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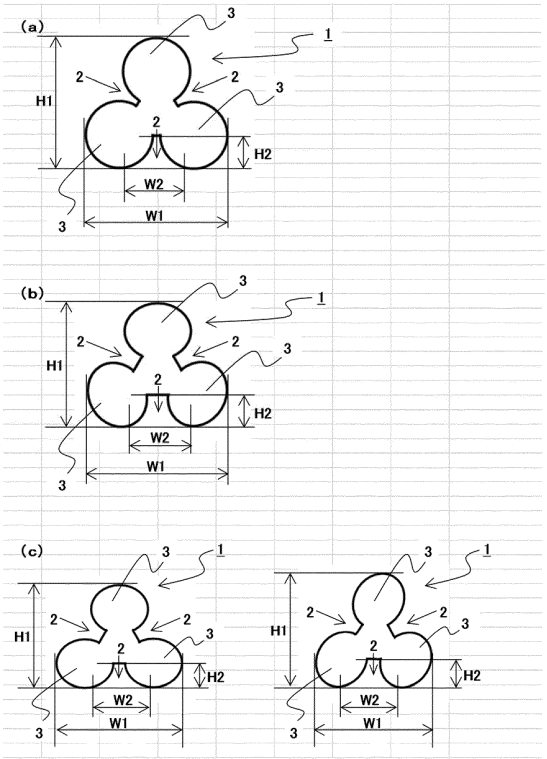
(54) FILAMENT FOR ARTIFICIAL HAIR AND ARTIFICIAL HAIR PRODUCT

(57) It is a task to provide a filament for artificial hair which is excellent in terms of volume and luster and not subject to yarn cracking or yarn breakage. The filament for artificial hair is a filament of a thermoplastic resin, its shape of a cross section in a direction perpendicular to a fiber axis is a multilobal shape having three or more interlobe gap regions, widths W2 of the interlobe gap regions are 10 to 60% of a width W1 of the filament, and depths H2 of the interlobe gap regions are 5 to 30% of a height H1 of the filament.

[Fig. 1]



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Description

Technical field

[0001] The invention relates to a fiber for artificial hair for use for a hairpiece, a hair wig, a hair extension, or the like.

Background art

[0002] A modacrylic fiber, a vinyl chloride fiber, a vinylidene chloride fiber, a polyester fiber, a nylon fiber, and the like have been used as fibers for artificial hair. In connection with manufacturing artificial hair products, such as hair pieces, hair wigs, hair extensions, or the like, through the use of these fiber, researches and developments of fibers suitable for these products have been cumulatively made, and studies and improvements on shapes of cross section of fibers have also been cumulatively done.

[0003] For example, fibers for artificial hair whose shapes of cross section have a constriction at a central portion, such as a spectacles shape or a cocoon shape, have been proposed (refer to, e.g., Patent document 1).

[0004] Furthermore, a fiber having a letter Y shape of cross section (refer to, e.g., Patent document 2), a fiber having a letter Y shape of cross section with rounded distal ends (refer to, e.g., Patent document 3), etc. have been proposed.

Prior Art Documents

Patent Documents

[0005]

Patent document 1: Japanese Unexamined Patent Publication (Kokai) No. 2007-146306
Patent document 2: International Publication WO 2008/029727
Patent document 3: Japanese Patent No. 3365141

Summary of the Invention

Problems to be Solved by the Invention

[0006] However, the fiber whose shape of cross section has a constriction at a center portion as proposed in Patent document 1 does not readily give a volume and inevitably bends in a short-diameter direction. Therefore, there exist problems that the orientations of the fiber become uniform at a curved surface and the luster likely becomes unnatural and that when subjected curling, the fiber does not easily produce three-dimensional appearance. The fibers having shapes of cross section as proposed in Patent documents 2 and 3 improve presentation of a volume but are subject to yarn cracking or yarn breakage under external force and are not satisfactory in terms of durability.

[0007] It is a task of the invention to solve the foregoing problems of the related-art technologies.

[0008] Therefore, a purpose of the invention is to provide a filament for artificial hair which is excellent in terms of volume and luster and not subject to yarn cracking or yarn breakage.

Means for Solving the Problems

[0009] In order to achieve the foregoing purpose, according to the invention, there is provided a filament for artificial hair which is a filament of a thermoplastic resin and whose shape of a cross section in a direction perpendicular to a fiber axis is a multilobal shape having three or more interlobe gap regions, wherein widths of the interlobe gap regions are 10 to 60% of a width of the filament and depths of the interlobe gap regions are 5 to 30% of a height of the filament.

[0010] Incidentally, as for the filament for artificial hair of the invention,
that the number of the multilobal shaped lobe regions be 3 to 8,
that the fineness of single filament be 20 to 150 dtex, and
that the thermoplastic resin be at least one species selected from the group consisting of a polyester resin, a polyamide resin, an acrylic resin, a polyvinyl chloride resin, a polyacrylonitrile resin, a polyphenylene sulfide resin, and a cellulose resin, are cited as preferable conditions. If these conditions are satisfied, further excellent performance will be delivered.

[0011] Furthermore, the artificial hair product of the invention is characterized in that the foregoing filament for artificial hair has been used in at least a part of material for hair.

Advantageous Effect of the Invention

[0012] According to the invention, a filament for artificial hair that is excellent in terms of volume and luster and not subject to yarn cracking or yarn breakage can be obtained as described below.

Brief Description of the Drawings

[0013]

[Figs. 1] Figs. 1(a) to 1(c) are each a sectional view of a filament for artificial hair according to an example of the invention, taken in a direction perpendicular to the fiber axis.
[Figs. 2] Figs. 2(d) to 2(f) are each a sectional view of a filament for artificial hair according to a different example of the invention, taken in a direction perpendicular to the fiber axis.
[Figs. 3] Figs. 3(g) to 3(i) are each a sectional view of a filament for artificial hair of a comparative example, taken in a direction perpendicular to the fiber axis.
[Fig. 4] Fig. 4 is a schematic view for describing a container for use for measurement of the content rate of interspace among filaments and the measurement.
[Figs. 5] Fig. 5(a) is a schematic view of a sample holder for degree-of-luster measurement in which eleven single yarns of a sample have been fixed. Furthermore, Fig. 5(b) is a side view schematically showing the positions of a sample, a light source, and a photoreceiver at the time of the degree-of-luster measurement.

Description of Preferred Embodiments

[0014] Hereinafter, the filament for artificial hair of the invention will be described with reference to the drawings. Figs. 1(a) to 1(c) and Figs. 2(d) to 2(e) are each a sectional view of a filament for artificial hair according to the invention, taken in a direction perpendicular to the fiber axis. In the drawings, 1 represents a filament for artificial hair, 2 represents an interlobe gap region, and 3 represents a lobe region. Note that although the interlobe gap region refers to a groove that a depression portion in a cross section forms along the fiber axis direction of the filament, the depression portion in the cross section is also termed the interlobe gap region in this description. Furthermore, the lobe region refers to a portion sandwiched between interlobe gap regions adjacent to each other, and is a concept that applies in both a filament and a cross section, as is the case with the interlobe gap region.

[0015] The filament for artificial hair of the invention has a cross section in a direction perpendicular to the fiber axis which is a multilobal shape having three or more interlobe gap regions. In the invention, it is important that in the cross section, the interlobe gap regions have such a specific shape. Note that in this description, the cross section is assumed to indicate a cross section in a direction perpendicular to the fiber axis unless particularly mentioned regarding the direction of section.

[0016] The multilobal shape in the invention is a shape having a plurality of interlobe gap regions and lobe regions segmented by the interlobe gap regions. For example, the shapes in (a) to (c) of Fig. 1 and (a) of Fig. 2 are called trilobe, the shape in (b) of Fig. 2 is called tetralobe, and the shape in (c) of Fig. 2 is called pentalobe.

[0017] In the filament for artificial hair of the invention, the widths (W2) of the interlobe gap regions are 10 to 60% of the width (W1) of the filament. Such a proportion of the width (W2) of each interlobe gap region to the width (W1) of the filament is a proportion (hereinafter, sometimes mentioned simply as W2/W1) is preferred to be greater than or equal to 30% and more preferred to be greater than or equal to 40%. On the other hand, as for the upper limit, the W2/W1 is preferred to be less than or equal to 55% and more preferred to be less than or equal to 50%. Furthermore, in the filament for artificial hair of the invention, the depths (H2) of the interlobe gap regions are 5 to 30% of the height (H1) of the filament. Such a proportion of the depth (H2) of each interlobe gap region to the height (H1) of the filament (hereinafter, sometimes mentioned simply as H2/H1) is preferred to be greater than or equal to 10% and more preferred to be greater than or equal to 15%. On the other hand, as for the upper limit, the H2/H1 is preferred to be less than or equal to 25% and more preferred to be less than or equal to 20%. Note that, in the invention, it is defined that satisfaction of the foregoing relations by the values of the width (W1) of the filament, the widths (W2) of the interlobe gap regions, the height (H1) of the filament, and the depths (H2) of the interlobe gap regions is satisfaction of the foregoing relations by the foregoing values that are found for each interlobe gap region of all the interlobe gap regions in the cross section of the filament.

[0018] The width (W1) of the filament, the widths (W2) of the interlobe gap regions, the height (H1) of the filament, and the depths (H2) of the interlobe gap regions are defined as follows. A tangential line that contacts both of two lobe regions adj acent to each other across one interlobe gap region is drawn, and the maximum value of the distance between outlines of the filament measured in a direction parallel with that tangential line is defined as the width (W1) of the filament, and the distance between the two points of contact between the tangential line and the lobe regions is defined

as the width (W2) of the interlobe gap region. The maximum value of the distance between outlines of the filament measured in a direction perpendicular to the tangential line is defined as the height (H1) of the filament, and the maximum value of the depth of the interlobe gap region measured in the direction perpendicular to the tangential line is defined as the depth (H2) of the interlobe gap region.

[0019] If any one of the proportions (W2/W1) of the widths of the interlobe gap regions to the width of the filament and the proportions (H2/H1) of the depths of the interlobe gap regions to the height of the filament is below the foregoing range, a volume becomes hard to obtain when the filament is used as artificial hair and, furthermore, because protuberances and depressions of the filament surface become small, natural luster also becomes hard to obtain. On the other hand, if any one of them is above the range, the lobe region becomes thin, so that yarn cracking and yarn breakage will likely occur.

[0020] In the filament for artificial hair of the invention, the number of lobe regions in the multilobal shape is preferred to be 3 to 8, more preferred to be 3 to 6, and even more preferred to 3 or 4. If the number of lobe regions is outside the foregoing range, it is likely that there will be tendency of it being difficult to satisfy the relation between the width of each interlobe gap region and the width of the filament and the relation between the depth of each interlobe gap region and the height of the filament.

[0021] With regard to the kind of the filament, the kind, such as a multifilament, a monofilament, etc., does not matter, but the filament is preferred to be a monofilament. Note that in the case of a multifilament, the shape of cross section of each of the single yarns that constitute the multifilament is to satisfy what are mentioned.

[0022] Furthermore, the fineness of the filament for artificial hair of the invention is preferred to be 20 to 150 dtex. As for the fineness, 30 dtex or greater is more preferable and 40 dtex or greater is even more preferable. On the other hand, as for the upper limit thereof, 130 dtex or less is more preferable, 100 dtex or less is even more preferable, and 70 dtex or less is particularly preferable. Furthermore, the filament may be a filament of a single fineness, but filaments of a plurality of finesses may be combined for use within the foregoing ranges. Note that, as for the fineness of the filament, in the case of a multifilament, it is assumed that the average value of the finenesses of the single yarns that constitute the multifilament is within the foregoing range.

[0023] Furthermore, the filament for artificial hair of the invention is a filament of thermoplastic resin. As long as the filament is of thermoplastic resin, the kind of the thermoplastic resin does not matter but is preferred to be, for example, at least one species selected from the group consisting of polyester resin, polyamide resin, acrylic resin, polyvinyl chloride resin, polyacrylonitrile resin, polyphenylene sulfide resin, and cellulose resin. Among these, particularly the polyester resin, the polyamide resin, and the polyphenylene sulfide resin are preferable.

[0024] Furthermore, the filament for artificial hair of the invention may, according to need, contain a delusterant, such as titanium oxide, calcium carbonate, kaolin, or clay, a pigment, a dye, a lubricant, an antioxidant, a heat-resistant agent, an anti-steaming agent, a light resistant agent, an ultraviolet absorbent, an antistatic agent, a fluorescent agent, a plasticizing agent, an antimicrobial agent, etc.

[0025] The filament for artificial hair of the invention may contain a known organic or inorganic flame retardant, such as a phosphorus based or halogen based one, or antimony trioxide, in order to protect human bodies from the risk of a fire during use.

[0026] The filament for artificial hair of the invention may be one in which the polyester that constitute the filament for artificial hair has been modified or one whose surface has been provided with an antistatic agent, for the purpose of preventing the clinging or tangling of the filament due to electric withstanding or the attachment of dust.

[0027] In the filament for artificial hair of the invention, the filament surface may be provided with a known surface active agent, such a silicone based agent, in order to further improve the combing property.

[0028] Furthermore, the tensile strength and the knot tenacity of the filament for artificial hair of the invention are preferred to be 1 to 5 cN/dtex and 0.5 to 3 cN/dtex, respectively. If the tensile strength and the knot tenacity are within the foregoing ranges, there is a tendency that, during the processing stage of the artificial hair product, the process passability will be good.

[0029] Furthermore, as for the filament for artificial hair of the invention, the bending hardness is preferred to be 0.03 to 0.25 cN. If the bending hardness thereof is within the foregoing range, an elasticity of hair similar to that of human hair is likely to be felt.

[0030] Next, a production method for the filament for artificial hair of the invention will be described. However, the production method is not particularly limited, but known fiber spinning methods can be adopted. As an example, melt spinning will be described; however, the production method is not limited to this method.

[0031] First, various raw materials are placed in a hopper. At this stage, various additives may be mixed in and then supplied. The raw materials are supplied from the hopper into a single-screw extruder type melt spinning apparatus and melt spinning is performed It is desirable that the melt temperature at this time be about the melting point of the thermoplastic resin used + 20°C. After the molten polymer is metered by a gear pump in accordance with the final fineness of the filament, the molten polymer is filtrated through a metal filter in a spinning pack and spun out of the oddly shaped spinneret.

[0032] Next, the spun-out undrawn fiber is continuously led into a cooling medium and is cooled and solidified. Incidentally, as the cooling medium, for example, water, polyethylene glycol, etc. can be cited. However, the cooling medium is not particularly limited as long as the cooling medium can be easily removed from the surface of the filament and does not cause a chemically or physically essential change.

[0033] Then, the cooled and solidified undrawn fiber is subjected to heated single-stage drawing or multi-stage drawing and thermal setting in order to obtain a strength that the filament needs. As for the heat medium used in this occasion, air, warm water, steam, polyethylene glycol, glycerol, silicone oil, etc., can be cited, but the heat medium is also not particularly limited as long as it can be easily removed from the surface of the filament and does not cause a chemically or physically essential change.

[0034] The filament for artificial hair thus obtained is provided with deposit of a finish oil agent according to need, and then is wound up.

[0035] The filament for artificial hair obtained as described above may be subjected to known after processes, such as dyeing, alkali treatment, a sandblasting process, a crimping process, a yaki process, and a curling process, according to need.

[0036] The artificial hair product of the invention is a product in which the foregoing filament for artificial hair is used in at least part of the material for hair, and includes hairpieces, hair wigs, hair pieces, hair extensions, attached hair, doll hair, head hair ornaments, etc. These artificial hair products can be produced by known methods. The production methods for the artificial hair products themselves are not particularly limited.

Examples

[0037] Hereinafter, the invention will be concretely described with reference to examples, but are not limited these examples. In the examples and the comparative examples, evaluation of the filament for artificial hair and the artificial hair was performed by methods as follows. In each test, measurement was performed after the sample was left for 24 hours or more under conditions that the temperature was 20 ± 2°C and the relative humidity was 65 ± 4%. Measurement was performed with the number n of measurements being 1, unless particularly mentioned.

(1) Fineness

[0038] Four samples of 500 mm were accurately taken by applying an initial load stipulated in JIS L1013:2010, and the masses were measured. Using the following expression, the finenesses thereof were calculated.

$$\text{Fineness [dtex]} = \text{mass [g]} \times 10000/2$$

(2) Shape of cross section

[0039] A filament sample of 30 m was cut at every 1 m. From those, five samples were arbitrarily extracted. With respect to the five extracted samples, samples for section observation cut out in a direction perpendicular to the fiber axis direction of the filament were created. These samples were observed by using a digital microscope (VHX-500F, made by Keyence Corp.), and lengths mentioned below were measured with a main measurement tool.

[0040] A tangential line contacting both of two lobe regions adjacent to each other across one interlobe gap region was drawn, and the maximum value of the distance in a direction parallel with the tangential line between outlines of the filament (the width of the filament: W1), the distance between the two points of contact between the tangential line and the lobe regions (the width of the interlobe gap region: W2), the maximum value of the distance in a direction perpendicular to the tangential line between outlines of the filament (the height of the filament: H1), and the maximum value of the depth of the interlobe gap region in the direction perpendicular to the tangential line (the depth of the interlobe gap region: H2) were measured. These values were measured for each of the interlobe gap regions of each sample. Table 1 shows results about each interlobe gap region with regard to one sample as a representative.

(3) Physical property test

[0041] The tensile stress [N] and the elongation (at break) [%], and the knot stress [N] and the elongation (at break) [%] of each filament were measured according to JIS L1013: 2010 8.5.1 and 8.6.1. For the measurement, an Autograph AG-50NIS made by Shimadzu Corporation, with a flat chuck attached, was used, and a test with n = 5 was performed in conditions that the sample's length was 25 cm and the tension speed was 30 cm/min.

(4) Volume

[0042] Artificial hair bundles of 40 cm in length and 150 g in mass were created, comparison thereof with the same quantity of human hair samples based on sensory evaluations was made by ten people. The evaluation references were as follows.

[0043]

O: Eight or more people determined that the artificial hair had a volume equivalent to that of the human hair.
Δ: Five to seven people determined that the artificial hair had a volume equivalent to that of the human hair.
x: It was four or less people that determined that the artificial hair had a volume equivalent to that of the human hair.

(5) Content rate of interspace among filaments

[0044] Bundles of straight artificial hair of 10 cm in length were prepared. These samples were put, in a predetermined amount, in order in parallel with the length direction within a container shown in Fig. 4, and a load of 27 g (an aluminum square bar of 10 x 10 x 100 mm) was applied, and the heights h [mm] thereof were measured during a period of 5 to 10 seconds after the load was applied. Furthermore, the mass m [g] of the samples within the container was measured. Incidentally, the predetermined amount refers to an amount such that the heights following application of the load become 5 to 10 mm.

[0045] Next, using the same sample, a sample for section observation cut out in the direction perpendicular to the fiber axis direction of the filament was obtained. With regard to the sample for section observation, observation was performed by using a digital microscope (VHX-500F, made by Keyence), and a sectional area A [mm^2] of a single yarn was measured by using the main measurement tool. As for the sectional area, measurements with n = 50 were taken and an average value was found.

[0046] From the foregoing measurement values, the content rate of interspace among filaments was calculated by using the following expression.

[Math. 1]

$$\text{Content rate of interspace among filaments}[\%] = \frac{10 \times 100 \times h - \dfrac{A \times m \times 10^7}{\text{fineness}}}{10 \times 100 \times h} \times 100$$

(6) Degree of luster (G value, half-value width)

[0047] A "GP-200" made by MURAKAMI COLOR RESEARCH LABORATORY CO., Ltd. was used as a degree-of-luster meter. As'shown in Fig. 5(a), a sample holder having at its center a hole of 36 mm in diameter was used. Eleven single yarns of the sample fixed equidistantly within a width of 6 mm in total formed by 3 mm to both sides from the center line of the hole were a sample. The light source aperture was 10.5 mm in diameter, and the light receiving aperture was 9.1 mm in diameter. A reflectance with respect to the reflection angle was measured by directing light at an incident angle of 30° and rotating the photoreceiver 0 to 90° as shown in Fig. 5(b). As for the G value, calculation was performed on the basis of the reflectance d at a reflection angle of 0° and the maximum reflectance Sf appearing near a reflection angle of 30°, by using the following expression (2), and the sample was changed for every measurement, and an average value of G values with n = 5 was calculated. The G value is an indicator of shine, greater G values indicate that the shine caused by regular reflection is stronger and therefore that the luster is stronger.

$$G \text{ value} = Sf/d \quad \text{...expression (2)}$$

With regard to the half-value width, an average value of values (n = 5) obtained at every time of measurement was calculated. The half-value width is an indicator of glariness. As the half-value width is smaller, the directionality of reflection is higher, giving greater glarinesses, and therefore it is indicated that the luster is strong.

(7) Luster

[0048] A bundle of straight artificial hair of 40 cm in length and 150 g in mass was compared with a human hair bundle

at a window inside a room with direct sunlight striking. Determinations based on views with an incident angle of the sunlight being 10° to 55° were made. Furthermore, an artificial hair bundle of the same amount was curled by using a curling iron of 32 mm in diameter under a condition of 130°C x 30 seconds, and compared with a human hair bundle at a window inside a room with direct sunlight striking. Determinations based on views with an incident angle of the sunlight being 10° to 55° were made. The evaluation references for the determinations were as follows.

[0049] ○: dull luster similar to that of human hair

Δ: fairly strong luster

×: strong luster

(8) Yarn cracking/yarn breakage test

[0050] An artificial hair bundle of 30 cm in length and 11 g in mass was created, and an end of the hair bundle was fixed. On a horizontal table, a spherical weight of 5 kg in mass was rolled for 20 back-and-forth movements in a direction perpendicular to the length direction of the hair, and then a wig-dedicated brush made of metal was run until there was no entanglement of hair. After this process was repeated five times, the hair bundle was observed with a microscope. The evaluation references were as follows.

[0051]

○: Yarn cracking or hair-end yarn breakage was not observed at all.

×: Yarn cracking or hair-end yarn breakage was observed in some yarns.

(9) Bending hardness

[0052] Filament samples cut into a length of about 4 cm were prepared. Each sample was set under two stainless steel bars of 2 mm in diameter placed at an interval of 10 mm in a horizontal direction so as to contact the stainless steel bars and, at a center of each stainless steel bar, a hook of 1 mm in diameter made of stainless steel was hooked on the sample. Using a "TCM-200 type Universal Tensile and Compression Tester" made by Minebea Co., Ltd., the hook made of stainless steel was pulled upward at a speed of 50 mm/min. The maximum stress that occurred was determined as a bending hardness. The measurement was performed, with n = 3, and an average value was found.

[Example 1]

[0053] A polyethylene terephthalate chip containing 2.5 mass% of a cohesive silicon oxide particle (having an average particle diameter of 2.43 μm) and having a limiting viscosity (measured at 25°C in a 1:1 mixed solvent of phenol and tetrachlorethane) of 0.97 was dried in vacuum at 165°C for 9 hours. The chip was supplied into an extrusion type fiber spinning machine at 285°C, and a heated and molten resin composition was extruded from a trilobal nozzle that corresponds to the yarn's shape of cross section in Fig. 1(a) and immediately cooled in water at 30°C, and subsequently put in warm water at 55°C and then under a 100°C dry hot condition where the drawing to 4.1 times was performed. After that, a relaxation heat treatment was performed in a dry hot atmosphere.

[0054] Next, the wound-up monofilament was dipped, as an alkali treatment, into a sodium hydroxide solution to subject the material for hair surface to dissolving processing. Then, washing and drying was performed to obtain a straight polyester monofilament:

[0055] This polyester monofilament was dyed black by using a dyeing method that is a usual method in a high-pressure dyeing machine. Next, using a washing method that is a usual method, reduction cleaning was performed to obtain a straight finish-dyed monofilament for artificial hair.

[0056] Properties of the obtained filament for artificial hair are shown in Table 1.

[Example 2]

[0057] A straight monofilament for artificial hair was obtained in substantially the same manner as in Example 1, except that a polyethylene terephthalate chip containing 1.5 mas% of a colloidal silica (Sylysia 730, made by Fuji Silysia Chemical) and having a limiting viscosity of 1.10 was used and the extrusion nozzle was changed to a trilobal nozzle that corresponds to the yarn's shape of cross section in Fig. 1(c).

[0058] Properties of the obtained filament for artificial hair are shown in Table 1.

[Examples 3 and 4 and Comparative Examples 1 to 3]

[0059] Straight monofilaments for artificial hair were obtained in substantially the same manner as in Example 2, except that the extrusion nozzle was changed to nozzles that correspond to their respective shapes shown in Table 1.

[0060] Properties of the obtained filaments for artificial hair are shown in Table 1.

[0061] **[Table 1]**

[Table 1]

			Example 1			Example 2			Example 3			Example 4				Comparative example 1			Comparative example 2				Comparative example 3	
Shape of cross section		*	Trilobe (a)			Trilobe (c)			Trilobe (d)			Tetralobe (e)				Trilobe (g)			Tetralobe (h)				Cocoon shape	
	W2/W1·100	%	41	40	40	44	48	44	55	53	50	44	40	43	45	81	86	77	85	86	88	92	36	44
	H2/H1·100	%	24	24	25	23	26	25	14	13	13	18	20	18	18	18	19	18	38	35	38	37	15	16
Fineness		dtex	45			48			51			45				46			47				52	
Tensile	Strength	cN/dtex	2.32			2.27			2.78			2.44				2.13			2.18				2.60	
	Elongation	%	34.2			36.3			31.2			35.4				42.3			46.8				22.2	
Knot	Tenacity	cN/dtex	2.13			2.29			2.25			2.14				1.54			1.20				2.17	
	Elongation	%	18.5			17.2			17.7			16.6				14.6			12.3				15.2	
Volume		-	○			○			○			○				x			x				Δ	
Content rate of interspace among filaments		%	56.2			65.4			55.3			52.1				74.1			69.6				29.8	
Degree of luster	G value	-	14.2			16.8			22.4			18.5				31.9			46.7				7.1	
	Half-value width	°	9.2			10.5			8.3			11.9				6.4			3.9				13.5	
Luster	Straight	-	○			○			○			○				Δ			Δ				Δ	
	Curled	-	○			○			○			○				Δ			Δ				x	
Yarn cracking/yarn breakage			○			○			○			○				x			x				○	
Bending hardness		cN	0.09			0.11			0.12			0.09				0.15			0.12				0.08	

*: The Roman letter within the parentheses indicates the corresponding one of the shapes of cross section in Figs. 1 to 3.

[0062] From Table 1, it has been confirmed that the filaments for artificial hair of the examples of the invention are excellent in terms of volume and luster and not subject to yarn cracking or yarn breakage.

[0063] On the other hand, the filaments for artificial hair having shapes of cross section that do not satisfy the conditions of the invention (Comparative Examples 1 to 3) were not only unnatural in terms of volume and luster but also subject to yarn cracking and yarn breakage and therefore unsuitable for use as a filament for artificial hair.

Explanation of Numerals

[0064]

1: filament for artificial hair
2: interlobe gap region
3: lobe region
4: load
5: sample holder
6: light source
7: incident angle (30°)
8: photoreceiver (position with a reflection angle of 0°)
9: photoreceiver (position with a reflection angle of 90°)
H1: height of a filament
H2: depth of an interlobe gap region
W1: width of a filament
W2: width of an interlobe gap region

Claims

1. A filament for artificial hair which is a filament of a thermoplastic resin and whose cross section in a direction perpendicular to a fiber axis is of a multilobal shape having three or more interlobe gap regions, wherein widths of the interlobe gap regions are 10 to 60% of a width of the filament and depths of the interlobe gap regions are 5 to 30% of a height of the filament.

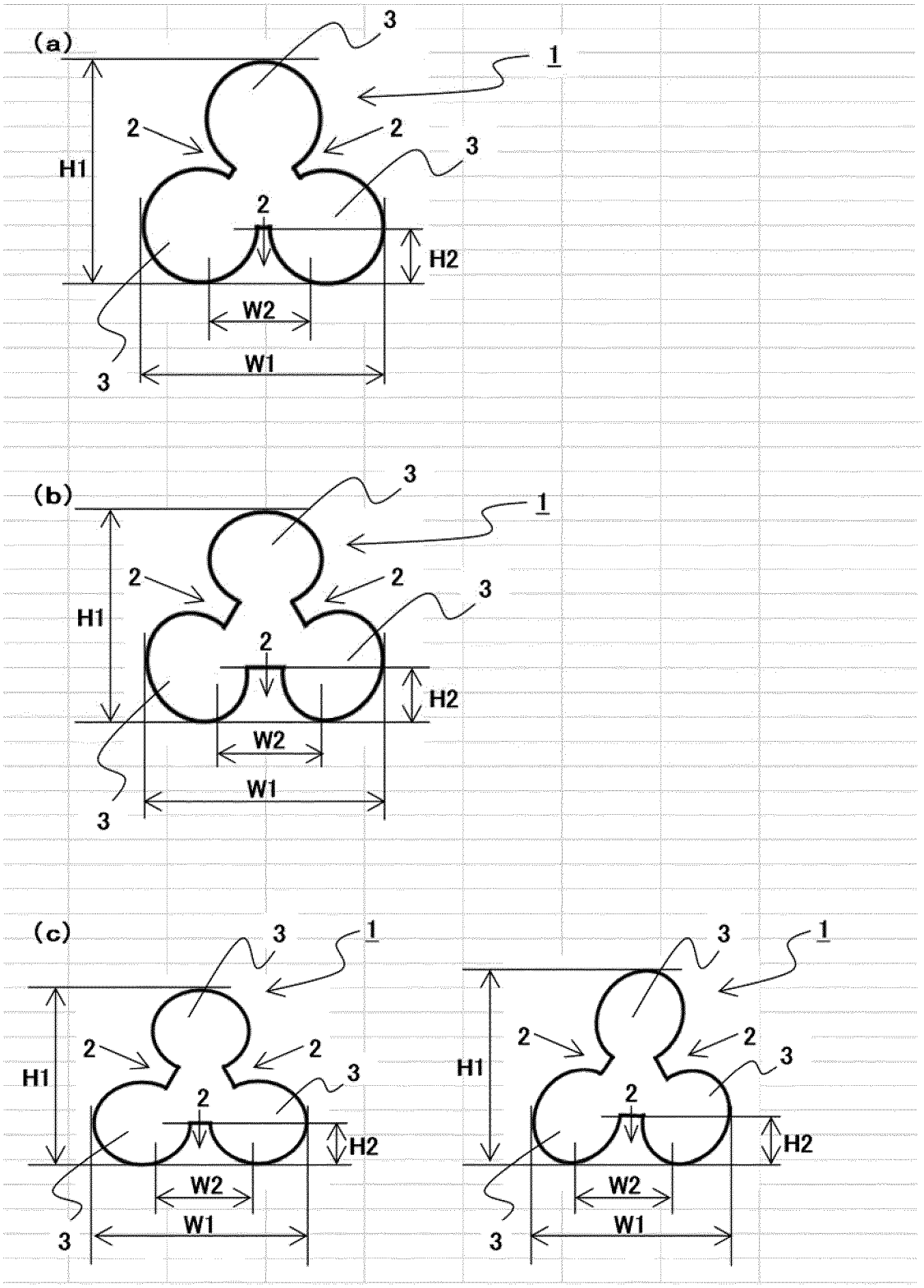
2. The filament for artificial hair according to Claim 1, wherein the number of lobe regions in the multilobal shape is 3 to 8.

3. The filament for artificial hair according to Claim 1 or 2, wherein a fineness of single filament is 20 to 150 dtex.

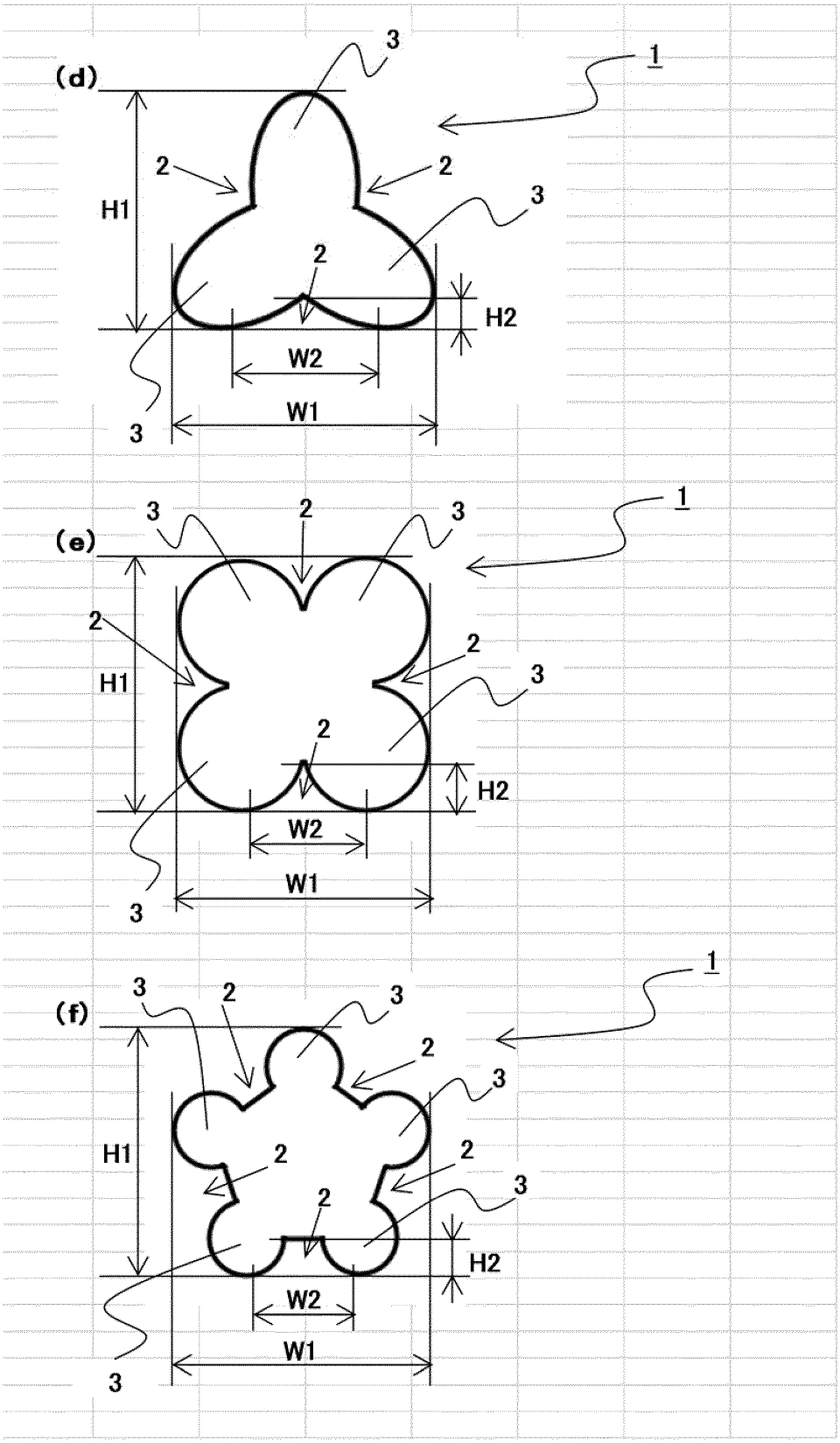
4. The filament for artificial hair according to any one of Claims 1 to 3, wherein the thermoplastic resin is at least one species selected from the group consisting of a polyester resin, a polyamide resin, an acrylic resin, a polyvinyl chloride resin, a polyacrylonitrile resin, a polyphenylene sulfide resin, and a cellulose resin.

5. An artificial hair product in which the filament for artificial hair according to any one of Claims 1 to 4 has been used in at least a part of material for hair.

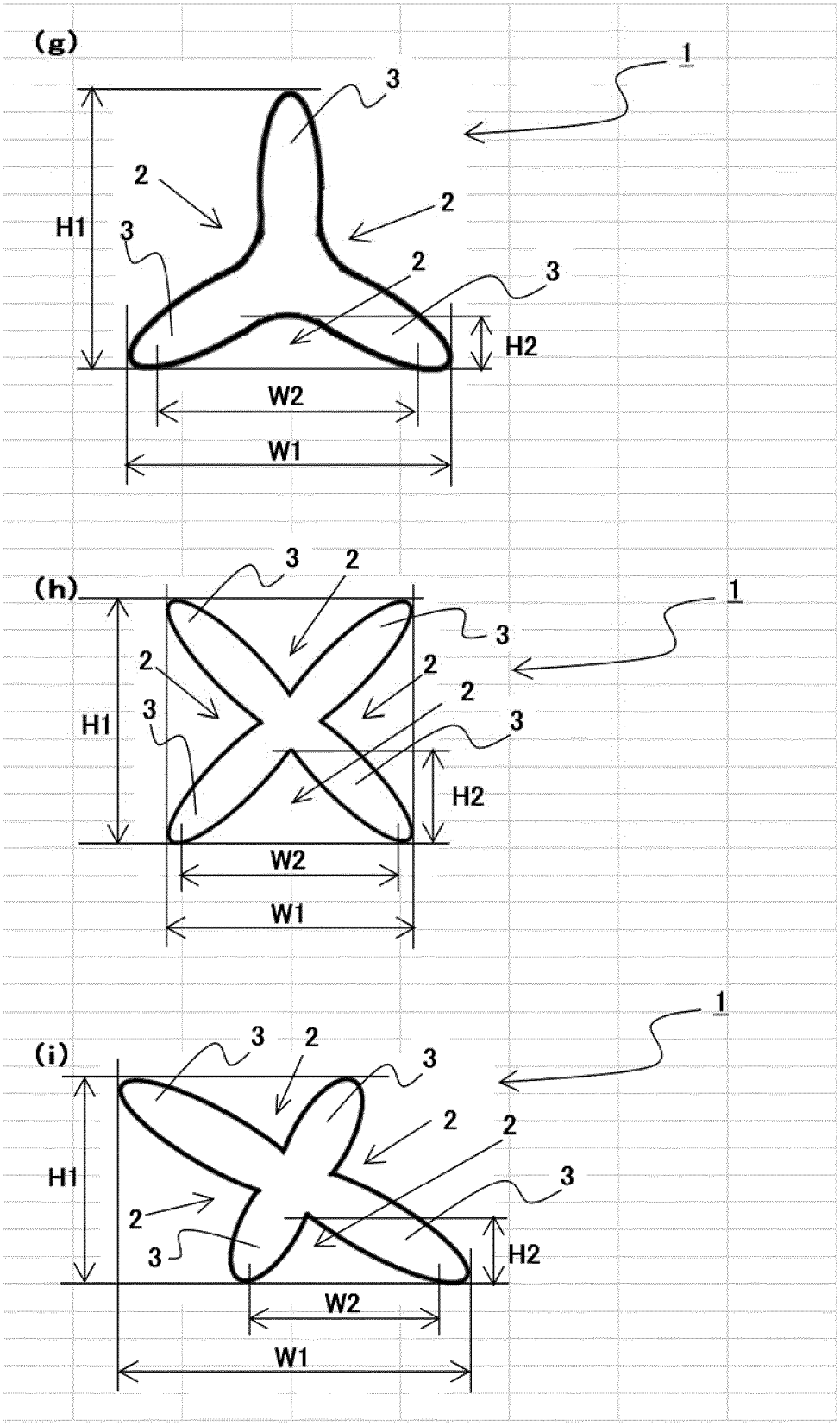
[Fig. 1]


(a)
3
1
2
2
3
H1
2
H2
W2
W1
3
(b)
3
1
2
2
3
H1
2
H2
W2
W1
3
(c)
3
1
2
2
3
H1
2
H2
W2
W1
3
3
1
2
2
3
H1
2
H2
W2
W1
3

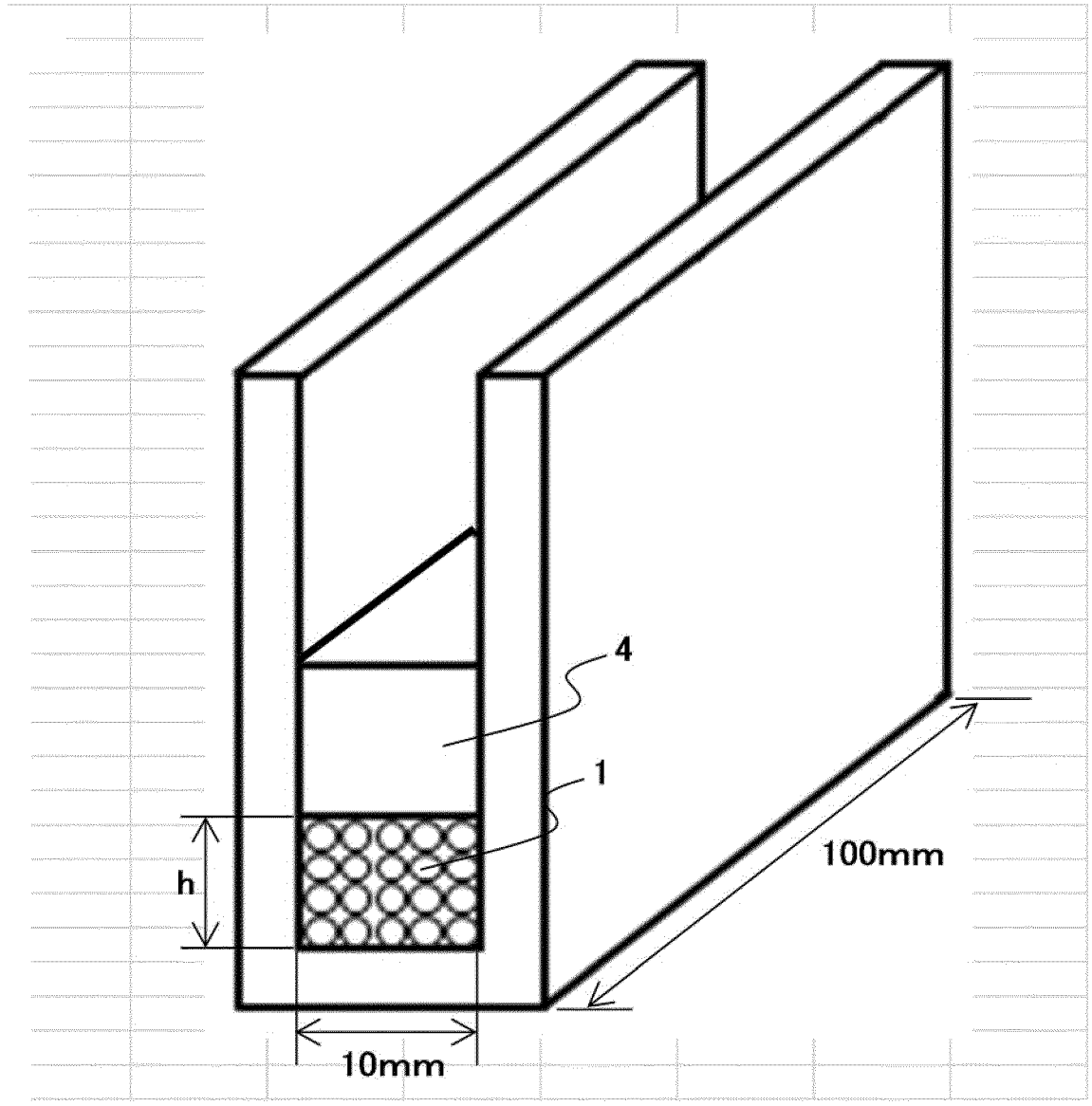
[Fig. 2]



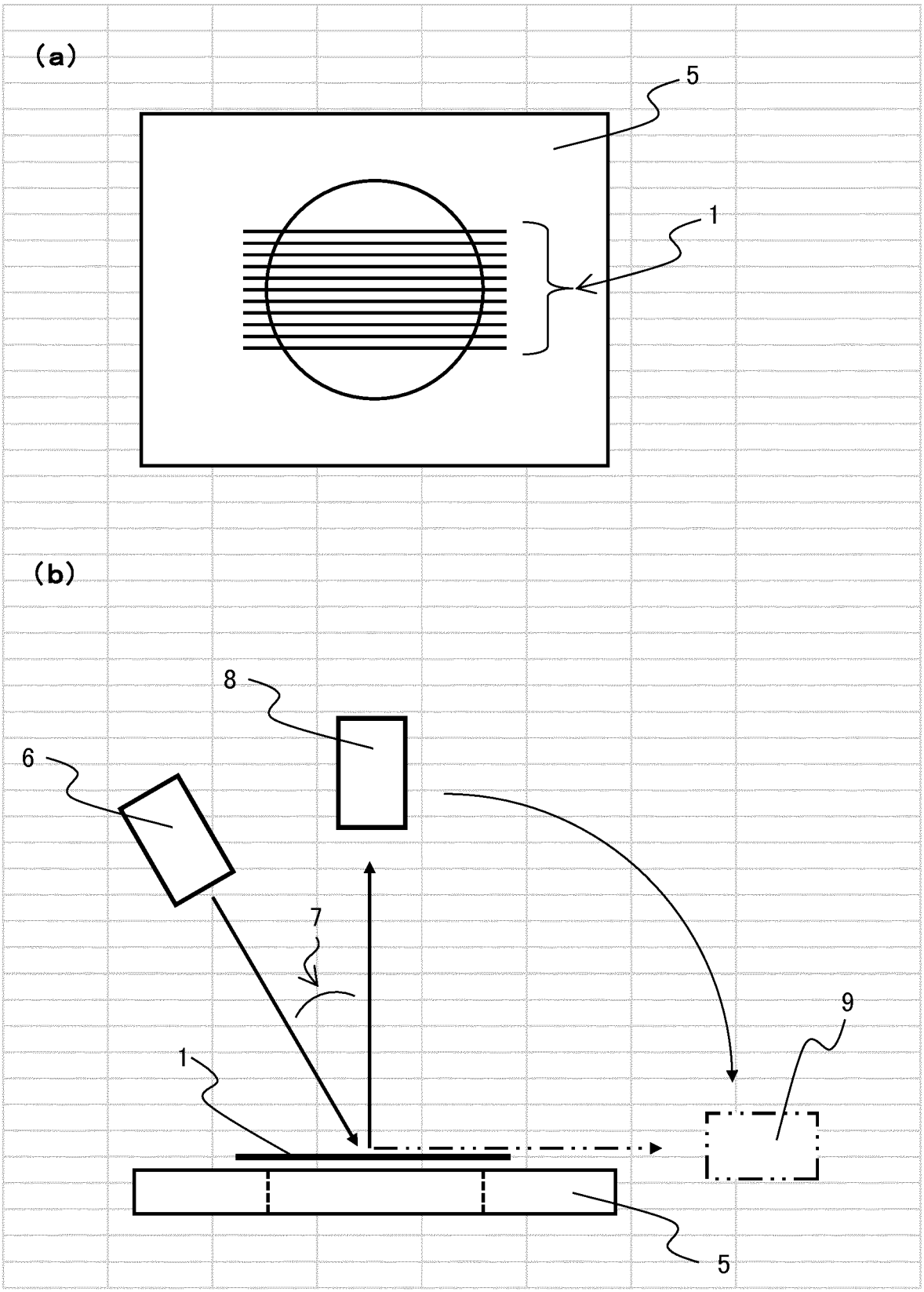
[Fig. 3]


(g)
1
3
2
H1
3
2
2
3
H2
W2
W1
(h)
3
2
1
3
2
2
2
H1
3
3
H2
W2
W1
(i)
1
3
2
3
2
2
H1
2
3
3
H2
W2
W1

[Fig. 4]



[Fig. 5]



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2014/079476

A. CLASSIFICATION OF SUBJECT MATTER
A41G3/00(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)
A41G3/00

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 1996-2015
Kokai Jitsuyo Shinan Koho 1971-2015 Toroku Jitsuyo Shinan Koho 1994-2015

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2006/135060 A1 (Denki Kagaku Kogyo Kabushiki Kaisha), 21 December 2006 (21.12.2006), paragraphs [0001], [0026] to [0031], [0076] to [0082]; fig. 2-1 & US 2008/0210250 A1 & KR 10-2008-0016792 A & AP 2364 A & CN 101193567 A & ZA 200800437 A & KR 10-1154906 B	1-5
X	JP 2010-24586 A (Kaneka Corp.), 04 February 2010 (04.02.2010), paragraphs [0014], [0043], [0044]; fig. 5 (Family: none)	1-5

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

* Special categories of cited documents:
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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
21 January 2015 (21.01.15)	03 February 2015 (03.02.15)
Name and mailing address of the ISA/ Japan Patent Office 3-4-3,Kasumigaseki,Chiyoda-ku, Tokyo 100-8915,Japan	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (July 2009)

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Patent documents cited in the description

- JP 2007146306 A **[0005]**
- WO 2008029727 A **[0005]**
- JP 3365141 B **[0005]**