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(54) **TOW BAND FOR SMOKING ARTICLE, FILTER FOR SMOKING ARTICLE, SMOKING ARTICLE, AND CARTRIDGE FOR SMOKING ARTICLE**

(57) A band for a smoking article includes crimped cellulose acetate fibers. The content of titanium oxide is set to a value in a range from 0 wt.% to 0.01 wt.%. The crimp ratio I (%) calculated by Equation 1 satisfies the relationship of Equation 2,

[Equation 1]

$$\text{Crimp ratio } I (\%) = [(L1 - L0)/L0] \times 100$$

[Equation 1]

where L0 is a length of the band in a case where a load of 250 g is applied to the band having a length of 250 mm in a direction in which crimp of the cellulose acetate fibers is stretched, and L1 is a length of the band in a case where a load of 2500 g is applied to the band having the length of 250 mm in the direction,

[Equation 2]

$$(-11.7 + 1.2 \times FD + 0.00083 \times TD) < I (\%) < (10.0 + 1.2 \times FD + 0.00083 \times TD).$$

[Equation 2]

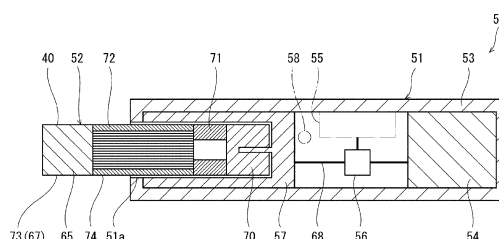


FIG. 3

Description

Technical Field

5 **[0001]** The present disclosure relates to a band for a smoking article, a filter for a smoking article, a smoking article, and a cartridge for a smoking article.

Background Art

10 **[0002]** This document uses the terms defined as follows.

[0003] TD: total fineness (total denier). TD refers to the fineness (grams per 9000 m) of a tow assembly (band).

[0004] FD: denier per filament (filament denier). FD refers to the fineness (grams per 9000 m) of a single fiber (one fiber). FD is also referred to as denier per filament.

15 **[0005]** Tow: a plurality of filament assemblies discharged from a spinneret hole of a cabinet. An end and a yarn are each an aspect of the tow.

[0006] Band: tows, which are assemblies of single fibers, discharged from each spinneret hole of a plurality of cabinets are bundled, and the TD is set to a predetermined numerical value. The bundled tow in which the TD is set to a predetermined numerical value is crimped. This crimped tow is a band. That is, the band has a TD and a number of crimps.

20 **[0007]** For example, cellulose acetate fibers are used as a material for a filter for a smoking article used in a combusted smoking article that is ignited and smoked, or a tip used in a cartridge of a heated smoking article that is heated and smoked (hereinafter, both the filter and the tip are also simply referred to as "filter"). The cellulose acetate fibers are spun by discharging spinning dope from a spinneret based on dry spinning, for example. A band is produced by crimping a plurality of cellulose acetate fibers. This band is opened and molded into a cylindrical shape, and winding paper is wound around the outer periphery. This produces a filter.

25 **[0008]** In addition to cellulose acetate, titanium oxide is added as a matting agent or a whitening agent to a spinning dope for spinning cellulose acetate fibers, as disclosed in Patent Document 1, for example. For example, as disclosed in Patent Document 2, a titanium compound is added to the spinning dope for the purpose of improving the spinnability of cellulose acetate fibers.

30 Citation List

Patent Document

[0009]

35 Patent Document 1: JP H8-500152 T

Patent Document 2: GB 949505 A

40 Summary of Invention

Technical Problem

45 **[0010]** In recent years, there has been a demand to produce a filter using cellulose acetate fibers that do not substantially contain titanium oxide. Cellulose acetate fibers not containing titanium oxide have lower frictional resistance than cellulose acetate fibers containing titanium oxide. For this reason, a filter produced by a band containing cellulose acetate fibers not containing titanium oxide can cause indentation in which the band shrinks relative to the winding paper from its axial end toward the inside. Indentation reduces the hardness of the filter. Indentation also reduces usability when the user holds the filter in the mouth. Further, indentation degrades the appearance of the filter.

50 **[0011]** One measure for preventing indentation of the filter is to increase the amount of stuffing of the band in the filter, for example. However, the pressure drop (PD) of the filter increases. This reduces ease of sucking through the filter and taste through the filter.

55 **[0012]** Therefore, an object of the present disclosure is to improve the quality of a filter produced using cellulose acetate fibers not substantially containing titanium oxide, by preventing indentation and a reduction in hardness while preventing an increase in pressure drop.

Solution to Problem

[0013] A band for a smoking article according to an aspect of the present disclosure includes crimped cellulose acetate fibers, content of titanium oxide is set to a value in a range from 0 wt.% to 0.01 wt.%, and a crimp ratio I (%) calculated by Equation 1 satisfies the relationship of Equation 2,

[Equation 1]

$$\text{Crimp ratio I (\%)} = [(L1 - L0)/L0] \times 100$$

where L0 is a length of the band in a case where a load of 250 g is applied to the band having a length of 250 mm in a direction in which crimp of the cellulose acetate fibers is stretched, and L1 is a length of the band in a case where a load of 2500 g is applied to the band having the length of 250 mm in the direction,

[Equation 2]

$$(-11.7 + 1.2 \times \text{FD} + 0.00083 \times \text{TD}) < \text{I (\%)} < (10.0 + 1.2 \times \text{FD} + 0.00083 \times \text{TD}).$$

[0014] Equation 2 is described such that the crimp ratio I (%) of the band is derived from the relationship between FD and TD in consideration of the ranges of FD and TD with which indentation can be suppressed when the filter is produced using the band based on the result studied by the inventors of the present application. According to the above configuration, the crimp ratio I (%) of the band is set to a value in a predetermined range according to the relationship between FD and TD of the band. This suppresses excessive crimp in a band in which FD is relatively large and TD is relatively small, for example. This makes it possible to decrease shrinkage of the band after opening. Therefore, even if the cellulose acetate fibers do not substantially contain titanium oxide, when the filter is produced using the band, the band can be hardly shrunk in the axial direction of the filter with respect to the winding paper. As a result, indentation of the filter can be prevented. Indentation of the filter can be prevented even without increasing the amount of stuffing of the band in the filter. This makes it possible to prevent pressure drop of the filter from increasing. It is also possible to prevent the appearance of the filter from degrading.

[0015] The FD may have a value in a range from 10 to 30, and TD may have a value in a range from 10000 to 50000. By setting FD to the above value, the rigidity of the cellulose acetate fibers is improved. Therefore, by setting TD to the above value, when the band is stuffed in a cylindrical filter, for example, it is possible to increase the repulsive force that the band gives to the winding paper, while appropriately retaining the pressure drop of the filter. This makes it possible to make the band less slippery in the axial direction of the filter with respect to the winding paper. As a result, indentation can be further prevented.

[0016] The number of crimps per 10 inch length of the surface may be a value in a range from 250 to 350. This makes it possible to retain crimping of the band in a suitable state. Therefore, when a filter is produced using the band, it is possible to produce a filter in which indentation is prevented and pressure drop is appropriately set, at a high quality.

[0017] A filter for a smoking article according to an aspect of the present disclosure includes: a filter material including any of the bands described above, the filter material being molded into a cylindrical shape; and winding paper wound around an outer periphery of the filter material, in which indentation of the filter material from an end of the winding paper in an axial direction of the filter material has a value in a range of equal to or less than 1 mm.

[0018] The filter for a smoking article may have a perimeter of a value in a range from 15 mm to 18 mm and TD of a value in a range from 15000 to 20000. Alternatively, the filter for a smoking article may have a perimeter of a value in a range from 21 mm to less than 23 mm and TD of a value in a range from 25000 to 30000. Alternatively, the filter for a smoking article may have a value in a range from 23.5 mm to 25.5 mm and TD of a value in a range from 30000 to 40000.

[0019] A smoking article according to an aspect of the present disclosure includes any of the filters for a smoking article described above, and a base member including tobacco leaf, the base member being molded into a cylindrical shape and disposed on one axial end side of the filter for a smoking article.

[0020] A cartridge for a smoking article according to an aspect of the present disclosure includes a base member including tobacco leaf, a hollow member configured such that a constituent generated by heating the base member passes through the hollow member, a coolant that cools the constituent having passed through the hollow member, and a filter material that filters a part of the constituent having passed through the coolant, in which at least any of the hollow member, the coolant, or the filter material includes the band described above.

Advantageous Effects of Invention

[0021] According to the present disclosure, it is possible to improve the quality of a filter produced using cellulose

acetate fibers not substantially containing titanium oxide, by preventing indentation and a reduction in hardness while preventing an increase in pressure drop.

Brief Description of Drawings

[0022]

FIG. 1 is a schematic view of a band production apparatus according to an embodiment.

FIG. 2 is a schematic view of a filter production apparatus according to an embodiment.

FIG. 3 is a cross-sectional view of a heated smoking article according to an embodiment.

FIG. 4 is a partially developed view of a combusted smoking article according to an embodiment.

Description of Embodiments

[0023] An embodiment will be described with reference to the drawings. "Smoking" mentioned herein includes both a case of igniting and smoking and a case of heating and smoking a base member containing tobacco leaf without igniting.

Embodiment

Cellulose Acetate Band Production Apparatus

[0024] FIG. 1 is a schematic view of a cellulose acetate (hereinafter, also referred to as "CA") band production apparatus 1. The CA band production apparatus 1 continuously spins CA fibers 61, which is a long fiber, by dry spinning. Using the CA fibers 61, the CA band production apparatus 1 produces a yarn 62, an end 63, and a CA band 64. The CA band 64 is a band for a smoking article. The CA band production apparatus 1 includes a mixing device 2, a filtering device 3, a spinning unit 4, a lubrication unit 5, godet rolls 6, a crimping apparatus 7, and a drying device 8.

[0025] In the CA band production apparatus 1, a spinning dope 60 in which cellulose acetate flakes made of, for example, cellulose diacetate are dissolved in an organic solvent at a predetermined concentration is used. This spinning dope 60 does not substantially contain titanium oxide. Specifically, the titanium oxide concentration of the spinning dope 60 has a value in a range where the content of titanium oxide in each CA fiber 61 to be spun is from 0 wt.% to 0.01 wt.%.

[0026] The spinning dope 60 is mixed using the mixing device 2, and then filtered by the filtering device 3. The spinning dope 60 having passed through the filtering device 3 is supplied to a spinneret 15 arranged on a cabinet 14 of the spinning unit 4. The spinning dope 60 is discharged from a plurality of spinneret holes 15a of the spinneret 15. The peripheral edge shape of the spinneret hole 15a is triangular as an example, but is not limited to this. The peripheral edge shape of the spinneret hole 15a may be circular as an example. The size of the spinneret hole 15a is appropriately set according to the FD of the CA fiber 61 after production.

[0027] The spinning dope 60 discharged from each spinneret hole 15a comes into contact with hot air supplied into the cabinet 14. The spinning dope 60 is dried by volatilization of the organic solvent. Due to this, CA fibers 61 as a solid are formed. The plurality of CA fibers 61 having passed through one cabinet 14 are collected to form the yarn 62. After the lubricant is applied by the lubrication unit 5, the yarn 62 is wound by the godet rolls 6. The yarn 62 is then taken up by a predetermined winding device.

[0028] In the CA band production apparatus 1, a plurality of the yarns 62 are accumulated or layered. This causes the plurality of yarns 62 to be collected to form the end (tow) 63, which is a flat assembly of the yarns 62. The end 63 has a predetermined TD. The end 63 is conveyed and guided to the crimping apparatus 7.

[0029] The crimping apparatus 7 includes a pair of nip rolls 16, 17 and a stuffing box 18. The end 63 is pressed into the stuffing box 18 after nip pressure is applied at nip points of the pair of nip rolls 16, 17. Due to this, the end 63 is crimped to produce the CA band 64. The CA band 64 having passed through the crimping apparatus 7 is dried and accumulated by the drying device 8. Thereafter, the CA band 64 is compressed and packed into a packing container 19 in the form of a bale.

[0030] In the CA band 64, the crimp ratio I (%) calculated by Equation 1 satisfies the relationship of Equation 2,

[Equation 1]

$$\text{Crimp ratio I (\%)} = [(L1 - L0)/L0] \times 100$$

where L0 is a length of the CA band 64 in a case where a load of 250 g is applied to the CA band 64 having a length of 250 mm in a direction in which the crimp of the CA fibers 61 is stretched, and L1 is a length of the CA band 64 in a case where a load of 2500 g is applied to the CA band 64 having a length of 250 mm in the same direction,

[Equation 2]

$$(-11.7 + 1.2 \times \text{FD} + 0.00083 \times \text{TD}) < \text{I} (\%) < (10.0 + 1.2 \times \text{FD} + 0.00083 \times \text{TD}).$$

[0031] Equation 2 shows that the crimp ratio I (%) of the CA band 64 is set in relation to the FD and the TD of the CA band 64. In the CA band 64, the crimp ratio I (%) is set to a value that falls within an appropriate range in a case where the CA band 64 is used for a filter application while the FD is set to a relatively large value and the TD is set to a relatively small value by satisfying the relationship of Equation 2. That is, the CA band 64 is less likely to be excessively crimped. Due to this, the CA band 64 shrinks less due to crimping after opening. Therefore, when the filter is produced using the CA band 64, the CA band 64 shrinks less in the axial direction of the filter due to crimping even in a case where the amount of stuffing in the filter is not so large.

[0032] The FD of the CA band 64 can be set to any value in a range where Equation 2 is satisfied. An example of the FD of the CA band 64 is a value in a range from 10 to 30. As still another example, one of 9.9, 10, 11.8, 19.2, and 20 is an example of the lower limit value of the FD of the CA band 64. One of 25 and 30, whichever is a value larger than the lower limit value, is an example of the upper limit value of the FD of the CA band 64.

[0033] The TD of the CA band 64 can be set to any value in a range where Equation 2 is satisfied. An example of the TD of the CA band 64 is a value in a range from 10000 to 50000. As another example, one of 10000, 15000, 16800, 17000, 25000, 25700, and 30000 is an example of the lower limit value of the TD of the CA band 64. One of 20000, 30000, 40000, or 50000, whichever is a value larger than the lower limit value, is an example of the upper limit value of the TD of the CA band 64.

[0034] In the CA band 64, when the FD is 10 and the TD is 10000, the crimp ratio I (%) is a value in a range from 8.6 to 30.3. In the CA band 64, when the FD is 10 and the TD is 50000, the crimp ratio I (%) is a value in a range from 41.8 to 63.5. In the CA band 64, when the FD is 30 and the TD is 10000, the crimp ratio I (%) is a value in a range from 32.6 to 54.3. In the CA band 64, when the FD is 30 and the TD is 50000, the crimp ratio I (%) is a value in a range from 65.8 to 87.5.

[0035] In the CA band 64 of the present embodiment, the number of crimps per 10 inch length of the surface is a value in a range from 250 to 350. The number of crimps mentioned here can be measured based on the measurement method described in JP H7-316975 A, for example. That is, a personal computer or an image processing device, for example, is used to convert a captured image of the illuminated surface of the CA band 64 into data with a light amount level of 256 gradations. Then, the number of crimps can be measured by counting, as crimps, peaks having a gray level difference of 10 or greater gradations among the data from which a peak waveform of noise shorter than a cycle of a primary crimp has been removed.

[0036] Thus, according to the above configuration, the crimp ratio I (%) of the CA band 64 is set to a value in a predetermined range according to the relationship between the FD and the TD of the CA band 64. This suppresses excessive crimping in the CA band 64 in which the FD is relatively large and the TD is relatively small, for example. This makes it possible to decrease shrinkage of the CA band 64 after opening. Therefore, even if the CA fibers 61 do not substantially contain titanium oxide, when the filter is produced using the CA band 64, the CA band 64 is less likely to shrink in the axial direction of the filter with respect to the winding paper. As a result, indentation of the filter can be prevented. Indentation of the filter can be prevented even without increasing the amount of stuffing of the CA band 64 in the filter. This makes it possible to prevent an increase in pressure drop of the filter. It is also possible to prevent the appearance of the filter from degrading.

[0037] In the CA band 64 of the present embodiment, the FD is a value in a range from 10 to 30 and the TD is a value in a range from 10000 to 50000. By setting the FD to the above value, the rigidity of the CA fibers 61 is improved. Therefore, by setting the TD to the above value, when the CA band 64 is stuffed into a cylindrical filter, for example, it is possible to increase the repulsive force that the CA band 64 gives to the winding paper while appropriately retaining the pressure drop of the filter. This makes it possible to make the CA band 64 less slippery in the axial direction of the filter with respect to the winding paper. As a result, indentation can be further prevented.

[0038] In the CA band 64 of the present embodiment, the number of crimps per 10 inch length of the surface is a value in a range from 250 to 350. This makes it possible to retain the crimp of the CA band 64 in a suitable state. Therefore, when a filter is produced using the CA band 64, it is possible to produce a filter in which indentation is prevented and pressure drop is appropriately set, at a high quality.

Filter Production Apparatus

[0039] FIG. 2 is a schematic view of a filter production apparatus 20 according to an embodiment. As illustrated in FIG. 2, the filter production apparatus 20 includes a collection ring 21, a first opening unit 22, a guide 23, a second opening unit 24, a pre-tension roll pair 25, a first opening roll pair 26, a second opening roll pair 27, a third opening unit 28, a plasticizer application apparatus 29, a conveying roll pair 30, a transport jet 31, a transport stuffer unit 32, and a cutting device 33.

[0040] In the filter production apparatus 20, the CA band 64 drawn up from inside the packing container 19 passes through the collection ring 21, and then is opened in the width direction by pressurized gas in the first opening unit 22. Thereafter, the CA band 64 is guided by the guide 23. Next, the CA band 64 is opened further in the width direction by pressurized gas in the second opening unit 24, and then sequentially inserted between the pre-tension roll pair 25, between the first opening roll pair 26, and between the second opening roll pair 27. Due to this, the CA band 64 is opened in a conveyance direction.

[0041] The CA band 64 having passed between the second opening roll pair 27 is opened further in the width direction by pressurized gas in the third opening unit 28. Thereafter, a plasticizer is applied to the CA band 64 by the plasticizer application apparatus 29. The CA band 64 having passed through the plasticizer application apparatus 29 is inserted between the conveying roll pair 30. Thereafter, the CA band 64 is introduced into the transport jet 31 and carried into the transport stuffer unit 32 by a jet stream.

[0042] The transport stuffer unit 32 has a funnel 41, a tongue 42, and a garniture 43. The CA band 64 transported into the transport stuffer unit 32 is wound at the funnel 41 and molded into a cylindrical shape. As a result, a filter material 65 including the CA band 64 and molded into a cylindrical shape is formed. A winding paper 40 is guided toward the filter material 65 by the tongue 42. The filter material 65 is conveyed by the garniture 43, and the winding paper 40 is wound and fixed around the outer periphery of the filter material 65.

[0043] The cutting device 33 cuts the filter material 65 into a predetermined dimension. Thus, a plug (rod) 66 is produced. The plug 66 is further cut to produce a filter 67 that includes the filter material 65 including the CA band 64 and the winding paper 40 wound around the outer periphery of the filter material 65 is produced.

[0044] As described above, in the CA band 64 contained in the filter 67, the content of titanium oxide is set to a value in a range from 0 wt.% to 0.01 wt.%, and the crimp ratio I (%) calculated by Equation 1 satisfies the relationship of Equation 2. Thus, the filter 67 is prevented from indentation. In the filter 67, the stuffing amount of the CA band 64 is appropriately set, and an appropriate amount of the CA band 64 is used for stuffing. Due to this, the filter 67 has an appropriate pressure drop.

Heated Smoking Article

[0045] FIG. 3 is a cross-sectional view of a heated smoking article 50 according to an embodiment. This smoking article 50 is a heated tobacco product. The smoking article 50 has a long shape and includes a unit 51 and a replaceable cartridge 52. As an example, the unit 51 includes an enclosure 53, a heating unit 57 that heats a base member 70 (described later) of the cartridge 52, a power supply 54 that is an operation drive source, a display unit 55 that displays information to a user, an operation unit 58 operated by the user, and a control unit 56 that controls the display unit 55 and the heating unit 57.

[0046] The cartridge 52 is an aerosol generation article used in the smoking article 50. The cartridge 52 includes the base member 70, a hollow member 71, a coolant 72, and a tip 73. As an example, the cartridge 52 is molded into a cylindrical shape. The base member 70, the hollow member 71, and the filter material 65 are each also molded into a cylindrical shape. The hollow member 71, the coolant 72, and the tip 73 are integrally wound from a winding paper 74 in a state of being arranged side by side in the longitudinal direction. When the smoking article 50 is to be used, the cartridge 52 is inserted into an insertion port 51a formed at the other longitudinal end of the unit 51. In the cartridge 52 of the present embodiment, at least any of the hollow member 71, the coolant 72, or the tip 73 includes the CA band 64. By configuring two or more of the components 71 to 73 to include the CA band 64, the materials of the cartridge 52 can be made common. This makes it possible to improve the production efficiency of the cartridge 52.

[0047] The base member 70 includes tobacco leaf. The base member 70 contains a tobacco constituent that can be vaporized by heating. The base member 70 vaporizes the tobacco constituent by being heated by the heating unit 57 when the smoking article 50 is in use. The base member 70 of the present embodiment also contains a flavor constituent such as nicotine that can be vaporized by heating. The base member 70 is disposed at one longitudinal end of the cartridge 52 (the insertion side to the insertion port 51a).

[0048] The base member 70 may include, for example, at least any of tobacco rib, expanded tobacco, homogenized tobacco, and herb leaf. These materials may be contained in the base member 70 in the form of a solid being any of fine fragments, a powder, a thread, or a band, in the form of a liquid, or in the form of both a solid and a liquid. When the material is contained as a liquid, the liquid of the material may be enclosed in a capsule. Such a capsule is heated and melted when the smoking article 50 is in use.

[0049] The flavor constituent may be carried on a thermally stable carrier. The flavor constituent may be carried on the carrier in the form of a sheet, foam, gel, or slurry. The flavor constituent may be dispersed in the base member 70, or may be unevenly distributed at specific positions in the base member 70.

[0050] The hollow member 71 is disposed between the base member 70 and the coolant 72. The hollow member 71 is formed into a cylindrical shape. The hollow member 71 is configured such that a constituent generated by heating the base member 70 passes through the hollow member 71. The hollow member 71 functions as a separator that separates

the base member 70 and the coolant 72. The hollow member 71 prevents the cartridge 52 from being compressed in the longitudinal direction and the base member 70 from being crushed when the cartridge 52 is inserted into the unit 51 from the insertion port 51a. The hollow member 71 of the present embodiment includes the CA band 64. The hollow member 71 may contain other materials such as polypropylene.

[0051] The coolant 72 cools the constituent having passed through the hollow member 71. The coolant 72 of the present embodiment generates an aerosol (liquid) by cooling and aggregating a gas constituent from the base member 70 that has passed through the hollow member 71. The coolant 72 includes, for example, a band-like sheet body wound in the circumferential direction of the cartridge 52 or a band-like sheet body finely folded with each fold extending in the longitudinal direction of the cartridge 52. In the coolant 72, a circulation path for the aerosol is formed by gaps in the sheet body thus wound or finely folded.

[0052] The coolant 72 of the present embodiment includes the CA band 64. The coolant 72 may contain one or more of, for example, polyethylene, polypropylene, polyvinyl chloride, high-strength polyethylene terephthalate (polyethylene terephthalate copolymer) (PETG), polylactic acid, and starch-based polyester. The sheet body of the coolant 72 may be made of a material of any of porous paper, aluminum foil, or the like.

[0053] The tip 73 filters a part of the constituent having passed through the coolant 72. The tip 73 is the filter 67. The tip 73 is disposed on the cartridge 52 on the side opposite to the base member 70. The tip 73 is put in the user's mouth when the smoking article 50 is in use. The tip 73 filters the aerosol having passed through the coolant 72.

[0054] Here, smoking comfort of a heated smoking article is preferably close to smoking comfort of, for example, a cigarette, which is a combusted smoking article. Therefore, the tip 73 includes the CA band 64 in which the plurality of CA fibers 61 are crimped, similar to a filter of a cigarette, which is a combusted smoking article.

[0055] The dimension of the tip 73 in the insertion direction with respect to the insertion port 51a (hereinafter, referred to as "length dimension of the tip 73") can be appropriately set. The length dimension of the tip 73 is set to a value in a range of, for example, from 5 mm to 35 mm. One of 5 mm, 7 mm, or 10 mm is an example of the lower limit value of the length dimension of the tip 73, for example. One of 17 mm, 20 mm, 25 mm, 28 mm, 30 mm, or 35 mm is an example of the upper limit value of the length dimension of the tip 73.

[0056] The pressure drop of the tip 73 is proportional to the length dimension of the tip 73. The pressure drop of the tip 73 can be calculated, for example, by comparing the length dimension of the tip 73 with the length dimension of the filter material 65, which has a known pressure drop. The perimeter of the tip 73 can be set as appropriate, and is, as an example, a value in a range of equal to or greater than 15 mm. A value in a range from 16 mm to less than 17 mm is an example of the perimeter of the tip 73. As another example, a value in a range from 21 mm to less than 23 mm is an example of the perimeter of the tip 73. As still another example, a value in a range from 23.5 mm to 25.5 mm is an example of the perimeter of the tip 73.

[0057] When using the smoking article 50, the user inserts the cartridge 52 into the unit 51 from the insertion port 51a. Then, the operation unit 58 is operated to turn on the power supply of the unit 51. The control unit 56 controls a power supply circuit to heat the heating unit 57 with electric power from the power supply 54. When the heating unit 57 is heated to a predetermined temperature and a predetermined time elapses, the control unit 56 notifies the user that smoking is possible via the display unit 55.

[0058] When the user holds the tip 73 in the mouth and inhales, a gas component from the base member 70 generated by being heated by the heating unit 57 circulates through the hollow member 71. At least some of the gas component having passed through the hollow member 71 is cooled and aggregated when circulating through the gaps of the coolant 72. This generates an aerosol. The aerosol having passed through the coolant 72 is sucked by the user after passing through the tip 73.

[0059] Here, in the cartridge 52, indentation of the tip 73 is prevented. This prevents the hardness of the tip 73 from being reduced due to indentation of the tip 73. This allows the user to experience good usability when holding the tip 73 in the mouth. Further, degradation of the appearance of the cartridge 52 due to the indentation of the tip 73 is prevented. In the tip 73, an appropriate amount of the CA band 64 is used for stuffing. Therefore, the pressure drop of the tip 73 is set to a value that is not too high. This prevents the tip 73 from excessively filtering the aerosol. Therefore, the user can experience a good taste due to the cartridge 52.

[0060] Since the CA band 64 is appropriately crimped, the stuffing amount of the CA band 64 is stable in the tip 73. Due to this, for example, when a capsule is disposed inside the tip 73, the position of the capsule in the tip 73 is less likely to change due to a variation in density of the CA band 64. Therefore, the capsule can be easily positioned in the tip 73. There is a case where the tip 73 used in the heated smoking article 50 has a shorter length dimension than when used in a combusted smoking article. In this case, when the tip 73 has indentation, the proportion of the indentation in the length direction of the tip 73 increases. Therefore, a defect due to the indentation increases. In the present embodiment, such a defect due to indentation can be satisfactorily prevented.

Combusted Smoking Article

[0061] FIG. 4 is a partially expanded view of a combusted smoking article 45 of an embodiment. FIG. 4 illustrates a state in which rolling paper 46 is partially expanded to show the internal configuration of the smoking article 45. The smoking article 45 illustrated in FIG. 4 is ignited and smoked. The smoking article 45 of the present embodiment is a cigarette. The smoking article 45 includes a base member 47, the filter (filter for a smoking article, or cigarette filter) 67, and the rolling paper 46. The base member 47 includes a cigarette filler 48 containing tobacco leaf and winding paper 49 wound around an outer periphery of the cigarette filler 48. The base member 37 is molded into a cylindrical shape and is disposed at one axial end of the filter 67. The rolling paper 46 is wound over the outer periphery of the base member 47 and the filter 67 in a state where the base member 47 and the filter 67 are arranged side by side in the longitudinal direction. The smoking article 45 is a thin cigarette, as an example, and has a diameter from 3.0 mm to 6.0 mm. As the format of the thin cigarette, "super slim" or "ultra super slim" are examples, but the format is not limited to this. As another example of the format of the cigarette of the smoking article 45, "demi slim" or "regular" are examples, but the format is not limited to this.

[0062] As an example, the smoking article 45 has a perimeter of a value in a range from 15 mm to 18 mm and a TD of a value in a range from 15000 to 20000. As another example, the smoking article 45 has a perimeter of a value in a range from 21 mm to less than 23 mm and a TD of a value in a range from 25000 to 30000. As another example, the smoking article 45 has a perimeter of a value in a range from 23.5 mm to 25.5 mm and a TD of a value in a range from 30000 to 40000. In the filter 67, indentation of the filter material 65 from an end of the winding paper 40 in an axial direction of the filter material 65 has a value in a range of equal to or less than 1 mm. The smoking article 45 is prevented from indentation in the filter 67, even when configured as a thin cigarette, for example. The filter 67 has appropriate pressure drop. Therefore, ease of smoking the smoking article 45 at the time of smoking is retained. Further, good filtration performance of the filter 67 is obtained. This effect is similarly obtained even when the smoking article 45 is a cigarette having a certain diameter. The smoking article 45 may be an article other than a cigarette.

[0063] Next, a filter according to a modification of the embodiment will be described. The filter according to the present modification is disposed at one axial end of a cigar. This filter has a similar structure to the tip 73 (filter 67). As the format of a cigar applied with this filter, a cigarillo is an example, but the format is not limited to this.

Confirmation Test

[0064] Next, a confirmation test will be described. The present disclosure is not limited to Examples 1 to 4 described below.

[Test 1]

[0065] A CA band and a plug of Examples 1 to 4 and Comparative Examples 1 to 5 were produced by the following procedure. 29 wt.% of CA flakes of cellulose diacetate were dissolved in an organic solvent (acetone and water mixture) to prepare the spinning dope 60 having a titanium oxide concentration of 0 wt.%. The CA fiber 61 (Y-shaped cross section) of Example 1 was spun using the plurality of spinnerets 15 formed with the plurality of spinneret holes 15a each having a triangular peripheral edge shape with a side length of 118 μm . Here, a total of 15 spinnerets 15 were used. The spinneret 15 has 145 spinneret holes 15a per spinneret.

[0066] The CA band 64 of Example 1 having a FD of about 10 (actual measurement value 9.9) and a TD of about 17000 (actual measurement value 16800) was produced by adjusting the discharge amount from the spinneret holes 15a, the winding speed of the winding device for winding the spun CA fiber 61, and the peripheral speed of the pair of nip rolls 16 and 17. In the crimping apparatus 7, the crimp ratio I (%) of the CA band 64 was set to 25% by adjusting the nip pressure of the pair of nip rolls 16 and 17 and the pressing force of pressing the end 63 into the stuffing box 18.

[0067] The CA band 64 of Example 2 was produced by a similar method to that in Example 1 except that the CA band 64 having a FD of about 12 (actual measurement value 11.8) and a TD of about 25000 (actual measurement value 25700) was spun, and the crimp ratio I (%) was set to 43% based on Equation 2. The CA band 64 of Example 3 was produced by a similar method to that in Example 2 except that the crimp ratio I (%) was set to 32%. The CA band 64 of Example 4 was produced by a similar method to that in Example 1 except that the CA band 64 having a FD of about 20 (actual measurement value 19.2) and a TD of 27000 (actual measurement value 27000) was spun, and the crimp ratio I (%) thereof was set to 45%.

[0068] The CA band of Comparative Example 1 was produced by a similar method to that in Example 1 except that the crimp ratio I (%) of the CA band was set to 47%. The CA band of Comparative Example 2 was produced by a similar method to that in Example 2 except that a mixed solution having a titanium oxide concentration of 0.5 wt.% was used and the crimp ratio I (%) of the CA band was set to 56%. The CA band of Comparative Example 3 was produced by a similar method to that in Example 2 except that the crimp ratio I (%) of the CA band was set to 56%. The CA band of

Comparative Example 4 was produced by a similar method to that in Example 2 except that the crimp ratio I (%) of the CA band was set to 22%. The CA band of Comparative Example 5 was produced by a similar method to that in Example 4 except that the crimp ratio I (%) of the CA band was set to 66%. The number of crimps per 10 inch length of the CA bands of Examples 1 to 4 and Comparative Examples 1 to 5 were measured by the method described above.

[0069] Next, using the CA bands of Examples 1 to 4 and Comparative Examples 1 to 5, whether the filter production apparatus 20 (winding machine "KDF-2" produced by Hauni Ltd.) was capable of producing a plug (rod), which is an intermediate body immediately before cutting the tip for electronic cigarette, was confirmed. It was found that, in Comparative Example 4, production of the plug was difficult because crimping of the CA band was insufficient, and problems such as entanglement of the CA fibers in the filter production apparatus 20 occurred. Therefore, plugs were produced for Examples 1 to 4 and Comparative Examples 1 to 3 and 5.

[0070] The length dimensions of the plugs of Examples 1 to 4 and Comparative Examples 1 to 3 and 5 were set to 120 mm. The perimeters of the plugs of Example 1 and Comparative Example 1 were set to 16.5 mm. The perimeters of the plugs of Examples 2 to 4 and Comparative Examples 2, 3, and 5 were set to 22.5 mm. The amount of stuffing of the CA band into the plugs of Example 1 and Comparative Example 1 (stuffing amount per unit length of the plug: NTW) was set to 0.29 g/rod. The amount of stuffing of the CA band into the plugs of Examples 2 to 4 and Comparative Examples 2 and 3 (stuffing amount per plug length (rod length): NTW) was set to 0.47 g/rod. The amount of stuffing of the CA band into the plugs of Example 4 and Comparative Example 5 (stuffing amount per unit length of the tip: NTW) was set to 0.5 g/rod. Further,

[0071] In each of Examples 1 to 4 and Comparative Examples 1 to 3 and 5, ten plugs were produced, and an appearance abnormality of the plug was confirmed by the following procedure. First, the plurality of plugs in each of Examples 1 to 4 and Comparative Examples 1 to 3 and 5 were placed on a base surface with an inclination angle of 45 degrees such that the longitudinal direction was along the vertical direction. In this state, the presence or absence of an appearance abnormality was confirmed using a microscope with a scale capable of measuring the length dimension of the object. Thus, the indentation depth of each plug (the indentation depth of the filter material from the end of the winding paper in the axial direction of the filter material) was measured. Then, a mean value of the measured values was calculated.

[0072] In each of Examples 1 to 4 and Comparative Examples 1 to 3 and 5, tips were produced by cutting the 10 produced plugs into a length dimension of 7 mm. A test cartridge was produced by connecting each of these tips with a remaining portion at which a tip is cut off from a cartridge "HeatStick (registered trademark)" for "iQOS" produced by Philip Morris International Inc. The pressure drop (PD) (mmWG) of each aerosol generation component was measured using a filter plug measurer (automatic pressure drop measurer) "QTM" produced by Celulean Ltd. Then, a mean value of the measured values was calculated. The test results are shown in Tables 1 and 2. Tables 1 and 2 show, as mean values, values of the indentation depth of the plug and the pressure drop of the aerosol generation component.

[Table 1]

	Example 1	Example 2	Example 3	Example 4
Titanium oxide content (wt. %) of CA band	0	0	0	0
FD	9.9	11.8	11.8	19.2
TD	16800	25700	25700	27000
Crimp ratio I (%) by Equation 2	$14.1 < I (\%) < 35.8$	$23.8 < I (\%) < 45.5$	$23.8 < I (\%) < 45.5$	$33.8 < I (\%) < 55.5$
Measured crimp ratio I (%)	25	43	32	45
Plug processing possible?	Yes	Yes	Yes	Yes
PD (mmWG)	355	115	115	79
Appearance abnormality of plug end	Indentation 1 mm or less	Indentation 1 mm or less	Indentation 1 mm or less	Indentation 1 mm or less
Number of crimps per 10 inch length	300	340	290	300
Stuffing amount of CA band into plug (NTW (g))	0.29	0.47	0.47	0.5
Plug perimeter (mm)	16.5	22.5	22.5	22.5

[Table 2]

	Comparative Example 1	Comparative Example 2	Comparative Example 3	Comparative Example 4	Comparative Example 5
Titanium oxide content (wt.%) of CA band	0	0.5	0	0	0
FD	9.9	11.8	11.8	11.8	19.2
TD	16800	25700	25700	25700	27000
Crimp ratio I (%) by Equation 2	$14.1 < I (\%) < 35.8$	$23.8 < I (\%) < 45.5$	$23.8 < I (\%) < 45.5$	$23.8 < I (\%) < 45.5$	$33.8 < I (\%) < 55.5$
Measured crimp ratio I (%)	47	56	56	22	66
Plug processing possible?	Yes	Yes	Yes	No	Yes
PD (mmWG)	360	120	120	-	81
Appearance abnormality of plug end	Indentation 1 mm or greater	Indentation 1 mm or less	Indentation 1 mm or greater	-	Indentation 1 mm or greater
Number of crimps per 10 inch length	400	400	400	240	400
Stuffing amount of CA band into plug (NTW (g))	0.29	0.47	0.47	-	0.5
Plug perimeter (mm)	16.5	22.5	22.5	-	22.5

[0073] As shown in Table 1, in Examples 1 to 4, a stuffing amount of the CA band equivalent to that in Comparative Examples 1 to 3 and 5 was set, but it was confirmed that the indentation of the plug was less than that in Comparative Examples 1 to 3 and 5 and the depth of indentation was equal to or less than 1 mm. Due to this, it was confirmed that the plugs of Examples 1 to 4 had a good appearance. In Examples 1 to 4, it was confirmed that the pressure drop of the tip 73 in the cartridge 52 was appropriately set, and the aerosol of the cartridge 52 was sucked well when the smoking article 50 was in use. From the above, superiority of Examples 1 to 4 over Comparative Examples 1 to 5 was confirmed. From the tendency indicated by the test results, it is thought that similar excellent results to those of Examples 1 to 5 can be obtained even in a case where the FD of the CA band 64 has a value in a range of greater than 19.2 and equal to or less than 30 and the TD of the CA band 64 has a value in a range of greater than 27000 and equal to or less than 30000.

[0074] Note that each of the configurations, combinations thereof, or the like in the embodiments are exemplary, and additions, omissions, replacements, and other changes to the configurations may be made as appropriate without departing from the spirit of the present disclosure. The present disclosure is not limited by the embodiments and is limited only by the claims. Each aspect disclosed in the present specification can be combined with any other feature disclosed herein.

Reference Signs List

[0075]

- 45 Combusted smoking article
- 50 Heated smoking article
- 52 Cartridge
- 61 CA fiber
- 64, 164 CA band
- 65 Filter material
- 67 Filter (filter for smoking article)

70 Base member
 71 Hollow member
 72 Coolant
 73 Tip (filter)

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Claims

1. A band for a smoking article, comprising

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a crimped cellulose acetate fiber, wherein
 content of titanium oxide is set to a value in a range from 0 wt.% to 0.01 wt.%, and
 a crimp ratio I (%) calculated by Equation 1 satisfies a relationship of Equation 2,

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[Equation 1]

$$\text{Crimp ratio I (\%)} = [(L1 - L0)/L0] \times 100$$

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where L0 is a length of the band in a case where a load of 250 g is applied to the band having a length of 250 mm in a direction in which crimp of the cellulose acetate fibers is stretched, and L1 is a length of the band in a case where a load of 2500 g is applied to the band having the length of 250 mm in the direction,

[Equation 2]

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$$(-11.7 + 1.2 \times \text{FD} + 0.00083 \times \text{TD}) < \text{I (\%)} < (10.0 + 1.2 \times \text{FD} + 0.00083 \times \text{TD}).$$

2. The band for a smoking article according to claim 1, wherein

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FD has a value in a range from 10 to 30, and
 TD has a value in a range from 10000 to 50000.

3. The band for a smoking article according to claim 1 or 2, wherein a number of crimps per 10 inch length of a surface is a value in a range from 250 to 350.

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4. A filter for a smoking article, comprising:

a filter material including the band described in any one of claims 1 to 3, the filter material being molded into a cylindrical shape; and
 winding paper wound around an outer periphery of the filter material, wherein
 indentation of the filter material from an end of the winding paper in an axial direction of the filter material has a value in a range of equal to or less than 1 mm.

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5. The filter for a smoking article according to claim 4, wherein a perimeter has a value in a range from 15 mm to 18 mm, and TD is a value in a range from 15000 to 20000.

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6. The filter for a smoking article according to claim 4, wherein a perimeter has a value in a range from 21 mm to less than 23 mm, and TD is a value in a range from 25000 to 30000.

7. The filter for a smoking article according to claim 4, wherein a perimeter has a value in a range from 23.5 mm to 25.5 mm, and TD is a value in a range from 30000 to 40000.

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8. A smoking article comprising:

the filter for a smoking article described in any one of claims 4 to 7; and
 a base member including tobacco leaf, the base member being molded into a cylindrical shape and disposed on one axial end side of the filter for a smoking article.

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9. A cartridge for a smoking article, comprising:

a base member including tobacco leaf;
a hollow member configured such that a constituent generated by heating the base member passes through
the hollow member;
5 a coolant that cools the constituent having passed through the hollow member; and
a filter material that filters a part of the constituent having passed through the coolant, wherein
at least any of the hollow member, the coolant, or the filter material includes the band described in any of claims
1 to 3.

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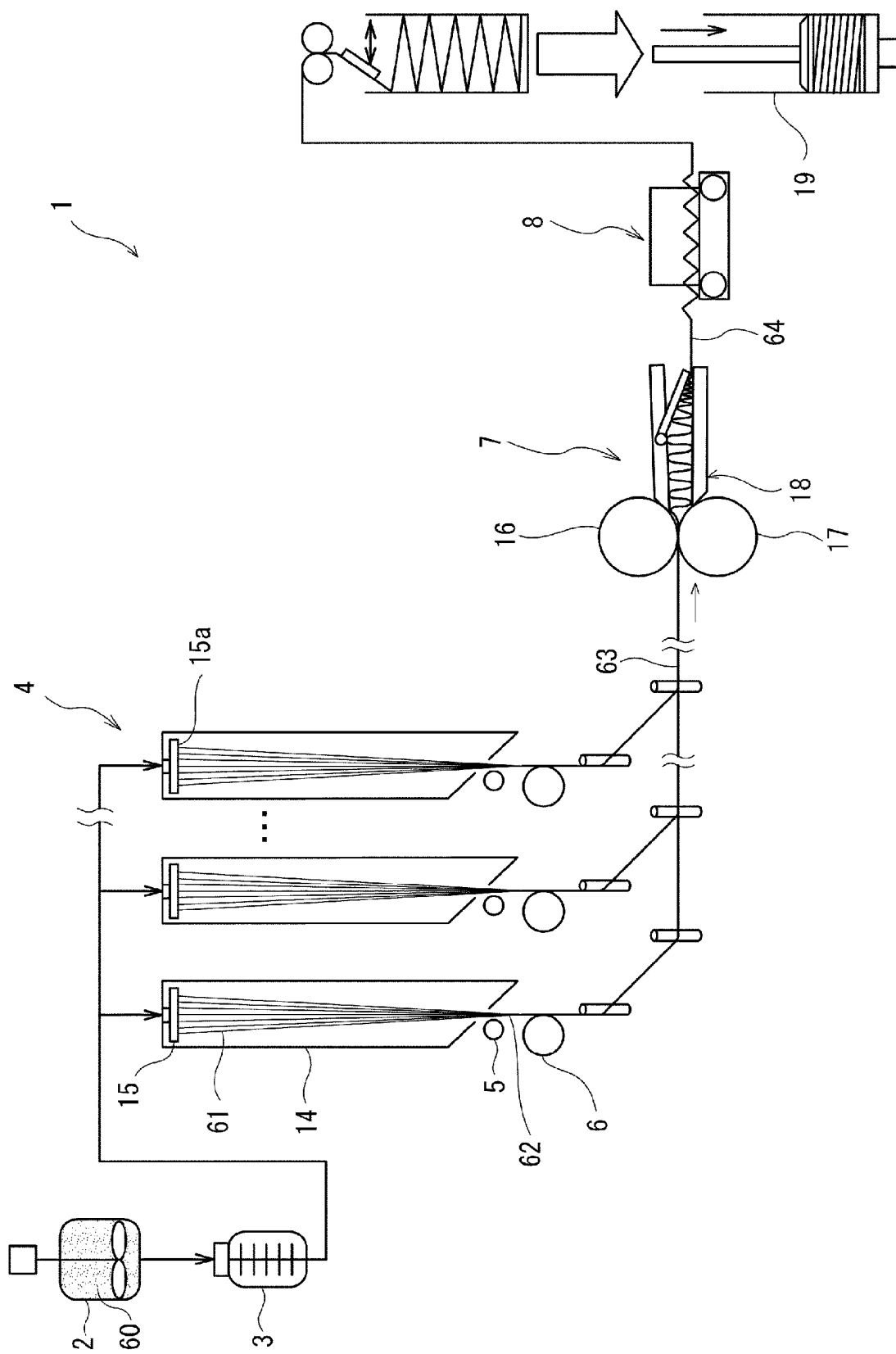


FIG. 1

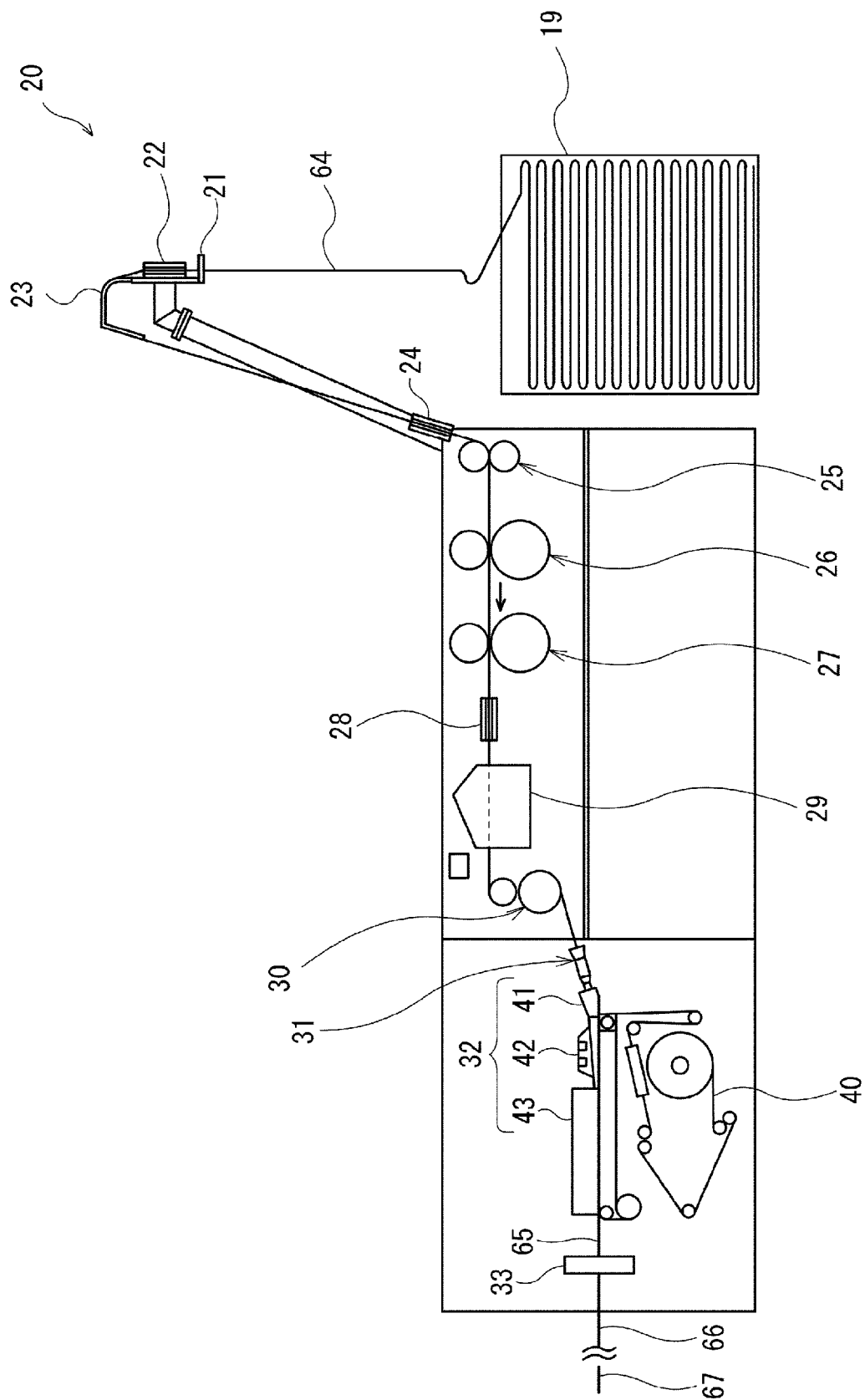


FIG. 2

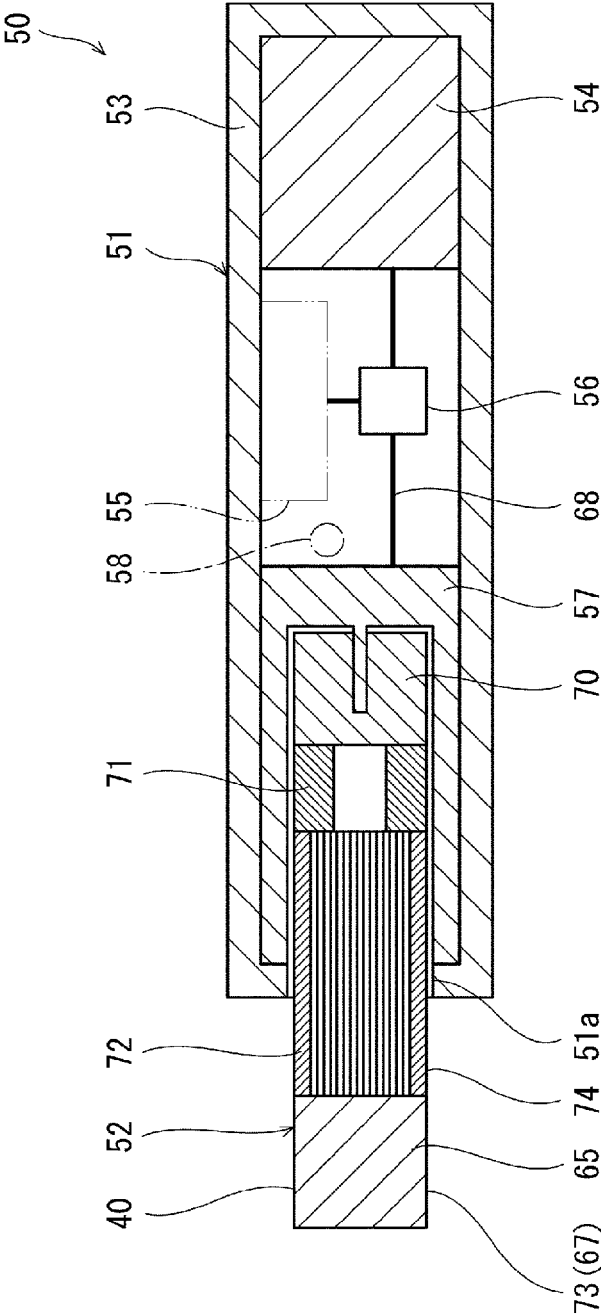


FIG. 3

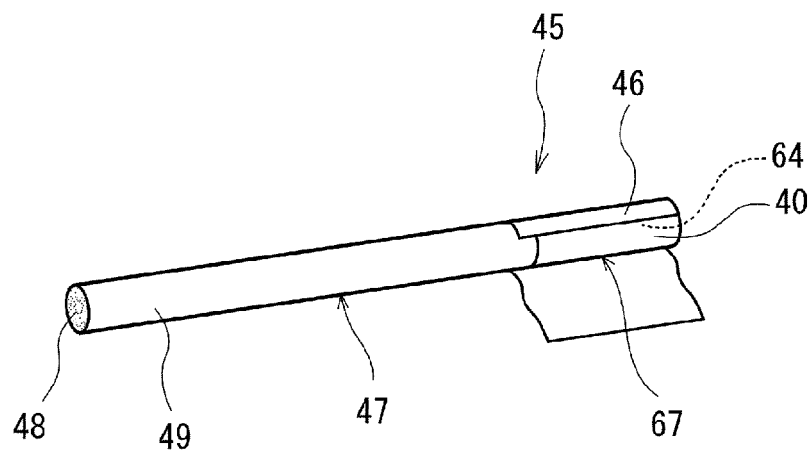


FIG. 4

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2020/047849

A. CLASSIFICATION OF SUBJECT MATTER

Int.Cl. A24D3/10 (2006.01) i

FI: A24D3/10

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. A24D3/10, A24F40/40, A24F42/60, D01F2/28, D01F11/02, D01D5/04

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 1971-2021

Registered utility model specifications of Japan 1996-2021

Published registered utility model applications of Japan 1994-2021

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	JP 2019-15009 A (DAICEL CORPORATION) 31 January 2019 (2019-01-31), claims 1-9, paragraphs [0018]-[0157]	1-9
Y	JP 2020-188811 A (TOA INDUSTRY CO., LTD.) 26 November 2020 (2020-11-26), paragraphs [0014], [0041]-[0045], [0126]-[0129], fig. 2-4	1-9

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

☒ See patent family annex.

* Special categories of cited documents:

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

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Date of the actual completion of the international search
09 March 2021Date of mailing of the international search report
16 March 2021Name and mailing address of the ISA/
Japan Patent Office
3-4-3, Kasumigaseki, Chiyoda-ku,
Tokyo 100-8915, Japan

Authorized officer

Telephone No.

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/JP2020/047849

5 JP 2019-15009 A 31 January 2019 US 2020/0131670 A1
claims 1-9, paragraphs [0020]-[0165]
WO 2019/012712 A1
EP 3653765 A1
10 CN 110678586 A
KR 10-2020-0027920 A
JP 2020-188811 A 26 November 2020 (Family: none)

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REFERENCES CITED IN THE DESCRIPTION

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- JP H7316975 A [0035]