adhesion.

[0095] The description of some embodiments of the present invention ends here. The present invention is not limited to the embodiments described above, and various changes may be made without departing from the scope of the present invention.

[0096] For example, the smoking article 1 manufactured according to the embodiments described above has further preferred embodiments, and is not limited to the structure described above. Accordingly, other embodiments of the smoking article 1 will be described, to which the aforementioned method for manufacturing the smoking article 1 is applicable.

<Second Embodiment>

[0097] In the smoking article 1 illustrated in Fig. 16 (which illustrates the intermediate rod 15 alone), an outer periphery 6a of the first wrapping paper 6 wrapped around the first coupled body 13 is a non-coated surface that is not coated with a pigment, such as calcium carbonate. The first wrapping paper 6 is preferably high-density paper that has a basis weight ranging from 70 g/m^2 to 140 g/m^2. The first wrapping paper 6 having such a basis weight range may be metal-laminated paper, such as aluminum-laminated paper, as described above.

[0098] When the outer periphery 6a of the first wrapping paper 6 is a non-coated surface where the paper material is bare, the cost of producing the smoking article 1 can be reduced. When the first wrapping paper 6 is high-density paper, the first wrapping paper 6 can be prevented from being burned when the heat source 3 is heated during use of the smoking article 1. Also, since an appropriate tensile strength is applied to the first wrapping paper 6, the coupling between segments wrapped in the first wrapping paper 6 is enhanced. This further improves the quality of the smoking article 1.

<Third Embodiment>

[0099] In the smoking article 1 illustrated in Fig. 17 (which illustrates the intermediate rod 15 alone), the non-adhesive portion 9 is a thin portion 6c of the first wrapping paper 6 thinner in thickness than the adhesive portion 8. For example, the thickness of the thin portion 6c is less than or equal to half the thickness of the first wrapping paper 6. This facilitates separation of the wrapping member 2 at the non-adhesive portion 9, and further improves separability of the smoking article 1.

<Fourth Embodiment>

[0100] In the smoking article 1 illustrated in Fig. 18 (which illustrates the intermediate rod 15 alone), a heat conducting element 40 is disposed inside an inner periphery 6b of the first wrapping paper 6 wrapped around the first coupled body 13. The heat conducting element 40 is disposed over a region extending in the axial direction X, from the wrapping member 2 through the heat source 3 to the flavor source 4. In the first continuous body 14, the heat conducting element 40 extends to reach the wrapping members 2 at both ends.

[0101] In this case, the first wrapping paper 6 may be aluminum-laminated paper formed by bonding the heat conducting element 40 to the paper material. The aluminum-laminated paper may be composed of two layers, paper and aluminum (with the paper being the outer periphery when wrapped), or may be composed of three layers, paper, aluminum, and paper. When the first wrapping paper 6 is aluminum-laminated paper, aluminum is preferably absent in the center of the flavor source 4 in the axial direction X. The absence of aluminum in the center portion is advantageous in that the first continuous body 14 is easily cut in the first cutting step.

[0102] The heat conducting element 40 may extend over two flavor source materials 12 of the first continuous body 14. The heat conducting element 40 may be made of any material, but is preferably made of metal foil (e.g., aluminum foil). The heat conducting element 40 facilitates heat transfer from the heat source 3 to the flavor source 4, and this enables more efficient generation of aerosol from the flavor source 4.

<Fifth Embodiment>

[0103] Fig. 19 is a plan view of the first wrapping paper 6 spread and viewed from the inner periphery 6b. The inner periphery 6b of the first wrapping paper 6 is laminated with metal foil 41 (e.g., aluminum foil) serving as the heat conducting element 40, and the first wrapping paper 6 constitutes metal-laminated paper. The first wrapping paper 6 is laminated with the metal foil 41 in three areas at the center in a rolling direction Y, except both edges 42 of the first wrapping paper 6 in the rolling direction Y. Adjacent ones of the pieces of metal foil 41 in the three areas are spaced apart, with one of two linear portions 43 interposed therebetween. The two linear portions 43 extend from one to the other of the two edges 42 in the rolling direction Y. That is, the two edges 42 and the two linear portions 43 are made of paper material.

[0104] Fig. 20 is a sectional view of the first continuous body 14 that includes the first wrapping paper 6 which is metal-laminated paper. The two linear portions 43 made only of paper material are each formed in a region corresponding to the non-adhesive portion 9. That is, the inner periphery 6b is laminated with the metal foil 41, except at least the regions corresponding to the non-adhesive portions 9. This facilitates separation of the wrapping member 2 at each linear portion 43, and ensures separability of the smoking article 1.

[0105] The adhesive portion 8 is formed at both edges 42 of the inner periphery 6b, that is, formed outside the

metal foil 41. This provides the first wrapping paper 6 with better adhesion properties than when the adhesive portion 8 is formed by applying an adhesive to the metal foil 41, and improves adhesion of the smoking article 1. Also, since the inner periphery 6b is laminated and integrated with the metal foil 41 serving as the heat conducting element 40, there is no need to perform processing (formation of a line of weakness, such as a line of perforations) on the first wrapping paper 6 for enhanced separability, and the outer periphery 6a with a smooth surface is obtained. This not only improves productivity in making the smoking article 1, but also improves the appearance of the smoking article 1.

<Sixth Embodiment>

[0106] In the smoking article 1 illustrated in Fig. 21 (which illustrates the intermediate rod 15 alone), the wrapping member 2 is composed of two separate bodies 2a and 2b separable at the non-adhesive portion 9. The separate body 2a is disposed at the extremity of the wrapping member 2, provided to secure a predetermined length of the wrapping member 2 in the axial direction X, and is mainly capable of enhancing machinability. The separate body 2a may be disposed in the non-adhesive portion 9 to be removable after the first wrapping step during manufacture of the smoking article 1. That is, the separate body 2a does not necessarily need to be included in the smoking article 1 made upon completion of the manufacture.

[0107] Since the adhesive portion 8 is a thin layer with a thickness of about 1 μm to 2 μm, the gap between the separate body 2a and the first wrapping paper 6, such as that illustrated in Fig. 21, is very small. Therefore, when the separate body 2a is wrapped in the first wrapping paper 6, the separate body 2a is retained by friction with the first wrapping paper 6 and prevented from easily falling off.

[0108] On the other hand, the separate body 2b is mainly capable of protecting the heat source 3 and is separated off by the user before use of the smoking article 1. The adhesive portion 8 is thus formed in a region of the first wrapping paper 6 where the separate body 2b is disposed. As described above, the wrapping member 2 is composed of the two separate bodies 2a and 2b having different functions. This increases the degree of freedom in designing the smoking article 1.

[0109] As illustrated in Fig. 22, the wrapping member 2 may include a coupling portion 2c by which the separate bodies 2a and 2b are coupled. This prevents the separate body 2a from accidentally falling off. It is preferable that one or two coupling portions 2c be provided to facilitate separation of the separate body 2a.

<Seventh Embodiment>

[0110] In the smoking article 1 illustrated in Fig. 23 (which illustrates the intermediate rod 15 alone), the first wrapping paper 6 has ventilation holes 6d that allow ventilation from the vicinity of the heat source 3 to the flavor source 4. The outer periphery of the flavor source 4 may have such ventilation holes. The heat source 3 that burns and generates heat by ignition may be formed by compacting and molding a granular material, other than carbon. As in Fig. 23, the heat source 3 may not have the hollow portion 3a.

[0111] The heat source 3 does not necessarily need to be solid. Instead, a material molded into a sheet form may be rolled up and used. Even without the hollow portion 3a, ventilation air may be generated, which flows from the ventilation holes 6d through the heat source 3 to the flavor source 4. Both the hollow portion 3a and the ventilation holes 6d may be provided. The hollow portion 3a does not necessarily need to be a hole penetrating in the axial direction X, and may be a hole formed in the periphery of the heat source 3. With at least the hollow portion 3a or the ventilation holes 6d, the efficiency of heat transfer is improved, and this may eliminate the need for the heat conducting element 40.

<Eighth Embodiment>

[0112] In the smoking article 1 illustrated in Fig. 24, the filter member 5 is formed by aligning the tube 10, a cooling element 50, and the filter element 11 in a row in the stated order, with the tube 10 being closest to the flavor source 4, in the axial direction X. The cooling element 50 is formed by folding, for example, a sheet of paper or biodegradable polymer and wrapping it in rolling paper 50a. In this case, an air flow passing through the heat source 3 and the flavor source 4 in this order is cooled by the cooling element 50. This enables more efficient generation of aerosol.

[0113] In the case of Fig. 24, the cooling element 50 and the filter element 11 are integrally wrapped in rolling paper 51 to form a dual segment attachment 52. The filter member material 16 is thus composed only of two components, the tube 10 and the dual segment attachment 52. This facilitates handling of components in the second alignment step, and improves productivity in making not only the filter member 5 but also the smoking article 1.

<Ninth Embodiment>

[0114] In the smoking article 1 illustrated in Fig. 25, the filter member 5 is formed by aligning the tube 10, the cooling element 50, and the filter element 11 in a row in the stated order, with the tube 10 being closest to the flavor source 4, in the axial direction X. These components are integrally wrapped in the rolling paper 51 to form a triple segment attachment 53. The filter member material 16 is thus composed only of the triple segment attachment 53. This further facilitates handling of components in the second alignment step, and further improves productivity in making not only the filter member 5 but also the smoking article 1.

[0115] The aforementioned method for manufacturing the smoking article 1 is applicable to the smoking article 1 to be manufactured in accordance with any one or combination of the embodiments described above.

Reference Signs List

[0116]

1: smoking article
2: wrapping member
3: heat source (carbon heat source)
4: flavor source (tobacco ingredients)
5: filter member
6: first wrapping paper
7: second wrapping paper
8: adhesive portion
9: non-adhesive portion
12: flavor source material
13: first coupled body
14: first continuous body
15: intermediate rod
16: filter member material
18: second coupled body
19: second continuous body

Claims

1. A smoking article manufacturing method comprising:

a first alignment step of feeding two wrapping members, two heat sources, and one flavor source material and aligning the wrapping member, the heat source, the flavor source material, the heat source, and the wrapping member in a row in a stated order to form a first coupled body;
a first wrapping step of integrally wrapping the first coupled body in a first wrapping paper to form a first continuous body;
a first cutting step of cutting the first continuous body at the flavor source material into two intermediate rods, each including the wrapping member, the heat source, and a flavor source aligned in a row in a stated order, the flavor source being one of two flavor sources into which the flavor source material is divided;
a second alignment step of feeding a filter member material and aligning the intermediate rod, the filter member material, and the intermediate rod in a row in a stated order, with the flavor sources of the two intermediate rods facing respective ends of the filter member material, to form a second coupled body;
a second wrapping step of integrally wrapping the second coupled body in a second wrapping paper to form a second continuous body; and
a second cutting step of cutting the second continuous body at the filter member material into two smoking articles, each including the wrapping member, the heat source, the flavor source, and a filter member aligned in a row in a stated order, the filter member being one of two filter members into which the filter member material is divided.

2. The smoking article manufacturing method according to Claim 1, wherein the first wrapping step forms an adhesive portion and a non-adhesive portion in the first continuous body when wrapping the first coupled body in the first wrapping paper, the adhesive portion being configured to bond the first coupled body to the first wrapping paper, the non-adhesive portion being configured not to bond a part of the heat source to the first wrapping paper, the part being adjacent to the wrapping member; and
before use of the smoking article, at least part of the wrapping member is separated off at the non-adhesive portion to expose at least part of the heat source in such a manner that the at least part of the heat source can be heated by ignition.

3. The smoking article manufacturing method according to Claim 1 or 2, further comprising a hardness evaluation step of evaluating hardnesses of the wrapping member, the heat source, and the flavor source material.

4. The smoking article manufacturing method according to Claim 3, wherein the hardness evaluation step measures hardnesses of 20 samples of each of the wrapping member, the heat source, and the flavor source material on a basis of a ratio of a residual height to an initial height of each of the samples obtained by applying a load of 19.6 N to the samples continuously for 20 seconds, calculates an average of the hardnesses that are measured for the 20 samples, and defines the average that is calculated as a hardness of the samples.

5. The smoking article manufacturing method according to Claim 4, wherein when a hardness of the heat source is defined as 100%, the hardness evaluation step determines whether hardnesses of the wrapping member and the flavor source material are greater than or equal to 60% and less than or equal to 95%.

6. The smoking article manufacturing method according to Claim 4 or 5, wherein when a hardness of the heat source is defined as 100%, the hardness evaluation step determines whether a difference in hardness between the wrapping member and the flavor source material is less than or equal to 30%.

7. The smoking article manufacturing method accord-

ing to any one of Claims 4 to 6, wherein when a hardness of the heat source is defined as 100%, the hardness evaluation step determines whether a difference in hardness between the wrapping member and the flavor source material is less than or equal to 15%.

8. The smoking article manufacturing method according to any one of Claims 1 to 7, further comprising a restoration rate evaluation step of evaluating restoration rates of the wrapping member and the flavor source material.

9. The smoking article manufacturing method according to Claim 8, wherein the restoration rate evaluation step measures the restoration rates of the wrapping member and the flavor source material on a basis of ellipticities of the wrapping member and the flavor source measured after the wrapping member and the flavor source material are each subjected to a load for one minute and left to stand for five minutes, the load being capable of compressing a corresponding one of the wrapping member and the flavor source material by half in diameter.

10. The smoking article manufacturing method according to Claim 9, wherein the restoration rate evaluation step determines whether ellipticities of the wrapping member and the flavor source material are less than or equal to 40%.

11. The smoking article manufacturing method according to Claim 9 or 10, wherein the restoration rate evaluation step determines whether a difference in ellipticity between the wrapping member and the flavor source material is less than or equal to 30%.

12. The smoking article manufacturing method according to any one of Claims 9 to 11, wherein the restoration rate evaluation step determines whether a difference in ellipticity between the wrapping member and the flavor source material is within 15%.

13. The smoking article manufacturing method according to any one of Claims 1 to 12, wherein the heat source is a carbon heat source.

14. The smoking article manufacturing method according to any one of Claims 1 to 13, wherein the flavor source contains tobacco ingredients.

FIG. 1

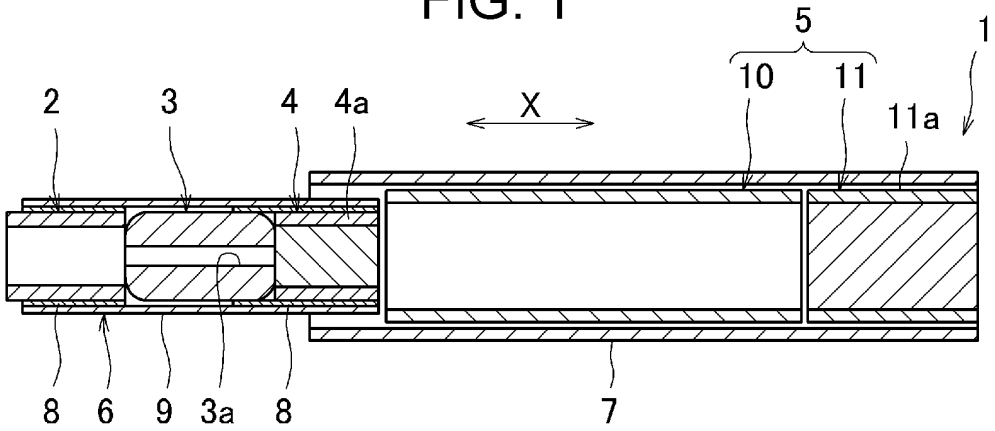


FIG. 2

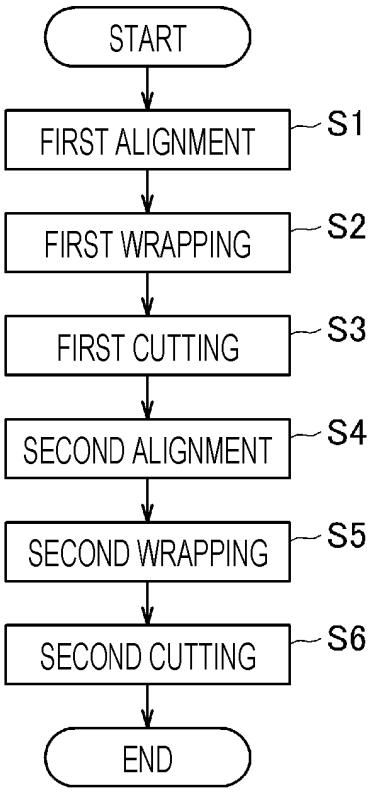


FIG. 3

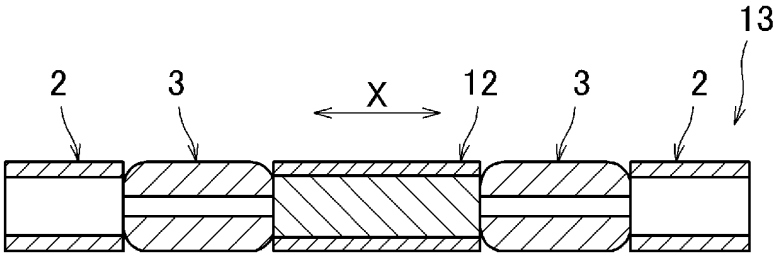
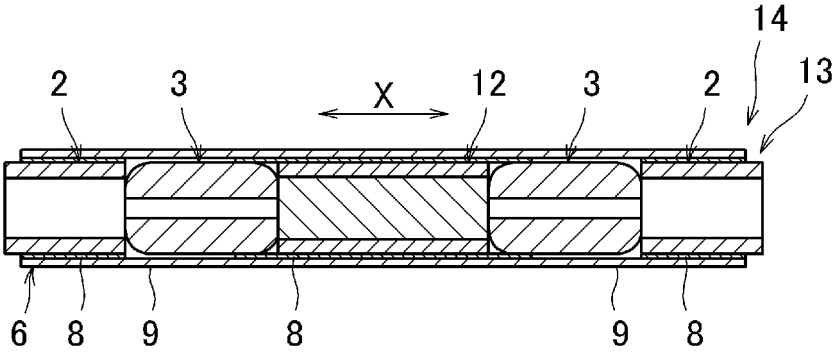


FIG. 4


14
13
2
3
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12
3
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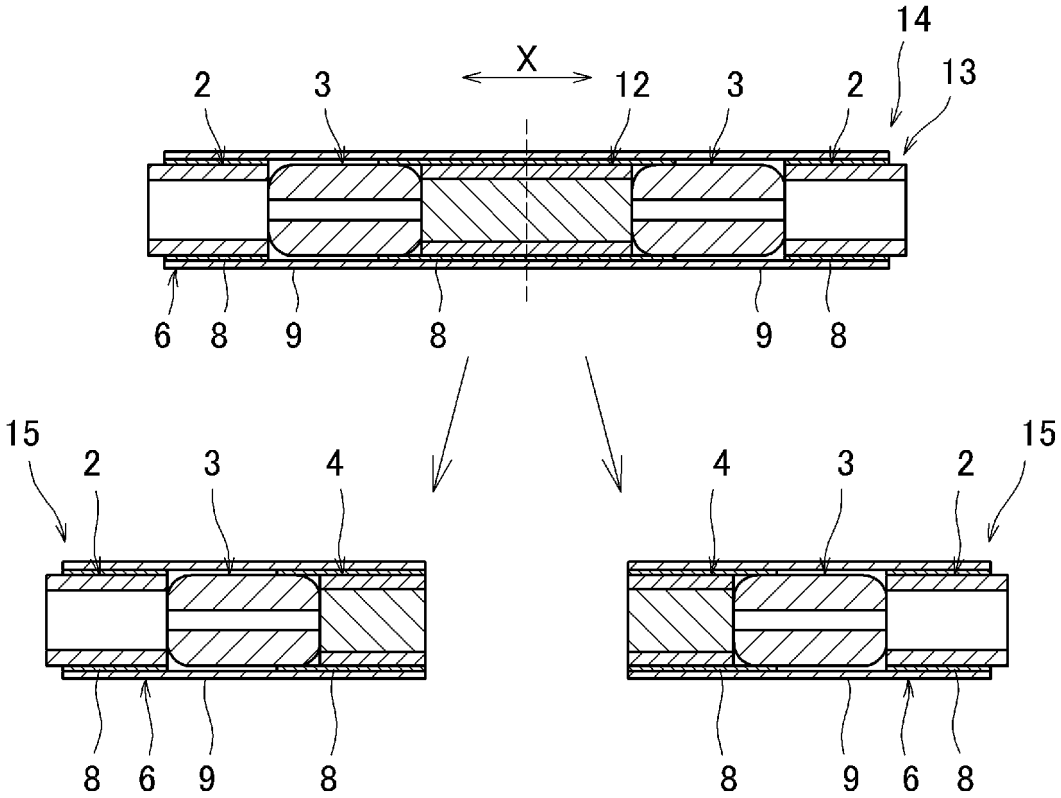
FIG. 5


14
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6
8
9
8
9
8
15
2
3
4
4
3
2
15
8
6
9
8
8
9
6
8

FIG. 6

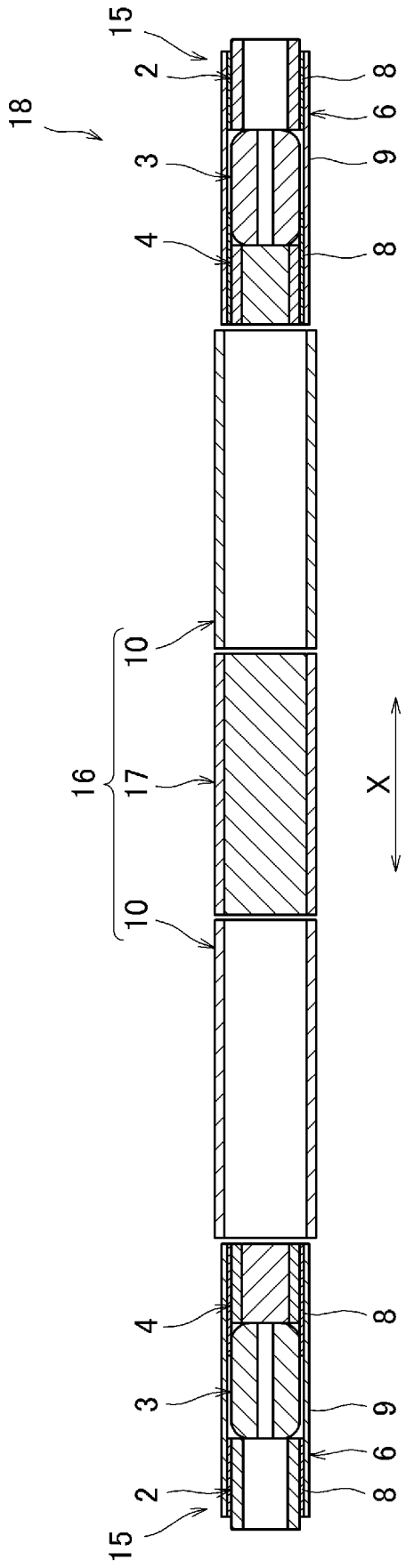


FIG. 7

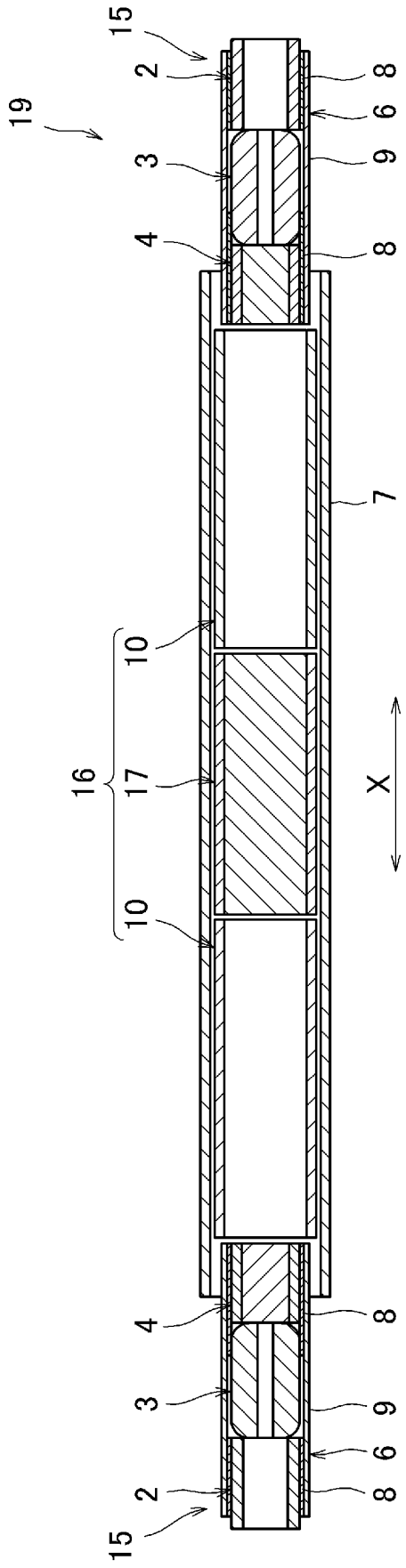


FIG. 8

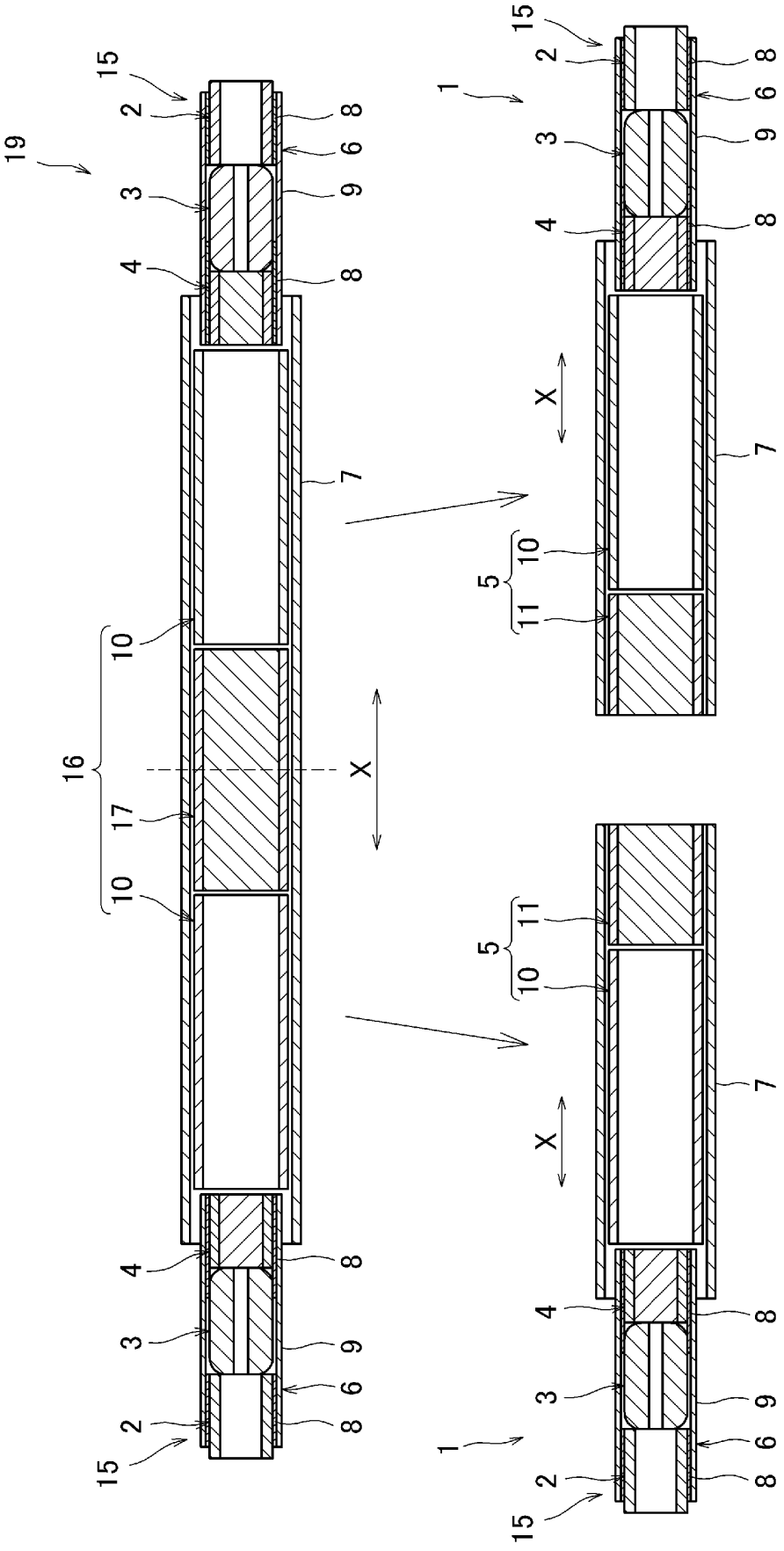

19
15
2
8
6
3
9
4
8
7
10
16
17
10
X
1
15
2
8
6
3
9
4
8
X
7
5
10
11
5
11
10
X
7
4
8
3
9
6
2
8
15
1
15
2
8
6
3
9
4
8

FIG. 9

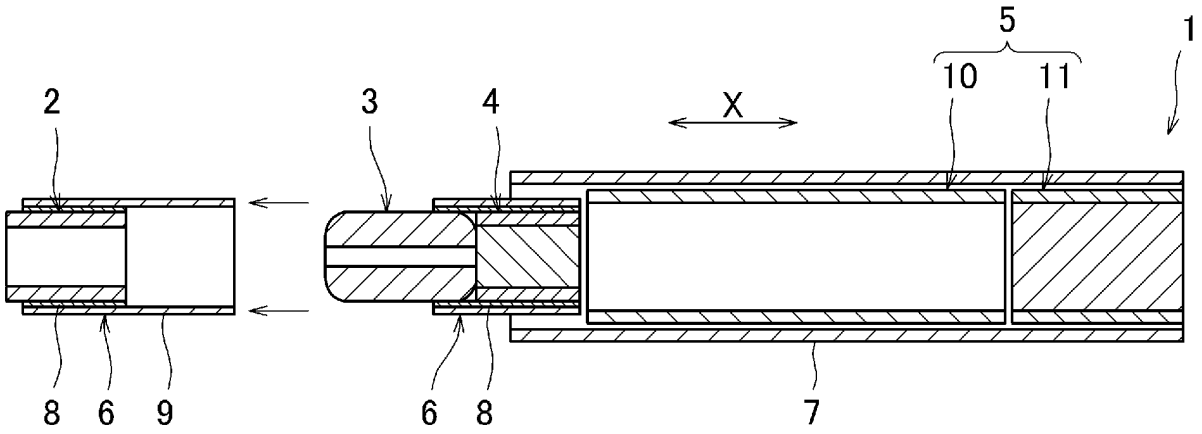

5
1
10
11
2
3
4
X
8
6
9
6
8
7

FIG. 10

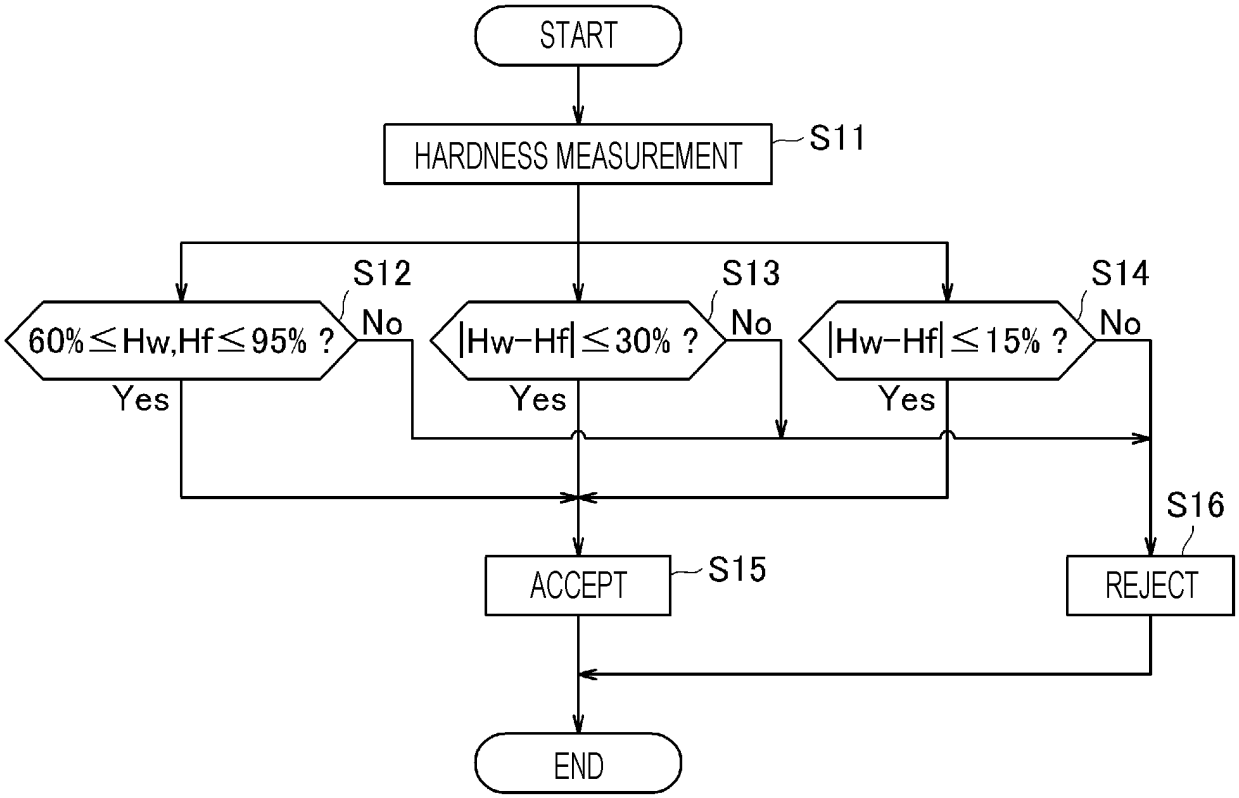

START
HARDNESS MEASUREMENT
S11
S12
S13
S14
60%≤Hw,Hf≤95% ?
No
Yes
|Hw−Hf|≤30% ?
No
Yes
|Hw−Hf|≤15% ?
No
Yes
S16
ACCEPT
S15
REJECT
END

FIG. 11

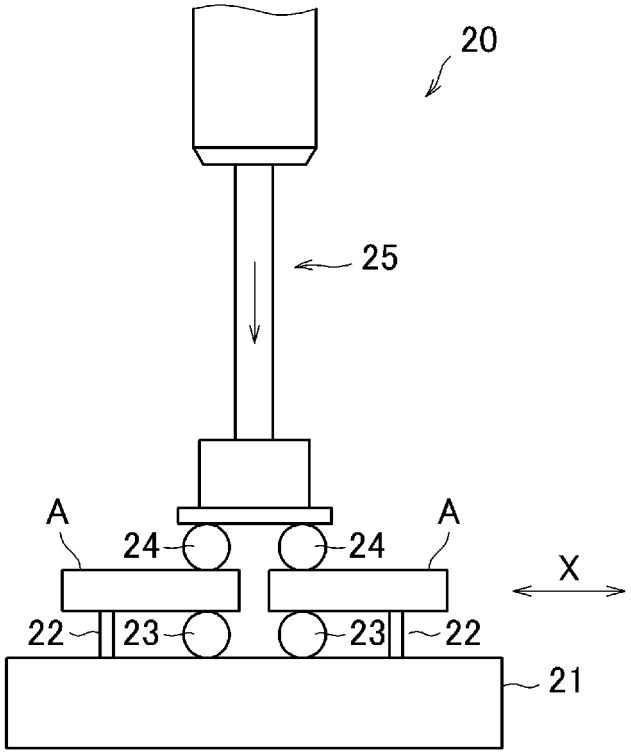


FIG. 12

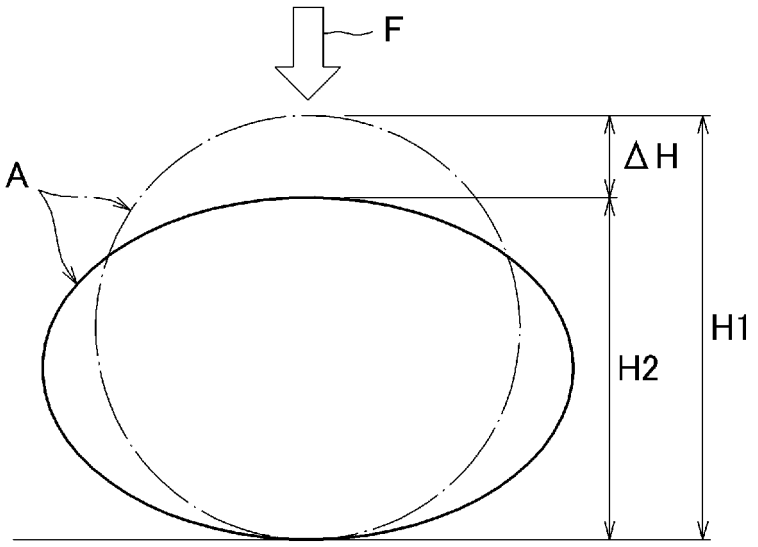


FIG. 13

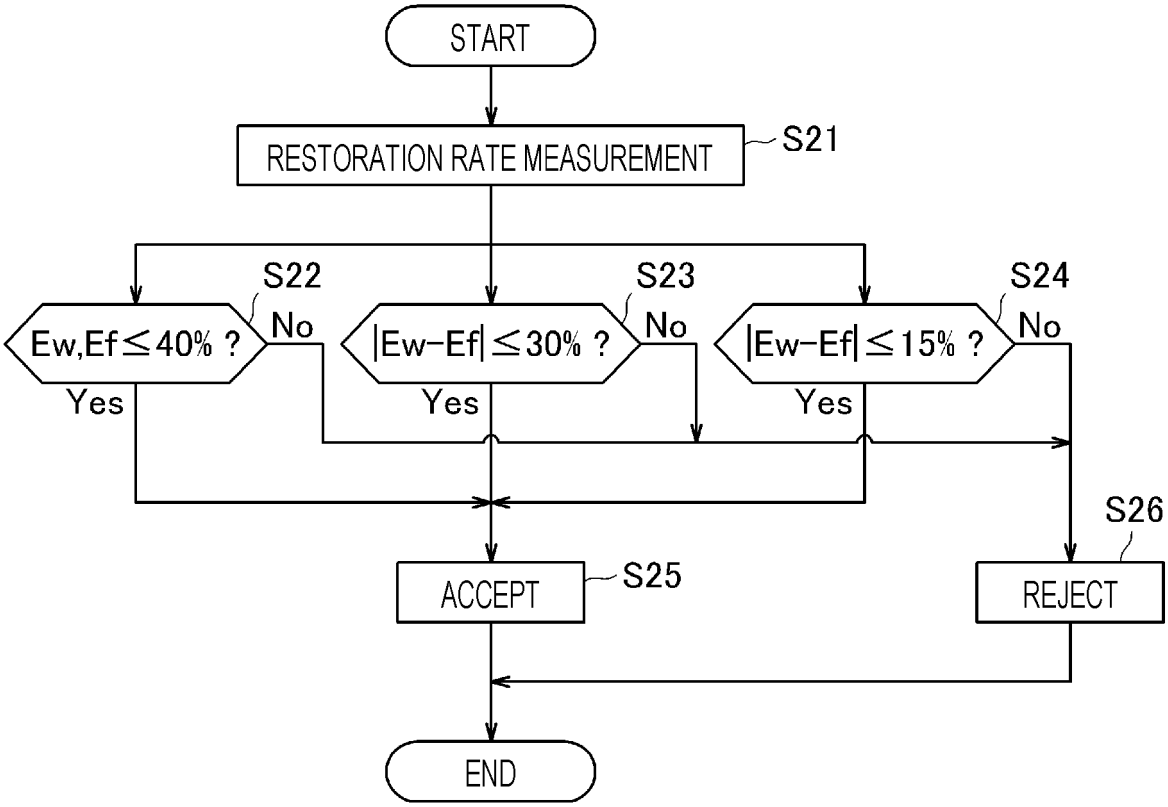

START
RESTORATION RATE MEASUREMENT
S21
S22
Ew,Ef≤40% ?
No
Yes
S23
|Ew−Ef|≤30% ?
No
Yes
S24
|Ew−Ef|≤15% ?
No
Yes
S26
ACCEPT
S25
REJECT
END

FIG. 14

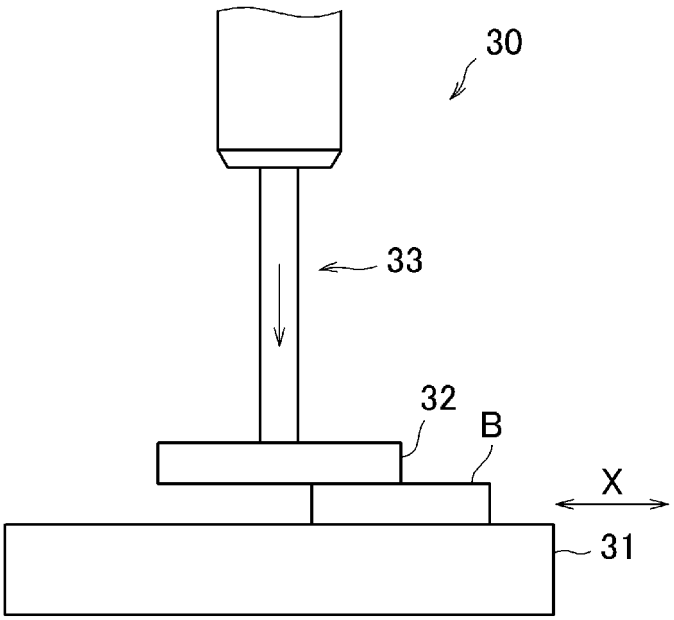

30
33
32
B
X
31

FIG. 15

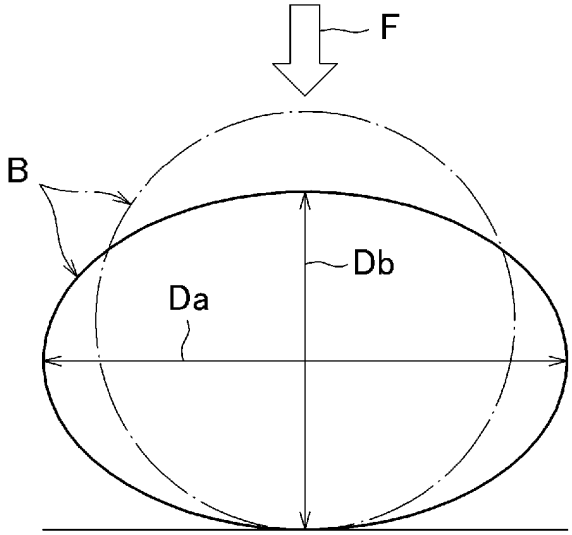


FIG. 16

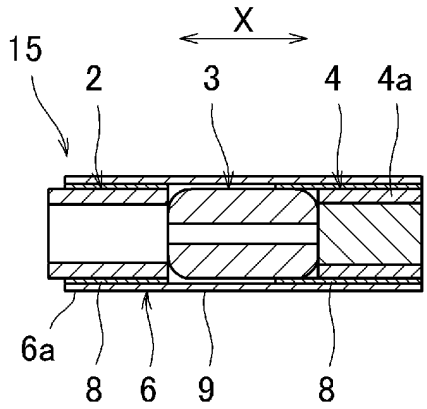


FIG. 17

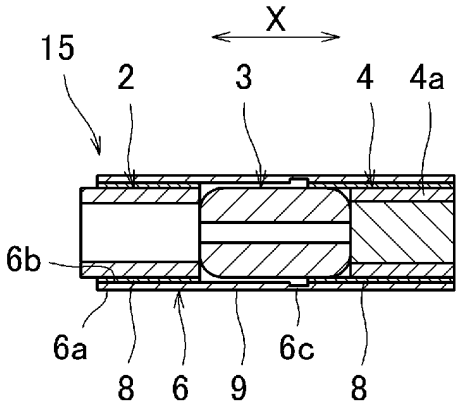


FIG. 18

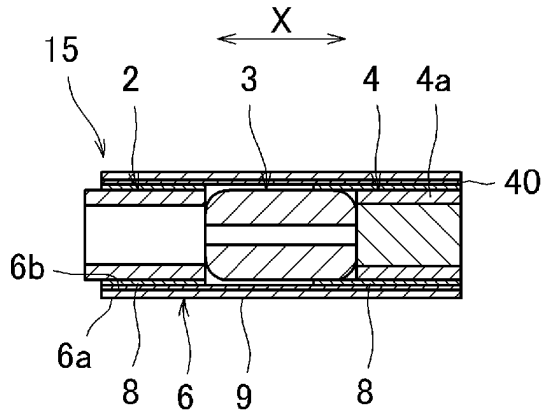


FIG. 19

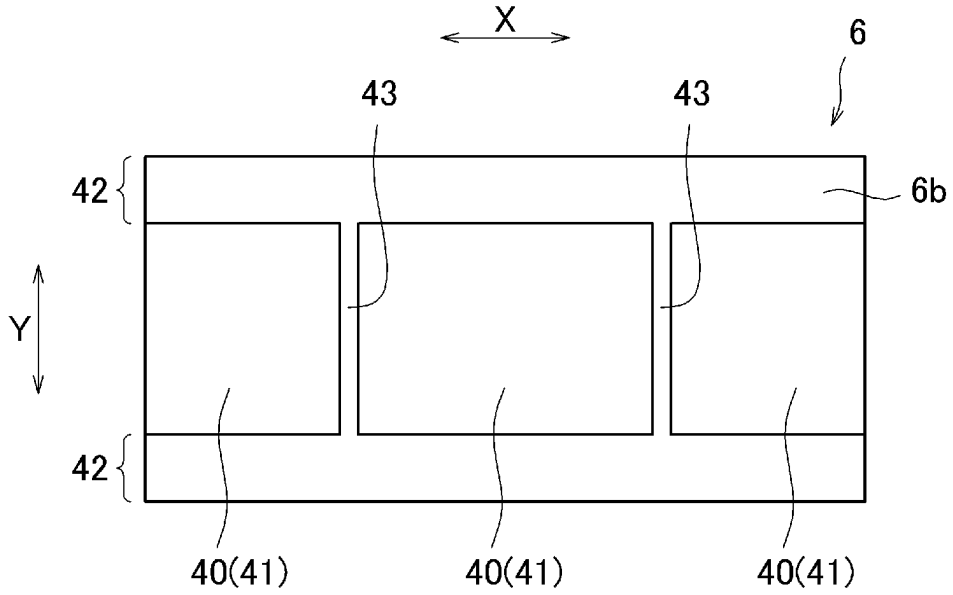


FIG. 20

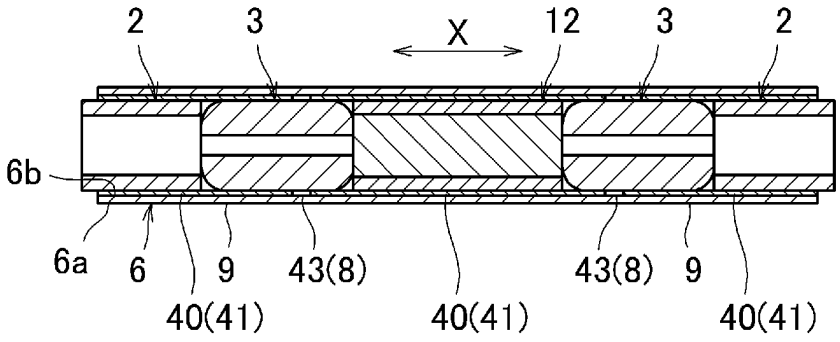


FIG. 21

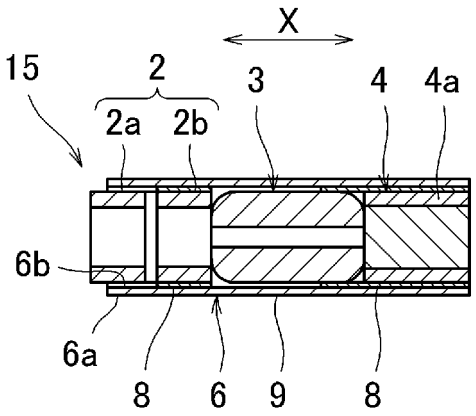


FIG. 22

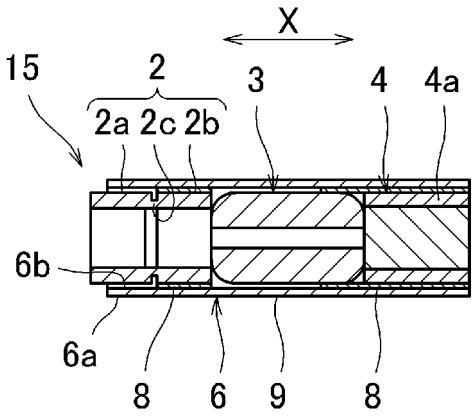


FIG. 23

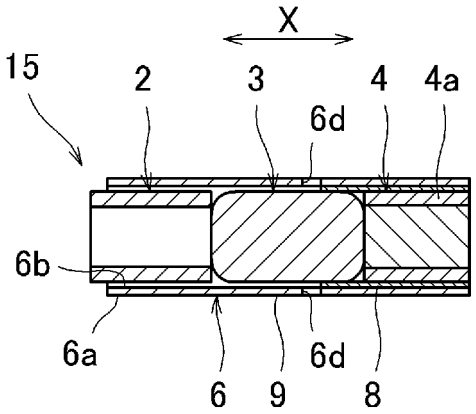


FIG. 24

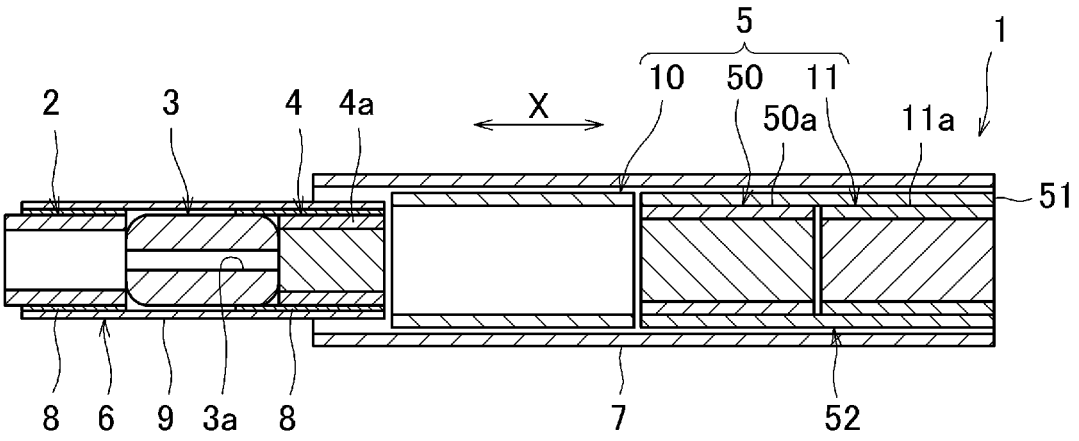
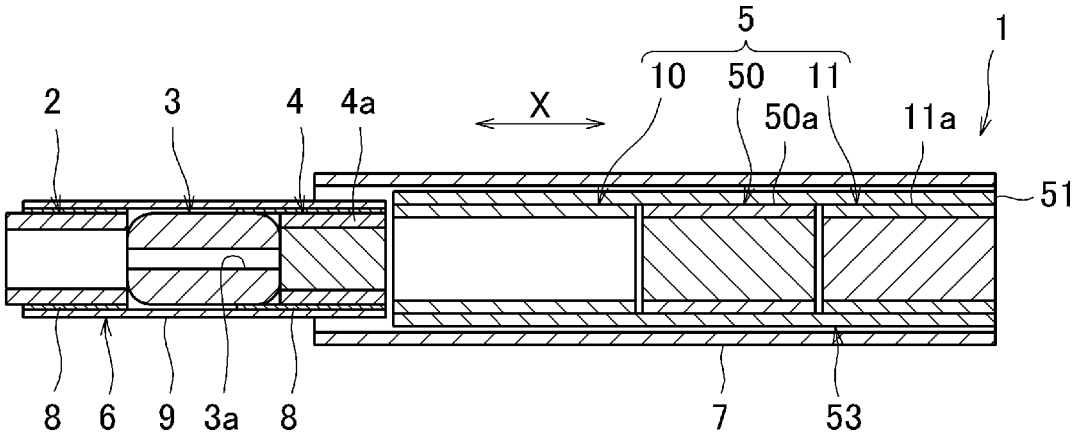

5
1
10
50
11
2
3
4
4a
X
50a
11a
51
8
6
9
3a
8
7
52

FIG. 25


5
1
10
50
11
2
3
4
4a
X
50a
11a
51
8
6
9
3a
8
7
53

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2019/012202

A. CLASSIFICATION OF SUBJECT MATTER
Int. Cl. A24F47/00(2006.01)i, A24C5/18(2006.01)i, A24C5/47(2006.01)i, A24D3/02(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)
Int. Cl. A24F47/00, A24C5/18, A24C5/47, A24D3/02

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

Published examined utility model applications of Japan	1922-1996
Published unexamined utility model applications of Japan	1971-2019
Registered utility model specifications of Japan	1996-2019
Published registered utility model applications of Japan	1994-2019

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.
Y A	JP 2009-529872 A (R.J. REYNOLDS TOBACCO COMPANY) 27 August 2009, paragraphs [0019]-[0059], fig. 1-6 & US 2007/0215168 A1, paragraphs [0017]-[0058], fig. 1-6 & WO 2007/108878 A2 & EP 1993388 A2 & ES 2393371 T3	1, 3-14 2
Y	JP 2018-522539 A (PHILIP MORRIS PRODUCTS S.A.) 16 August 2018, paragraphs [0073], [0075]-[0077], fig. 1, 2, 4 & US 2018/0177235 A1, paragraphs [0073], [0075]-[0077], fig. 1, 2, 4 & WO 2016/207192 A1 & EP 3313211 A1 & TW 201703660 A & AR 105096 A1 & AU 2016282803 A1 & CA 2983090 A1 & CN 107690288 A & KR 10-2018-0020136 A & MX 2017016395 A & BR 112017025710 A2	1, 3-14

☒ 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
"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	Date of mailing of the international search report
22.05.2019	04.06.2019

Name and mailing address of the ISA/	Authorized officer
Japan Patent Office 3-4-3, Kasumigaseki, Chiyoda-ku, Tokyo 100-8915, Japan	Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2019/012202

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 2018/163253 A1 (JAPAN TOBACCO INC.) 13 September 2018, paragraphs [0021]-[0023], [0025], [0026], [0088]-[0092] (Family: none)	3-14

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Patent documents cited in the description

- JP 2015536673 PCT **[0005]**