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(54) **TOBACCO FILTER WRAPPING PAPER, TOBACCO FILTER USING TOBACCO FILTER WRAPPING PAPER, AND CIGARETTE USING TOBACCO FILTER**

(57) Provided is a tobacco filter wrapping paper which has good adhesiveness to a filter after being wrapped around the filter, is easy-to-handle during the wrapping of a filtering material for a filter which has been impregnated with a water-soluble liquid, and exhibits good preservation stability after being wrapped. Specifically, provided is: a tobacco filter wrapping paper which contains a nonwoven fabric layer comprising hydrophobic fibers and having interfiber bonding points, has a front surface and a back surface in which a contact angle with water on at least one surface thereof is 90° or greater, and has a thickness of 100-300 μm; or a tobacco filter wrapping paper which contains a nonwoven fabric layer comprising hydrophobic fibers and having interfiber bonding points and an air impermeable layer, has a front surface and a back surface in which a contact angle with water on at least one surface thereof is 50° or greater, and has a thickness of 100-300 μm.

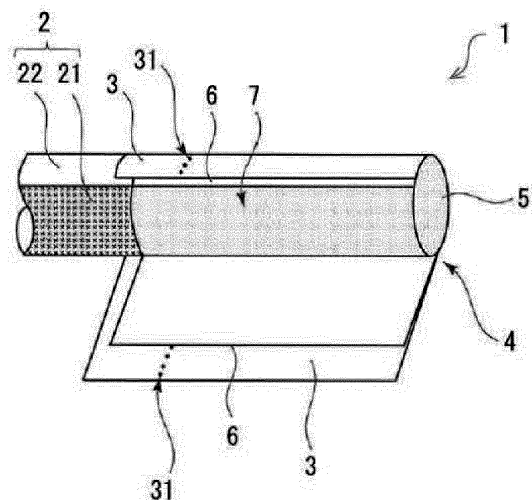


Fig.1

Description

[Technical Field]

5 **[0001]** The present invention relates to a tobacco filter wrapping paper, a tobacco filter using the tobacco filter wrapping paper, and to a cigarette using the tobacco filter.

[Background Art]

10 **[0002]** Known instances of wrapping paper in rod-like smoking articles, such as cigarettes, include filter wrapping paper such as wrapping paper resulting from wrapping a medium of a filter for rod-like smoking articles, and tipping paper for wrapping integrally a filter and a tobacco rod, as well as rod wrapping paper for wrapping shredded tobacco in a tobacco rod. To wrap a filter medium with wrapping paper, a rod state is brought about through wrapping of the filter medium using the wrapping paper, after which one end of the wrapping paper in the wrapping direction, and the other end, are superimposed on each other and are glued. The portion at which the ends the wrapping paper are superimposed is referred to as a wrap portion.

[0003] Cigarettes are also known in which a capsule having a fluid material sealed therein is introduced into the filter of a filtered cigarette, such that and wherein pressing of the capsule by the smoker causes the fluid material within the capsule to penetrate into the medium of the filter, to modify thus the flavor at the time of smoking (Patent Document 1).

20 **[0004]** Patent Document 1 discloses a feature wherein at least part of a filter assembly is covered by a material that is impermeable towards the fluid material. Patent Document 1 indicates that by adopting such a configuration it becomes possible to prevent or eliminate contamination of tipping paper when the fluid material is released out of the capsule. As the material impermeable to the fluid material, Patent Document 1 describes cellophane, polyvinylidene chloride or a substantially impermeable film or sheet.

[Citation list]

[Patent Document]

30 **[0005]** [Patent Document 1] Japanese Translation of PCT Application No. 2008-539717

[Summary of Invention]

[Technical Problem]

35 **[0006]** Characteristics that are demanded from wrapping paper for tobacco filters include formability, adhesiveness of the wrap portion during wrapping of the filter, and adhesiveness of the wrap portion after production. The term formability denotes herein the feasibility of wrapping the wrapping paper around a filter medium at a predetermined speed.

40 **[0007]** In a case where the medium of the tobacco filter is impregnated with a water-soluble liquid, storage stability is also demanded in that the water-soluble liquid should not leak out of the filter after wrapping. During wrapping of a filter medium having been permeated beforehand with a water-soluble liquid, moreover, the wrapping paper is required to exhibit durability towards the water-soluble liquid, so as to achieve satisfactory wrapping.

[0008] No existing conventional wrapping paper for tobacco filters has succeeded in satisfying all the above characteristics.

45 **[0009]** It is an object of the present invention, arrived at in the light of the above considerations, to provide a wrapping paper for tobacco filters that is excellent in formability, is excellent in adhesiveness of a wrap portion during filter wrapping and in adhesiveness of the wrap portion after production, is excellent in durability towards a water-soluble liquid during wrapping of a filter medium impregnated beforehand with the liquid, and is excellent in storage stability after wrapping.

[Solution to Problem]

50 **[0010]** In order to attain the above goal, the wrapping paper for tobacco filters in the present invention (hereinafter, merely referred to as "wrapping paper") has incorporated therein a nonwoven fabric layer made up of hydrophobic fibers and having interfiber bonding points, such that a contact angle with water in at least one from among a front surface and a back surface of the paper is set to be 90° or greater, and thickness is set to 100 μm to 300 μm, or has incorporated therein a nonwoven fabric layer made up of hydrophobic fibers and having interfiber bonding points, and an air impermeable layer, such that a contact angle with water in at least one from among a front surface and a back surface is set to be 50° or greater, and thickness is set to 100 μm to 300 μm.

[0011] The present invention relates to the following matters.

[1] A tobacco filter wrapping paper containing: a nonwoven fabric layer made up of hydrophobic fibers and having interfiber bonding points, wherein a contact angle with water of at least one surface from among a front surface and a back surface of the paper is 90° or greater, and thickness is 100 μm to 300 μm.

[2] A tobacco filter wrapping paper containing: a nonwoven fabric layer made up of hydrophobic fibers and having interfiber bonding points, and an air impermeable layer, wherein a contact angle with water of at least one surface from among a front surface and a back surface of the paper is 50° or greater, and thickness is 100 μm to 300 μm.

[3] The tobacco filter wrapping paper of [2], wherein the air impermeable layer is a layer made up of a polyolefin.

[4] The tobacco filter wrapping paper of any of [1] to [3], wherein an Ra value of at least one from among the front surface and the back surface is 10 or greater.

[5] The tobacco filter wrapping paper of any of [1] to [4], wherein the hydrophobic fibers have a double core-sheath structure.

[6] A tobacco filter containing the tobacco filter wrapping paper of any one of [1] to [5], and a medium.

[7] The tobacco filter of [6], wherein a water-soluble liquid is added to the medium.

[8] A cigarette containing the tobacco filter of [6] or [7], and a tobacco rod.

[Effects of Invention]

[0012] The present invention succeeds in providing a wrapping paper for tobacco filters that is excellent in formability, and after filter wrapping, is excellent in adhesiveness of a wrap portion during filter wrapping and in adhesiveness of the wrap portion after production, is excellent in durability towards a water-soluble liquid during wrapping of a filter medium impregnated beforehand with the liquid, and is excellent in storage stability after wrapping.

[Brief Description of Drawings]

[0013]

[Fig. 1]

Fig. 1 is an exploded perspective-view diagram of a cigarette according to one mode of the present invention.

[Fig. 2]

Fig. 2 is a diagram illustrating a cross-section of a sheet-like wrapping paper, prior to wrapping of a filter section, according to a first mode of the present invention.

[Fig. 3]

Fig. 3 is a diagram illustrating a cross-section of a sheet-like wrapping paper, prior to wrapping of a filter section, according to a second mode of the present invention.

[Fig. 4]

Fig. 4 is a schematic diagram illustrating interfiber bonding points generated through thermal fusion of hydrophobic fibers.

[Fig. 5]

Fig. 5 is a schematic diagram illustrating a contact angle with water.

[Description of Embodiments]

<First mode>

[0014] In a first mode of the present invention, a wrapping paper of a tobacco filter wrapping paper is formed by a nonwoven fabric made up of hydrophobic fibers.

[0015] The hydrophobic fibers that make up the nonwoven fabric have interfiber bonding points. The presence of interfiber bonding points imparts the wrapping paper with the required tensile strength, and improves high-speed wrap-around properties. The term interfiber bonding points in the present invention denotes a plurality of points at which hydrophobic fibers are bonded to each other by thermal fusion or via an adhesive.

[0016] The thickness of the wrapping paper in the first mode of the present invention is 100 μm to 300 μm. When having such a thickness, the wrapping paper acts as a buffer in a case where a water-soluble liquid is added to a filter medium, and allows preventing that water-soluble liquid from leaking out of the filter.

[0017] More preferably, the thickness of the wrapping paper is 200 μm to 300 μm. The wrapping paper is preferably as thick as possible, from the viewpoint of preventing leakage of the water-soluble liquid from a filter medium having had the liquid added thereto, and from the viewpoint of securing adhesiveness of a wrap portion over long periods of

time. A thickness of 100 μm or greater results in excellent formability as a tobacco filter wrapping paper. In the present specification the term excellent formability denotes the feasibility of wrapping the wrapping paper around the filter medium at a predetermined speed.

[0018] In the first mode of the present invention the layer thickness of the wrapping paper corresponds to the thickness of the nonwoven fabric that makes up the wrapping paper.

[0019] The term "water-soluble liquid" in the present invention denotes a liquid containing 3 wt% or more of water. Such a water-soluble liquid has no affinity towards hydrophobic fibers.

[0020] The thickness of the wrapping paper according to the present invention is measured on the basis of the JIS P 8118 (Paper and board - determination of thickness and density). In the measurement, a paper surface pressure is set to 100 kPa.

[0021] The thickness of the wrapping paper worked out in accordance with the above measurement method is an average thickness.

[0022] Further, the contact angle of one of surfaces of the wrapping paper with water is 90° or greater. Since one of the surfaces of the wrapping paper of the first mode of the present invention has a contact angle lying within such a range, it becomes possible to secure sufficient waterproofness, and to prevent leakage of a water-soluble liquid to the exterior, even when a water-soluble liquid is added to the filter medium.

[0023] The contact angle with water is measured using "Drop Master" by Kyowa Interface Science Co., Ltd., as the measuring instrument, under measurement conditions that involve dropping of 2 μL droplets of distilled water onto a specimen, and measuring the contact angle after 0.1 seconds in accordance with a 1/20 method. The measurement method of contact angle with water is the same in a second mode below. Contact angle with water is illustrated conceptually in Fig. 5.

[0024] Examples of hydrophobic fibers include for instance fibers made up of polyolefins such as polyethylene or polypropylene, or thermoplastic resins other than polyolefins, for instance nylon or polyester, and also composite fibers being combinations of fibers made up of the foregoing thermoplastic resins.

[0025] Polyolefin fibers are preferably used among the foregoing, and among these, polyethylene or polypropylene fibers are more preferably used, since these form interfiber bonding points on account of heat, and allow fibers to fuse with each other at a low temperature.

[0026] The molecular weight of the thermoplastic resin, such as a polyolefin, that makes up the hydrophobic fibers is not particularly limited, but in ordinary implementations the mass average molecular weight (M_w) based on a standard polystyrene calibration curve and measured by GPC (Gel Permeation Chromatography) is 20,000 to 300,000.

[0027] The hydrophobic fibers may have a double core-sheath structure. In an exemplary implementation in that case, the materials that make up the outer side and the inner side may both be a polyolefin.

[0028] For instance, there can be readily used fibers having a double core-sheath structure being a combination in which the inside is made up of polypropylene and the outside is a resin having a lower melting point than that of polypropylene.

[0029] For instance, a double core-sheath structure can be preferably adopted in which the outside is made up of polyethylene and the inside is made up of polypropylene. By adopting such a double core-sheath structure it becomes possible to suitably increase the thickness/strength of the nonwoven fabric, since in that case fiber shape can be preserved while increasing the number of thermal fusion points between fibers upon generation of interfiber bonding points by thermal fusion.

[0030] The resins that make up fibers having such a double core-sheath structure can exhibit the above molecular weight range.

[0031] The fiber diameter of the hydrophobic fibers that make up the nonwoven fabric may be for instance 0.1 to 20 dtex.

[0032] Conditions identical to the production method, resin types, molecular weight and other conditions described above can likewise apply to the fibers that make up the nonwoven fabric used in the second mode of the present invention explained below.

[0033] The nonwoven fabric that makes up one surface of the tobacco filter wrapping paper is made up of hydrophobic fibers, and accordingly the contact angle with water at that surface is large.

[0034] By virtue of the fact that the contact angle of one of the surfaces of the tobacco filter wrapping paper is large it becomes possible to prevent a water-soluble liquid from penetrating into the interior of the tobacco filter wrapping paper, and to prevent tearing or embrittlement of the tobacco filter wrapping paper arising from penetration of that water-soluble liquid.

[0035] Ordinary tobacco filter wrapping paper is made up of paper having pulp as a starting material, such that fibers are connected to each other by intermolecular forces and partly by hydrogen bonds at the inter-fiber bonds that make up the paper. Accordingly, the weak bonds between the fibers are split as a result of penetration of a water-soluble liquid into the wrapping paper, and the paper exhibits tears or embrittlement as a result. By contrast, although at first glance the numerous voids between hydrophobic fibers in the paper of the present invention might ostensibly render the paper susceptible to water seeping, water does not however penetrate readily into the paper, and even if that is the case the

paper does not tear or become brittle, since the paper is made up of hydrophobic fibers that are connected to each other by interfiber bonding points.

[0036] Production of the nonwoven fabric involves a web formation process and a bonding process. Types of formation process include for instance carding or air-laying in which short fibers are randomly laid up in air, and wet methods in which short fibers are dispersed in water and are then filtered up. Examples of the subsequent bonding process include for instance chemical bonding through immersion in or spraying with a water-soluble or water-insoluble adhesive, thermal bonding by thermal fusion of thermoplastic resins or fibers, needle punching in which fibers become mechanically entangled with each other by being punched with needles, and hydro-entangling through jetting of a high-pressure water stream. For instance, spun-bonding methods and melt blown methods are methods widely resorted to as methods in which the formation process and the bonding process are part of the flow of a series of processes. In spun bonding, long fibers are formed through spinning of a thermoplastic resin while the resin is being thermally melted, and in a melt blown method a web is formed while short fibers are being discharged, with heat bonding of the fibers progressing simultaneously therewith.

[0037] Interfiber bonding points between hydrophobic fibers are present in a nonwoven fabric having thermal bonding points between hydrophobic fibers in the process of producing the nonwoven fabric, and hence the fabric endures penetration of a water-soluble liquid; also, the water-soluble liquid does not readily seep through, since the fabric is made up of hydrophobic fibers in the first place.

[0038] Interfiber bonding points between the hydrophobic fibers are present in a nonwoven fabric having bonding points derived from a water-insoluble adhesive between hydrophobic fibers in the process of producing the nonwoven fabric, and hence the fabric endures penetration of a water-soluble liquid; also, the water-soluble liquid does not readily seep through, since the fabric is made up of hydrophobic fibers in the first place.

[0039] Thermal bonding is preferred herein as the method for bonding fibers to each other, since such a method allows controlling surface roughness easily, and exerts little influence on cigarette flavor.

[0040] The surface roughness of the tobacco filter wrapping paper, in terms of Ra value, is preferably 10 or greater. The adhesiveness of the wrap portion during wrapping of the filter is improved by virtue of the fact that the Ra value is 10 or greater. As a result, it becomes possible to prevent peeling of the wrapping paper off the filter medium, caused by peeling of a bonding surface of the wrap portion when the filter medium is wrapped in a cylindrical shape. The value of Ra is ordinary 50 or smaller.

[0041] The surface roughness Ra of the nonwoven fabric as the wrapping paper can be adjusted for instance by performing a rolling treatment after production of the nonwoven fabric, by adjusting the fiber diameter of the hydrophobic fibers that form the nonwoven fabric, or by adjusting the basis weight of the nonwoven fabric.

[0042] The Ra value of wrapping paper can be measured for instance under conditions pertaining to ISO 1997 (cut-off value $\lambda_c = 2.5$ mm, $\lambda_s = 8$ μ m, number of intervals (N) 4)) using "Surf Test SJ-201 (stylus tip R = 2 μ m; tip angle 60°)" by Mitutoyo Corporation, and using a Gaussian filter as filter processing.

[0043] The wrapping paper of the first mode of the present invention is substantially air permeable, which means that voids are present in the wrapping paper. This elicits as a result an anchoring effect during bonding of the wrap portion at the time of wrapping of the filter, with increased adhesiveness of the wrap portion and while precluding peeling of the wrapping paper after wrapping of the filter medium.

[0044] The basis weight of the wrapping paper in the first mode of the present invention is preferably 20 to 50 gsm. The basis weight of the wrapping paper in the first mode of the present invention corresponds to the basis weight of the nonwoven fabric that makes up the wrapping paper.

[0045] A basis weight lying in the above range contributes to enhancing the waterproofness of the wrapping paper, and in a case where a water-soluble liquid is added to the filter medium, allows preventing leakage of the water-soluble liquid out of the filter.

[0046] The basis weight can be adjusted by adjusting the amount of fibers being supplied during production of the nonwoven fabric that is used in the wrapping paper, or by adjusting the thickness of the nonwoven fabric.

[0047] The basis weight was worked out by cutting the nonwoven fabric to a square shape having a 10 cm side, followed by weighing and calculation of the weight per unit area. Weighing is performed after storage for long enough as to bring about equilibrium moisture in an environment at 22°C and 60%. The same applies to the below-described second mode.

[0048] The first mode of the present invention basically envisages formation of the wrapping by a nonwoven fabric alone, but so long as the above-described features are not impaired, the wrapping paper may include features other than the nonwoven fabric, for instance some reinforcing material or the like.

<Second mode>

[0049] The second mode of the present invention is a wrapping paper having a layer made up of a nonwoven fabric (hereafter also referred to simply as nonwoven fabric) that is in turn made up of hydrophobic fibers and has inter-fiber

bonds, and an air impermeable layer.

[0050] The above nonwoven fabric layer and the air impermeable layer are laid on each other with one respective face of each layer facing the other.

[0051] The layering method may be a method that involves superimposing the nonwoven fabric layer and the air impermeable layer, and pressing and bonding the foregoing through application of heat; or an extrusion lamination method in which a thermoplastic resin is melted and is laminated in the form of a film, while being extruded, onto a nonwoven fabric that constitutes a base material.

[0052] The wrapping paper has an air impermeable layer, in addition to the nonwoven fabric layer; as a result, there is achieved the effect elicited by the nonwoven fabric explained above and, additionally, excellent storage stability is achieved in that sufficient waterproofness can be secured, also upon wrapping of a filter medium having had a water-soluble liquid added thereto. Excellent storage stability denotes herein a property whereby no water-soluble liquid leaks out of the filter after wrapping of the filter medium having had a water-soluble liquid added thereto.

[0053] Further, it becomes possible to prevent leakage of the water-soluble liquid to the exterior also in cases where the filter is pressed by the user during use of the filter having been wrapped with the wrapping paper.

[0054] The thickness of the wrapping paper made up of the above layers is 100 μm to 300 μm , similarly to the first mode of the present invention.

[0055] In a case where a water-soluble liquid is added to the filter medium a phenomenon is likely to occur wherein the water-soluble liquid seeps in through the nonwoven fabric layer exposed at the cut surface of the wrapping paper in the wrap portion, whereupon the water-soluble liquid leaks out of the filter. The wrapping paper in such a case acts as a buffer and can prevent the water-soluble liquid from leaking to the exterior of the filter, by virtue of the fact that the thickness of the wrapping paper is 100 μm or greater.

[0056] The layer thickness of the wrapping paper of the second mode of the present invention is more preferably 100 μm to 200 μm . Preferably, the layer thickness of the wrapping paper is as large as possible from the viewpoint of preventing leakage of a water-soluble liquid from a filter having had the water-soluble liquid added thereto. By virtue of the fact that the thickness is 100 μm or greater it becomes possible to secure sufficient tensile strength as a tobacco filter wrapping paper, and formability is thus excellent. Excellent formability denotes the feasibility of wrapping the wrapping paper around a filter medium at a predetermined speed.

[0057] The layer thickness of the wrapping paper of the second mode of the present invention refers to layer thickness after lamination of the nonwoven fabric layer and the air impermeable layer.

[0058] In the second mode of the present invention the wrapping paper has a layer made up of a nonwoven fabric, and an air impermeable layer. The thickness of the wrapping paper corresponds herein to total thickness, including the foregoing layers.

[0059] The thicknesses of the layer made up of a nonwoven fabric and of the air impermeable layer are not particularly limited, but for instance the thickness of the layer made up of a nonwoven fabric is 50 μm to 290 μm , and the thickness of the air impermeable layer is 10 μm to 50 μm . The foregoing thickness values denote thickness as wrapping paper, after forming (after lamination).

[0060] If in the second mode of the present invention a water-soluble liquid is present in the filter medium to be wrapped, that water-soluble liquid is arrested by the air impermeable layer, and the adhesiveness of the wrap portion can be secured over long periods of time by the nonwoven fabric layer having sufficient thickness such the above.

[0061] As the layer made up of a nonwoven fabric there can be used a layer identical to that of the first mode of the present invention, in terms of production method, types of resin and so forth, and thickness.

[0062] The air permeability of the air impermeable layer of the present invention is 0 CU.

[0063] The air impermeable layer is impermeable to air, and also impermeable to the water-soluble liquid. By having such properties the air impermeable layer allows securing the formability and waterproofness that are required of the wrapping paper of the present invention.

[0064] The air impermeable layer can be embodied for instance in the form of a film made up of a thermoplastic starting material, typically a polyolefin, or some other material. A commercially available film can be used as the film made up of a thermoplastic starting material. Examples include for instance films of polyethylene, polypropylene, copolymers of ethylene and propylene, nylon or polyester.

[0065] The molecular weight of the polyolefin is not particularly limited, but in an exemplary implementation the mass average molecular weight (M_w) based on a standard polystyrene calibration curve, measured by GPC (Gel Permeation Chromatography), can be ordinarily of 20,000 to 300,000.

[0066] In the wrapping paper of the second mode of the present invention, preferably, the contact angle with water of at least one surface from among the front surface and the back surface is 50° or greater. The surface at which the contact angle with water is 50° or greater is preferably the surface, of the layer made up of a nonwoven fabric, that is exposed at the outer surface.

[0067] When the contact angle with water is 50° or greater the water resistance of the wrapping paper is excellent, and even when a water-soluble liquid is added to the medium of the filter, the water-soluble liquid does not leak out of

the wrapping paper, nor does the tensile strength of the wrapping paper drop.

[0068] In the wrapping paper of the second mode of the present invention, preferably, the surface roughness of at least one from among the front surface and the back surface takes on an Ra value of 10 or greater. The adhesiveness of the wrap portion is improved by virtue of the fact that the Ra value is 10 or greater. This allows preventing the wrapping paper from coming off the filter medium.

[0069] The surface of the wrapping paper having the above Ra value is preferably the surface on the side of the outer surface of the filter. This surface is preferably the surface, of the layer made up of a nonwoven fabric, that is exposed at the outer surface. As a result, the presence of the air impermeable layer affords excellent adhesiveness of the wrap portion over long periods of time, while suppressing seeping of the water-soluble liquid into the wrapping paper, in a case where the filter medium is impregnated with an aqueous solution.

[0070] In the second mode the wrap portion is formed through superposition of both ends of the wrapping paper in the wrapping direction. However, for instance the surface of the layer made up of a nonwoven fabric and the surface of the air impermeable layer may be glued together at a portion of overlap of the foregoing surfaces; alternatively, one end of the wrapping paper in the wrapping direction may be folded back towards the inner face (filter medium side), to thereby glue together the surfaces in such a manner that the surfaces of the layer made up of a nonwoven fabric come into contact with each other. Herein there may be removed just the air impermeable layer, at the portion of overlap of both ends of the wrapping paper in the wrapping direction, and then the layers made up of a nonwoven fabric be brought into contact and glued together.

[0071] The basis weight of the wrapping paper in the second mode of the present invention is preferably 30 to 100 gsm. The basis weight of the wrapping paper in the first mode of the present invention corresponds to the basis weight of the total of the layer made up of a nonwoven fabric and of the air impermeable layer that make up the wrapping paper.

[0072] A basis weight lying in the above range contributes to enhancing the waterproofness of the wrapping paper and, also in a case where a water-soluble liquid is added to the filter medium, allows preventing leakage of the water-soluble liquid out of the filter.

[0073] The basis weight can be adjusted through adjustment of the thickness of the layer made up of a nonwoven fabric and the thickness of the air impermeable layer that makes up the wrapping paper.

[0074] In the wrapping paper of the present invention, preferably, the air permeability of the layer made up of a nonwoven fabric making up the wrapping paper is 27,000 to 45,000 CU (Coresta units), both in the first mode and the second mode. By virtue of having such air permeability, sufficient voids are present between fibers in the nonwoven fabric, and moderate surface roughness is imparted, which improves adhesiveness with the filter medium.

[0075] The air permeability can be adjusted for instance through adjustment of the type of the fibers, the thickness of the fibers, the amount of the fibers and the thickness of the nonwoven fabric, during production of the nonwoven fabric.

[0076] In the second mode of the present invention the air permeability of the wrapping paper is 0, since the wrapping paper has the air impermeable layer.

[0077] The term air permeability in the present invention denotes the flow rate of permeating (passing) air, per minute and per cm², when air is caused to pass at a constant pressure of 1 kPa from one face (2 cm²) of the paper.

[0078] The second mode of the present invention basically envisages the wrapping paper being formed by a nonwoven fabric and an air impermeable layer, but so long as the above-described features are not impaired, the wrapping paper may include features other than the nonwoven fabric and the air impermeable layer, for instance some reinforcing material or the like.

<Cigarette example>

[0079] Fig. 1 is an exploded perspective-view diagram of one mode of a filtered cigarette 1 that utilizes an example of the wrapping paper of the present invention. The cigarette 1 is a filtered cigarette provided with a tobacco rod 2, and a filter 4 connected to one end of the tobacco rod 2 via tipping paper 3.

[0080] The tobacco rod 2 is formed to a cylindrical shape (rod-like shape) through wrapping of shredded tobacco 21 using rod wrapping paper 22. The filter 4 is formed to have a cylindrical shape of substantially the same diameter as that of the tobacco rod 2, and is a part for filtering smoke components, contained in mainstream smoke and generated during smoking of the cigarette 1, as the mainstream smoke passes through the filter.

[0081] The filter 4 is wrapped by the tipping paper 3, and is connected to the rear end of the tobacco rod 2 via the tipping paper 3. The tipping paper 3 wraps integrally an end of the tobacco rod 2 and the filter 4, to thereby connect the tobacco rod 2 and the filter 4. Ventilation holes 31 for introduction, into the filter 4, of outside air (air) that dilutes mainstream smoke, are pierced at a region of the tipping paper 3 that covers the filter 4. The ventilation holes 31, being external air introduction holes for so-called ventilation, are provided in the form of a plurality of holes in the tipping paper 3. The air introduced through the ventilation holes 31 of the tipping paper 3 dilutes the mainstream smoke that passes through the filter 4. The ventilation holes 31 in the tipping paper 3 are not an essential feature, and the manner in which the ventilation holes 31 are provided can be modified as appropriate. In a case where the wrapping paper is made up of one nonwoven

fabric layer having air permeability, as in the first mode, the ventilation holes 31 may be provided in just the tipping paper 3. In a case where the wrapping paper includes a layer having an air impermeable layer, as in the second mode, air for mainstream smoke dilution can be introduced by arranging the ventilation holes, also in the wrapping paper, so as to correspond to the positions at which the ventilation holes 31 are disposed in the tipping paper 3.

[0082] The filter 4 has a filter section 7 resulting from wrapping of a medium 5, for instance cellulose acetate tow, with a wrapping paper 6 of the present invention.

[0083] The wrapping paper of the first mode of the present invention (Fig. 2) or the wrapping paper of the second mode (Fig. 3) of the present invention can be used herein as the wrapping paper 6. In a case where the wrapping paper of the second mode is used, the layer made up of a nonwoven fabric is preferably wrapped so as to constitute the outer surface side, from the viewpoint of securing adhesive strength in the wrap portion of the wrapping paper, during wrapping and after wrapping.

[0084] The method for wrapping the medium 5 using the wrapping paper 6 can be carried out using for instance a known filter maker, and the medium 5 can be wrapped through bonding of the wrap portion of the wrapping paper using a known adhesive.

[0085] In an exemplary implementation, a water-soluble liquid is added to the medium 5 of the filter section 7 of the present mode. The water-soluble liquid contains for instance propylene glycol (PG), glycerin (G), water or the like, as explained below. The filter section 7 is also referred to as the filter of the present invention.

<Water-soluble liquid added to the filter medium>

[0086] The wrapping paper of the present invention is used for wrapping the medium of a filter. The wrapping paper of the present invention is suitable for wrapping of a filter medium to be wrapped having added thereto a water-soluble liquid that contains for instance propylene glycol, glycerin, water or the like.

[0087] The water-soluble liquid that is added to the medium of the filter is not particularly limited, and may be a water-soluble liquid containing propylene glycol, glycerin, water or the like, as described above, but also a water-soluble liquid additionally containing, besides the foregoing, various additives such as flavor.

[0088] Due to the presence of propylene glycol in the solution that is added to the filter section 7, it becomes possible for limonene as one aroma component to selectively pass through the filter 4 during smoking. This is achieved with simultaneous selective removal of specific components such as phenols that are contained in the smoke at the time of smoking. Further, the presence of glycerin in the solution that is added to the filter section 7 allows preventing volatilization and disappearance of propylene glycol contained in the solution, during storage of the cigarettes. Commercially available products can be used as the propylene glycol and glycerin.

[0089] The ratio by weight of propylene glycol, glycerin or water in the water-soluble liquid that is added to the filter medium is not particularly limited. In an exemplary implementation in the case of ordinary filtered cigarettes having a circumference of 24.0 to 25.0 mm, for instance, propylene glycol may be 10 to 100 mg/filter, glycerin may be 1 to 150 mg/filter, and water may be 5 to 100 mg/filter, as the amount added to the filter medium of the filtered cigarette.

[0090] The solution added to the filter section 7 may contain a thickener. The type of thickener that can be used is not particularly limited, so long as the thickener dissolves in propylene glycol or glycerin and in water. Examples include for instance xanthan gum, gellan gum, psyllium seed gum, pectins, carboxymethyl cellulose, hydroxypropyl cellulose, polyvinyl alcohol, agarose, pullulan, alginic acid, polyacrylic acid and alkali metal salts or alkaline earth metal salts of the foregoing.

[0091] The amount of water-soluble liquid that is added to the filter medium is not particularly limited, and as a yardstick may be for instance 10 to 300 mg/filter, as the amount added to the filter medium of an ordinary filtered cigarette having a circumference of 24.0 to 25.0 mm.

[0092] Fig. 3 is a diagram illustrating a second mode of the sheet-like wrapping paper 6 prior to wrapping of the filter section 7 according to Embodiment 1 above. An air impermeable layer 61 is formed on one face of a layer 62 made up of a nonwoven fabric, of the wrapping paper 6. The filter section 7 is wrapped by the wrapping paper 6 in such a manner that the layer 62 made up of a nonwoven fabric constitutes an outer surface that faces the outer peripheral surface of the medium 5. In an exemplary implementation, the air impermeable layer 61 of the wrapping paper 6 is a film-like layer that is directly overlaid onto, and in contact with, the layer 62 made up of a nonwoven fabric.

Examples

[0093] The present invention will be explained next in more specific terms by way of examples. Within the scope of the present invention, however, the invention is not limited to the matter disclosed of the examples below.

<Examples>

[0094] In the tests below various samples were measured for the physical properties (design), paper quality properties, and mechanical processability (formability), waterproofness (affecting durability), peel strength (adhesiveness of wrap portion) during wrapping in an actual machine, and liquid leakage (storage stability).

[0095] The samples used in the tests are explained next.

<Wrapping paper test product>

[0096] As comparative examples there were used wrapping paper (paper having wood pulp as a main component), a polypropylene film (air impermeable film) and a cellophane film (high-density cellulose) that were ordinarily utilized.

[0097] As given in Table 1, as the wrapping paper of the present invention, a nonwoven fabric, in which polyethylene was used as hydrophobic fibers, as well as a nonwoven fabric, in which a polyethylene film was laminated on such a nonwoven fabric, were used. Both of the nonwoven fabrics had interfiber bonding points generated through thermal fusion.

[0098] In the wrapping paper used in Example 2 the nonwoven fabric had a layer thickness of 145 μm and the polyethylene film had a layer thickness of 20 μm . In the wrapping paper used in Example 4 the nonwoven fabric had a layer thickness of 220 μm and the polyethylene film had a layer thickness of 20 μm . In both Example 2 and Example 4, the nonwoven fabric and the polyethylene film were pressed during lamination, and accordingly the thickness after lamination decreased with respect to the total thickness of the nonwoven fabric and the polyethylene film before lamination; herein the thickness of the wrapping paper after lamination in Example 2 was 126 μm and the thickness of the wrapping paper after laminate in Example 4 was 194 μm .

<Desktop test method>

[0099] Thickness, surface roughness (Ra) and contact angle with water, among the items given in Table 1, were measured in accordance with the methods below.

1. Evaluation of physical properties of paper quality ii) Thickness

[0100] Thickness was measured in accordance with JIS P 8118: Paper and board - Determination of thickness and density. Paper surface pressure was set to 100 kPa.

ii) Roughness

[0101]

- The measuring instrument used was "Surf Test SJ-210" by Mitutoyo Corporation.
(Stylus tip R = 2 μm ; tip angle 60°)
- Filter processing: Gaussian filter
- Measurement conditions: in accordance with ISO 1997
(Cut-off value λ_c = 2.5 mm, λ_s = 8 μm , number of intervals (N) 4)

iii) Contact angle

[0102]

- Measuring instrument: "Drop Master" by Kyowa Interface Science Co., Ltd.
- Measurement conditions: dropping of 2 μL droplets of distilled water onto the specimen, and measurement of contact angle after 0.1 seconds, in accordance with a 1/20 method iv) Basis weight

[0103] Basis weight was worked out by cutting the nonwoven fabric to a square shape having a 10 cm side, followed by weighing and calculation of the weight per unit area. Weighing was performed after storage for long enough as to bring about equilibrium moisture in an environment at 22°C and 60%.

2. Waterproofness evaluation (surface waterproofness screening)

[0104] A set of a 6 cm square test piece and, in close contact thereunder, filter paper of identical size, was placed in a Petri dish; then 2 g of distilled water having a red dye added thereto was placed, once, on the top face of the test

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piece, and the dish was sealed quickly with a lid. The underlying filter paper was observed after 73 hours had elapsed. Instances where the diameter of the red dye on the filter paper, resulting from leakage, exceeded 1 cm of diameter were rated as "not waterproof X (poor)", instances where the diameter was smaller than 1 cm were rated as "Δ" (fair), and instances where red was not visible were rated as "waterproof ○ (good)".

[0105] Such "waterproofness" affects the durability of the wrapping paper in that the better the waterproofness, the higher the durability is.

<Practical test method>

[0106] Each wrapping paper illustrated in Table 1 was wrapped around a filter medium using a filter maker. The maximum number of revolutions that allowed for stable wraparound was likewise checked. There were further checked the peel strength of the wrap portion, water absorption by the wrapping paper, and degree of leakage to the outer surface, after storage of the filter. Storage involved sealing in a vinyl bag after wraparound, and being allowed to stand in conditions of 23°C and 60%. Samples having a laminate surface on one side were wrapped in such a manner that the laminate surface lay on the inside (tow side) during wrapping.

<Specifications of the water-soluble liquid added to the filter medium>

[0107] Water on its own evaporates / volatilizes, and hence a mixed solution of propylene glycol, glycerin and water was used in practice.

- Material of the filter medium: 6y35000
- Added solution (propylene glycol : glycerin : water) = 50:25:25 (w/w/w) (a very small amount of a coloring agent was added for checking the occurrence or absence of leakage)
- Addition amount: 50 mg/10 mm filter

(1) Peel strength of bonded portion (adhesiveness of wrap portion)

[0108] The opposite side of the wrapping paper of each produced filter was cut parallelly to a wrap gluing line.

[0109] The wrap portion tip of the cut wrapping paper was peeled by hand slightly, to form a tab. Each tab was set on a peel tester and was subjected to a 180-degree peel test. The median value from start of measurement up to 40 mm was obtained, and an average value of the foregoing upon five repetitions was expressed in g units, as the measurement result.

[0110] A measurement result under 15 g was rated as X (poor), and a result of 15 g or greater was rated as ○ (good).

(2) Water absorption by wrapping paper / liquid leakage (after 1 day and after 10 days)

[0111] The degree of red coloration of the wrapping paper as a whole and the degree of color transfer upon pressing of a tissue against the surface were assessed. The results denote the storage stability after wrapping of the wrapping paper.

[Degree of leakage]

[0112] X: entire surface of the wrapping paper (substantially 100%); Δ: partial leakage; ○: slight leakage; and ⊙: no leakage

(3) Filter wraparound speed

[0113] An existing performance of 1500 rpm for general-purpose products was set as a target rate, for 3300 rpm as the rated performance of a filter maker. Instances where wrapping at 1500 rpm was possible were regarded as indicative of excellent formability.

[0114] Table 1 below sets out results after measurements under the above conditions.

[0115] The samples used in Table 1 and Table 2 below are briefly explained next.

Comparative example 1 (regular paper): Wrapping paper produced using pulp as a material.

Comparative example 2 (high air permeability paper): Wrapping paper obtained by mixing rayon and pulp.

Comparative example 3 (cellophane): Film-like wrapping paper obtained using viscose.

Comparative example 4 (laminate-paper): Wrapping paper obtained by laying a film made up of polyethylene on

one face of paper produced using pulp.

Comparative example 5 (lamine-paper-lamine): Wrapping paper obtained by laying a film made up of polyethylene on both faces of paper produced using pulp.

Example 1 (olefin PPPE25): Wrapping paper made up of a nonwoven fabric (basis weight 25 gsm) obtained using double core-sheath structure fibers, as hydrophobic fibers, made up of polypropylene on the inside and of polyethylene on the outside.

Example 2 (olefin PPPE25-lamine): Wrapping paper obtained by laying up a polyethylene film on a nonwoven fabric (basis weight 25 gsm) obtained using double core-sheath structure fibers, as hydrophobic fibers, made up of polypropylene on the inside and of polyethylene on the outside.

Example 3 (olefin PPPE40): Wrapping paper made up of a nonwoven fabric (basis weight 40 gsm) obtained using double core-sheath structure fibers, as hydrophobic fibers, made up of polypropylene on the inside and of polyethylene on the outside.

Example 4 (olefin PPPE40-lamine): Wrapping paper obtained by laying up a polyethylene film on a nonwoven fabric (basis weight 40 gsm) obtained using double core-sheath structure fibers made up of polypropylene on the inside and of polyethylene on the outside.

[Table 1]

[0116]

Table 1 Properties of samples

	Sample	Material	Basis weight gsm	Thickness μm	Surface roughness Ra (outside/inside)	Contact angle (degrees)	Air permeability (CU)
Comparative example 1	Regular paper	Pulp	24	33	2.2/2.9	19/30	20
Comparative example 2	High air permeability paper	Rayon + pulp	24	55	6.4/6.0	119/109	10000
Comparative example 3	Cellophane	Viscose	27	36	0.3/0.3	27/26	0
Comparative example 4	Lamine-paper	PE film + pulp	38	52	5.2/2.9	35/97	0
Comparative example 5	Lamine-paper-lamine	PE film + pulp + PEfilm	50	65	2.4/2.4	94/94	0
Example 1	Olefin PPPE25	PE/PP fibers	25	145	15.1/18.5	121/130	40000
Example 2	Olefin PPPE25-lamine	PE/PP fibers + PEfilm	40	126	14/4.6	54/87	0
Example 3	Olefin PPPE40	PE/PP fibers	40	220	13.2/15.2	130/127	30000
Example 4	Olefin PPPE40-lamine	PE/PP fibers + PEfilm	56	194	12/4.1	70/98	0

[Table 2]

[0117]

Table 2 Results of filter wrapping

	Sample	Waterproofness (front face)	Operable speed rpm (formability)	One-day storage (peel strength of bonded portion)	Liquid leakage (day 1)	Liquid leakage (day 10)
5	Comparative example 1	Regular paper	×	1500	×(1)	×
10	Comparative example 2	High air permeability paper	Δ	1500	×(3)	Δ
	Comparative example 3	Cellophane	×	×	-	-
15	Comparative example 4	Laminate- paper	○	1000	×(0)	×
	Comparative example 5	Laminate- paper- laminate	○	500	×(2)	Δ
20	Example 1	Olefin PPPE25	○	1500	○(70)	○
	Example 2	Olefin PPPE25- laminate	○	1500	○(28)	⊙
25	Example 3	Olefin PPPE40	○	1500	○(22)	○
	Example 4	Olefin PPPE40- laminate	○	1500	○(21)	⊙
30						

<Results and Discussion>

[0118] Comparative example 1 is wrapping paper made up of so-called general-purpose paper (regular paper) formed out of fibers having wood pulp as a main component. High-speed operation in a filter maker was possible, given the general-purpose character of the paper, but the contact angle with water was low and leakage occurred readily, as a result of which hydrophilic bonding portions, being the main constituent of the paper, collapsed readily and eventually peeled off.

[0119] Comparative example 2 is wrapping paper for high air permeability, containing fibers having wood pulp as a main component and rayon, being regenerated fibers. The paper is coated with chemicals for the purpose of enhancing water resistance, and accordingly although the paper has a void structure, the initial contact angle with water is very high, and thus water is repelled by paper. The surface roughness of the paper is sufficient, and allows for high-speed operation.

[0120] With the passage of time, however, the water-soluble liquid gradually penetrated into hydrophilic bonding sites between fibers, while the thickness of the buffer zone of water-soluble liquid, of 55 μm, was insufficient. Collapse and leakage occurred ultimately as a result. The evaluation leakage after one day of storage for the amount of liquid added to the filter has a rating of Δ (fair), regarded herein as a practical limit. For the sake of a safer use, it is preferable to further increase the waterproofness of the web itself, with a thickness of 55 μm or greater.

[0121] Comparative example 3 is cellophane (cellulose film) having a barrier function in that cellophane has substantially no void structure for the passage of water or air. As the low contact angle with water indicates, however, hydrophilicity was high and gave rise to swelling and collapse with the passage of time. Further, surface roughness is virtually absent, and sufficient adhesive strength fails to be obtained at the wrap portion; as a result, just wrapping of the cellophane is difficult under ordinary settings. The result would still be impractical even if a waterproofing effect were achieved by coating the cellophane with a water resistance-imparting chemical.

[0122] Comparative example 4 is composite paper obtained through lamination of a water-repellent olefin onto one face of the regular paper of Comparative example 1. The paper lacks air permeability, and desktop water resistance is sufficient on account of the hydrophobicity of the laminate surface. However, the barrier effect at the laminate surface

is high and glue penetration is limited, although the paper exhibits roughness at the level of regular paper, on both faces. The operable speed is therefore somewhat lower than that of pulp, while waterproofness, as the essence of a filter, is low, which renders the paper unsuitable for practical use. This arises from the fact that even if the laminate surface is set as the inner side of the filter, water still penetrates from the pulp cut surface at the wrap portion (bonded portion) of the wrapping paper, and spreads to the surface of the paper from that point. Furthermore, adhesive strength is low, and accordingly peel strength as well lies outside a practical range.

[0123] Comparative example 5 is wrapping paper having a structure in which both faces of Comparative example 1 are laminated with a water-repellent olefin (polyethylene). Similarly to Comparative example 4, the paper lacks air permeability, and desktop water resistance is high enough on account of the hydrophobicity of the laminate surface. However, glue penetration at both faces is extremely limited, and accordingly the operable speed is even lower than that of Comparative example 4. Waterproofness as a filter cannot be regarded as perfect but is still higher than that of Comparative example 4. The paper is similar to that of Comparative example 4 in terms of exhibiting low peel strength, at a non-practical level.

[0124] Examples 1 and 3 differ in the thickness of the nonwoven fabric made up of double core-sheath structure fibers, as hydrophobic fibers, in turn made up of polypropylene on the inside and polyethylene on the outside. The wrapping paper in both examples has sufficient surface roughness, and accordingly exhibits high adhesive strength in the wrap portion and allows for high-speed operation. Although the void structure of the paper lets water and air readily through, the paper has a layer made up of polyolefin fibers, and the high contact angle with water is indicative of high waterproofness.

[0125] A phenomenon occurs however in that water is pressed into through-holes on account of a certain pressure that is exerted during formation of the filter. Therefore, waterproofness can be further increased by providing a buffer zone of water-soluble liquid, through an increase in thickness as in Example 3. Sufficient peel strength is moreover obtained on account of the effects elicited by water-resistant inter-fiber bonds and very large surface roughness.

[0126] To achieve waterproofness yet more completely it is effective to laminate a polyethylene film, as an air impermeable layer, on one face of a nonwoven fabric that utilizes double core-sheath structure fibers made up of polypropylene on the inside and polyethylene on the outside, illustrated in Examples 2 and 4. The surface roughness R_a on at least one face in the foregoing examples is larger than that of Comparative example 4 by one order of magnitude, and accordingly the examples exhibit sufficient adhesive strength at the wrap portion, and operation is possible at the same level as that of Comparative example 1. Lamination on both faces is not recommended, since this translates into a drop in operable speed, as in Comparative example 5. In terms of waterproofness, the problem of pressure during forming is solved by eliminating through-holes. Moreover, the paper has water-resistant inter-fiber bonds, and accordingly quality can be secured over long periods of time, with peel strength slightly lower than that in Examples 1 and 3 but still lying fully within a usable range.

[Reference Signs List]

[0127]

- 1 Cigarette
- 2 Tobacco rod
- 3 Tipping paper
- 4 Filter
- 5 Medium
- 6 Wrapping paper
- 7 Filter section
- 8 Hydrophobic fibers
- 9 Interfiber bonding points
- 10 Fused portion
- 61 Air impermeable layer
- 62 Layer made up of a nonwoven fabric

Claims

1. A tobacco filter wrapping paper comprising: a nonwoven fabric layer made up of hydrophobic fibers and having interfiber bonding points, wherein a contact angle with water of at least one surface from among a front surface and a back surface of the paper is 90° or greater, and thickness is 100 μm to 300 μm .

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2. A tobacco filter wrapping paper comprising: a nonwoven fabric layer made up of hydrophobic fibers and having interfiber bonding points, and an air impermeable layer, wherein a contact angle with water of at least one surface from among a front surface and a back surface of the paper is 50° or greater, and thickness is 100 μm to 300 μm.
- 5 3. The tobacco filter wrapping paper according to claim 2, wherein the air impermeable layer is a layer made up of a polyolefin.
- 10 4. The tobacco filter wrapping paper according to any one of claims 1 to 3, wherein an Ra value of at least one from among the front surface and the back surface is 10 or greater.
5. The tobacco filter wrapping paper according to any one of claims 1 to 4, wherein the hydrophobic fibers have a double core-sheath structure.
- 15 6. A tobacco filter comprising the tobacco filter wrapping paper of any one of claims 1 to 5, and a medium.
7. The tobacco filter according to claim 6, wherein a water-soluble liquid is added to the medium.
- 20 8. A cigarette comprising the tobacco filter of claim 6 or 7, and a tobacco rod.

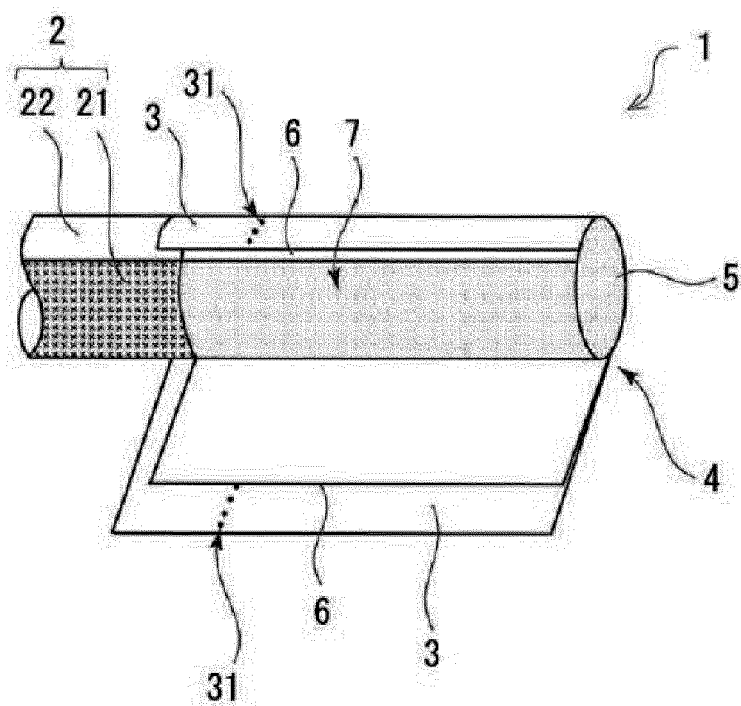


Fig.1

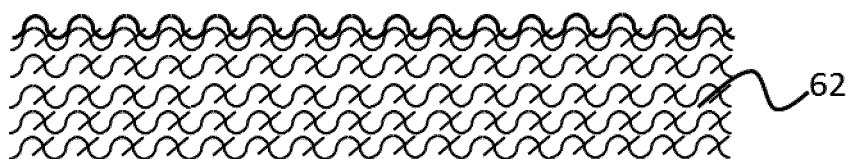


Fig.2

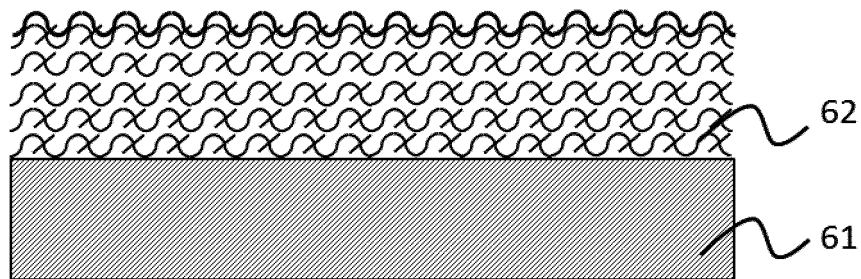


Fig.3

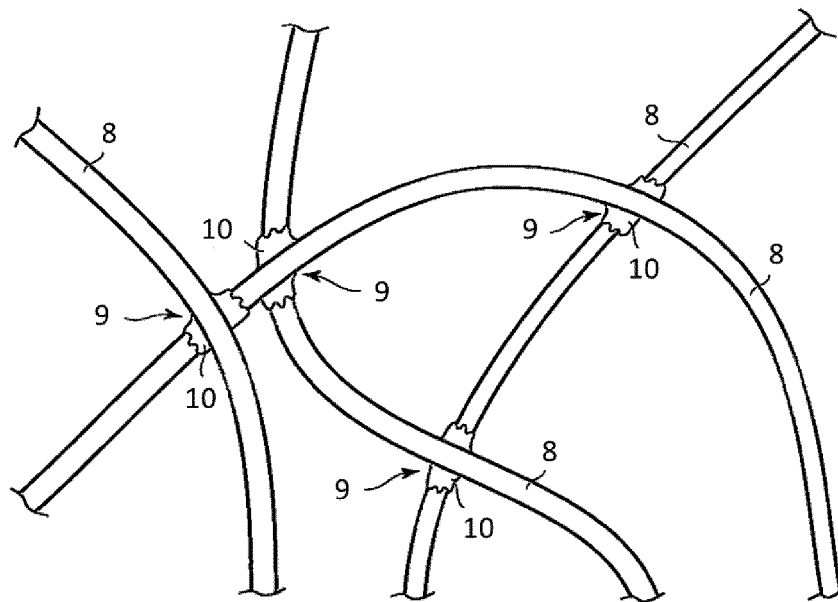


Fig.4

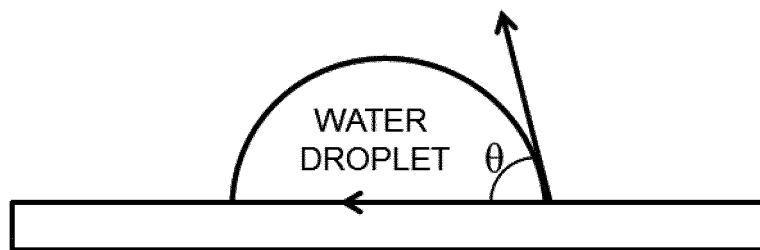


Fig.5

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2016/063718

A. CLASSIFICATION OF SUBJECT MATTER

A24D1/02(2006.01)i, A24C5/56(2006.01)i, A24D3/04(2006.01)i, D21H27/00
(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)

A24D1/02, A24C5/56, A24D3/04, D21H27/00

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 1996-2016

Kokai Jitsuyo Shinan Koho 1971-2016 Toroku Jitsuyo Shinan Koho 1994-2016

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 2015/107975 A1 (Japan Tobacco Inc.), 23 July 2015 (23.07.2015), paragraphs [0014], [0051]; fig. 1 to 2, 4 to 9 & TW 201531242 A	1-8
A	WO 2015/122426 A1 (Japan Tobacco Inc.), 20 August 2015 (20.08.2015), paragraphs [0019] to [0022]; fig. 1 to 4 & TW 201538090 A	1-8
A	US 2015/0272207 A1 (ESSENTRA FILTER PRODUCTS DEVELOPMENT CO. PTE. LTD.), 01 October 2015 (01.10.2015), entire text; all drawings & GB 201220098 D & GB 201220098 D0 & WO 2014/064087 A1	1-8

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

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Date of the actual completion of the international search
28 July 2016 (28.07.16)

Date of mailing of the international search report
09 August 2016 (09.08.16)

Name and mailing address of the ISA/
Japan Patent Office
3-4-3, Kasumigaseki, Chiyoda-ku,
Tokyo 100-8915, Japan

Authorized officer

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2016/063718

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2015/190256 A1 (Japan Tobacco Inc.), 17 December 2015 (17.12.2015), claim 4; paragraph [0010] & TW 201601644 A	1-8
A	JP 2015-536154 A (Philip Morris Products S.A.), 21 December 2015 (21.12.2015), claim 8; paragraphs [0023] to [0025]; fig. 3 & US 2015/0296875 A1 claim 8; paragraphs [0023] to [0025]; fig. 3 & WO 2014/086802 A2 & EP 2928329 A & TW 201438606 A & AU 2013354201 A & CN 104837377 A & KR 10-2015-0091118 A & MX 2015007117 A & HK 1211805 A	1-8
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Form PCT/ISA/210 (continuation of second sheet) (January 2015)

REFERENCES CITED IN THE DESCRIPTION

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