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(54) **FIBER ASSEMBLY INCLUDING CELLULOSE WATER-REPELENT FIBER, METHOD FOR MANUFACTURING SAME, AND FIBER PRODUCT**

(57) A fiber assembly including cellulose water-repellent fibers of the present invention is at least one selected from cotton, a fiber bundle, a yarn, and a gray fabric. A water-repellent agent is in a cross-linked state and fixed to the surface of cellulose fibers. A method for producing a fiber assembly including cellulose water-repellent fibers of the present invention includes applying a water-repellent agent to at least one fiber assembly selected from cotton, a fiber bundle, a yarn, and a gray fabric, and cross-linking the water-repellent agent to the surface of cellulose fibers by drying and then heat curing. Thus, the present invention provides a fiber assembly including cellulose water-repellent fibers that has durable water repellency, can be used for resist dyeing, and does not cause color transfer, a method for producing the fiber assembly, and a fiber product using the fiber assembly.

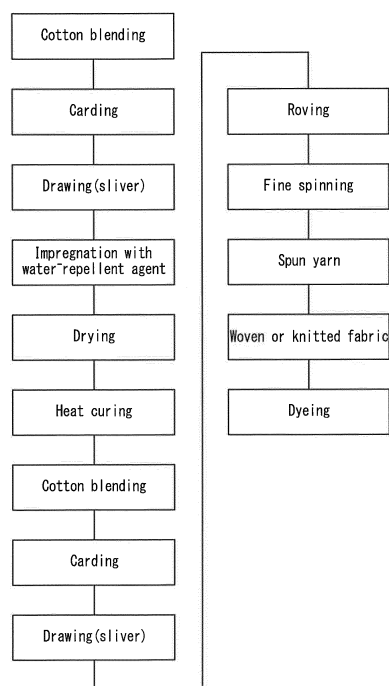


FIG. 1

Description

Technical Field

[0001] The present invention relates to a fiber assembly including cellulose water-repellent fibers, a method for producing the fiber assembly, and a fiber product using the fiber assembly.

Background Art

[0002] Water-repellent textile clothing is used for clothing people wear when they sweat a lot, such as sports clothing and summer clothing. Many clothes used for this purpose are made of synthetic fibers such as polyester and rendered water-repellent to improve quick drying properties. Patent Document 1 proposes a plied yarn composed of a water-repellent polyester short fiber bundle and a cotton spun yarn that has not been subjected to a water-repellent treatment. The water-repellent polyester fiber is twisted around the cotton spun yarn. This plied yarn is used for, e.g., sports clothing. Patent Document 2 proposes a spun yarn composed of water-repellent cotton as a core and natural fiber as a sheath that has not been subjected to a water-repellent treatment. Patent Document 3 proposes subjecting fibers such as cotton to a water-repellent treatment during dyeing. Patent Document 4 proposes a denim fabric having a double weft structure in which indigo-dyed cotton yarns are arranged as the warp, and polyester yarns and highly shrinkable yarns are arranged as the weft.

Prior Art Documents

Patent Documents

[0003]

Patent Document 1: JP H5(1993)-33234A
 Patent Document 2: JP H4(1992)-272247A
 Patent Document 3: JP S60(1985)-75678A
 Patent Document 4: JP 2013-520579A

Disclosure of Invention

Problem to be solved by the Invention

[0004] However, the conventional technologies have a problem in producing durable water-repellent cellulose fibers, and the use of water-repellent cellulose fibers for resist dyeing has not been considered. The indigo-dyed cotton yarns as disclosed in Patent Document 4 may cause color transfer.

[0005] In order to solve the above conventional problems, the present invention provides a fiber assembly including cellulose water-repellent fibers that has durable water repellency, can be used for resist dyeing, and does not cause color transfer, a method for producing the fiber

assembly, and a fiber product using the fiber assembly.

Means for Solving Problem

[0006] A fiber assembly including cellulose water-repellent fibers of the present invention is at least one selected from cotton, a fiber bundle, a yarn, and a gray fabric. A water-repellent agent is in a cross-linked state and fixed to the surface of cellulose fibers.

[0007] A method for producing a fiber assembly including cellulose water-repellent fibers of the present invention provides the above fiber assembly including the cellulose water-repellent fibers. The method includes the following: applying a water-repellent agent to at least one fiber assembly selected from cotton, a fiber bundle, a yarn, and a gray fabric; and cross-linking the water-repellent agent to the surface of cellulose fibers by drying and then heat curing.

[0008] A fiber product of the present invention includes the above fiber assembly including the cellulose water-repellent fibers.

Effects of the Invention

[0009] The fiber assembly of the present invention is at least one selected from cotton, a fiber bundle, a yarn, and a gray fabric and includes cellulose water-repellent fibers in which a water-repellent agent is in a cross-linked state and fixed to the surface of cellulose fibers. Thus, the present invention can provide the fiber assembly including the cellulose water-repellent fibers that has durability and can be used for resist dyeing, a method for producing the fiber assembly, and a fiber product using the fiber assembly. The water-repellent fibers are suitable for clothing people wear when they sweat a lot, such as sports clothing and summer clothing. Moreover, the water-repellent fibers function as a resist for piece dyeing. Therefore, it is possible to use the yarns of the present invention for specific yarns (e.g., the weft) and normal cotton yarns for the other yarns (e.g., the warp) to create a 100% cotton fabric. Then, the cotton fabric can be dyed by a dyeing process suitable for cotton fibers (e.g., reactive dyeing). During the dyeing process, only the normal cotton yarns are dyed, and the water-repellent yarns are not dyed, resulting in, e.g., a piece dyed denim-like fabric. This fabric has excellent fastness and does not cause problems such as color transfer.

Brief Description of Drawings

[0010] [FIG. 1] FIG. 1 is a process chart showing a method for producing water-repellent fibers of an embodiment of the present invention.

Description of the Invention

[0011] The water-repellent treatment of a fiber assembly such as cotton, a fiber bundle, a yarn, or a gray fabric

had not usually been performed because it was considered that the water-repellent cotton or fiber bundle would change the fiber lubricity and make spinning difficult. Moreover, it was considered that a good quality product was not able to be obtained, since the water-repellent yarn or gray fabric could not be dyed or could not be easily dyed. However, the present inventors found that when the fiber assembly such as cotton, a fiber bundle, a yarn, or a gray fabric was subjected to a water-repellent treatment, although it had been recognized as a problem, a surprisingly wide range of product development could be achieved. Based on these findings, the present inventors have reached the present invention. Further, cellulose fibers are hydrophilic fibers, and thus had not generally been made water-repellent. However, the present inventors also found that when the cellulose fibers were subjected to a water-repellent treatment before piece dyeing, a wide range of product development could be achieved.

[0012] The fiber assembly including cellulose water-repellent fibers of the present invention is at least one selected from cotton, a fiber bundle, a yarn, and a gray fabric, in which a water-repellent agent is in a cross-linked state and fixed to the surface of cellulose fibers. The cotton may be either opened cotton or unopened cotton. The fiber bundle may be, e.g., a web or a sliver. The yarn may be, e.g., a roving yarn or a spun yarn. The gray fabric may be, e.g., a woven fabric or a knitted fabric that have not yet been subjected to any subsequent treatment. When the water-repellent agent is cross-linked to cotton and a fiber bundle, the cross-linked cotton and fiber bundle are preferably opened by carding or the like. The cross-linked cotton and fiber bundle may be blended with other fibers in the opening process or between the opening process and the roving process. When the water-repellent agent is cross-linked to a yarn and a gray fabric, the cross-linked yarn and gray fabric are useful for applications that take advantage of the function of the water-repellent fibers as a resist for piece dyeing. It is preferable that the fiber assembly of the present invention is subjected to a water-repellent treatment before piece dyeing.

[0013] In the present invention, the water-repellent agent is in a cross-linked state and fixed to the surface of the cellulose fibers. The cross-linked state of the water repellent agent means that an aqueous solution or dispersion containing a mixture of the water-repellent agent and a cross-linking agent is applied to the surface of the cellulose fibers, and then subjected to, e.g., heat curing so that the water-repellent agent is firmly integrated with the surface of the cellulose fibers. The water repellency can be maintained in the subsequent dyeing or washing. Therefore, a portion of the cellulose fibers to which the water-repellent agent has been cross-linked will not be dyed and functions as a resist for piece dyeing.

[0014] The cellulose fibers are preferably at least one selected from natural cellulose fibers and regenerated cellulose fibers, and more preferably natural cellulose fibers. Examples of the natural cellulose fibers include

cotton and hemp. Examples of the regenerated cellulose fibers include normal rayon, Bemberg rayon, solvent type rayon, and lyocell. The present invention is particularly effective in using the natural cellulose fibers that require a scouring and bleaching process to remove contaminants and dirt.

[0015] The effects of the present invention can be achieved when the fiber assembly including the cellulose water-repellent fibers is present in an amount of 20% by mass or more, preferably 35% by mass or more, and more preferably 50% by mass or more. Therefore, other fibers may be further added in an amount of 80% by mass or less, preferably 65% by mass or less, and more preferably 50% by mass or less. The other fibers may include, e.g., fibers other than the cellulose fibers and cellulose fibers that have not been subjected to a water-repellent treatment.

[0016] The water-repellent agent is preferably a fluorine-based water-repellent agent. In particular, a heat curing type water-repellent agent is preferred in terms of durability. Further, it is preferable that the fluorine-based water-repellent agent is used in combination with a cross-linking agent, and that the fluorine-based water-repellent agent is cross-linked and fixed to the surface of the cellulose fibers. Examples of the cross-linking agent include a urethane cross-linking agent and an acrylic cross-linking agent. In this case, the urethane cross-linking agent is particularly preferred. The water-repellent agent may be, e.g., "NK GUARD S-09" manufactured by NICCA CHEMICAL CO., LTD. The cross-linking agent may be, e.g., "NKASSISTV" manufactured by NICCA CHEMICAL CO., LTD.

[0017] When the fluorine-based water-repellent agent is used as a water-repellent agent, the fluorine content is preferably 0.01 to 1.4% by mass, more preferably 0.1 to 1.0% by mass, and particularly preferably 0.2 to 0.7% by mass. The fluorine content within the above range is practically sufficient for resist dyeing. The fluorine content is measured as the ratio of the fluorine element to the total number of elements in, e.g., the water-repellent cotton, where the total number of elements is detected by a fluorescent X-ray analyzer and set to 100.

[0018] The fiber product of the present invention includes the cellulose water-repellent fibers. For example, the fiber product may be a piece dyed denim-like fabric. When a woven fabric is made by using normal cotton spun yarns as the warp and the water-repellent cotton spun yarns of the present invention as the weft, and then the woven fabric is dyed (piece dyeing), the warp is dyed, but the weft is not dyed, so that a denim-like fabric can be obtained. Other examples of the fiber product include an interwoven fabric other than the denim-like fabric, an interknitted fabric, and a fabric in which the water-repellent cotton spun yarns of the present invention are arranged in part. The fabric including the water-repellent cotton spun yarns of the present invention can have a white pattern on a colored background. A woven or knitted fabric using the spun yarns of the present invention

can be piece dyed and have water repellency as a whole. In the present invention, the water-repellent treatment may be performed after cotton dyeing or yarn dyeing.

[0019] The method for producing a fiber assembly including cellulose water-repellent fibers of the present invention includes the following steps of

- (1) applying a water-repellent agent to at least one fiber assembly selected from cotton, a fiber bundle, a yarn, and a gray fabric; and
- (2) cross-linking the water-repellent agent to the surface of cellulose fibers by drying and then heat curing.

[0020] The water-repellent agent is applied to the fiber assembly by, e.g., impregnation, spraying, or padding. It is preferable that the water-repellent agent is dispersed in water before being applied to the fiber assembly. Thus, uniform application can be achieved.

[0021] The drying process and the heat curing process may be continuously performed with a heated-air dryer. The heat curing conditions are preferably such that the temperature is 150 to 190°C and the time is 2 to 20 minutes. In this case, the cellulose fibers should not be damaged by heat.

[0022] When the water-repellent agent is cross-linked to the surface of the cellulose fibers in the cotton or the fiber bundle, the cotton or the fiber bundle is preferably opened. This is because the fibers may converge due to the water-repellent treatment.

[0023] Hereinafter, the present invention will be described with reference to the drawing. FIG. 1 is a process chart showing a method for producing water-repellent fibers of an embodiment of the present invention. First, raw cotton of cellulose fibers is blended and opened by a carding machine to form a web. Then, the web is drawn out to produce a sliver (fiber bundle). Next, the sliver is impregnated with an aqueous dispersion containing a water-repellent agent and a cross-linking agent, squeezed, dried, and heat cured so that the water-repellent agent is cross-linked and fixed to the surface of the cellulose fibers. Subsequently, the fibers are blended again and go through a carding machine to form an opened web. The opened web is drawn out to produce a sliver. The sliver is spun into yarn by roving and fine spinning. The spun yarn is used to make a woven fabric or a knitted fabric. For example, the woven fabric or the knitted fabric may be made by combining different types of yarns, e.g., the water-repellent spun yarns thus obtained and normal spun yarns that have not been subjected to a water-repellent treatment. When such a woven fabric or knitted fabric is dyed, the normal spun yarns that have not been subjected to a water-repellent treatment are dyed, but the water-repellent spun yarns are not dyed, so that a non-uniformly dyed fabric is obtained. The non-uniformly dyed fabric is useful as a denim-like fabric. In the above method, the water-repellent agent is applied to the fiber bundle because this allows the fibers

to be treated continuously and also facilitates material handling.

Examples

[0024] Hereinafter, the present invention will be described in detail by way of examples. The present invention is not limited to the following examples.

(Example 1)

<Raw cotton>

[0025] Egyptian cotton was used as raw cotton.

<Production of water-repellent cotton>

[0026] Water-repellent cotton was produced by the method shown in FIG. 1. First, 200 L of a chemical solution was prepared, which contained 20 L of a fluorine-based water-repellent agent "NK GUARD S-09" (trade name) manufactured by NICCA CHEMICAL CO., LTD., 4 L of a urethane cross-linking agent "NKASSIST V" (trade name) manufactured by NICCA CHEMICAL CO., LTD., 1 L of a penetrating agent "INVADINE 650" (trade name) manufactured by Huntsman Corporation, and water. Then, a sliver was impregnated with the chemical solution, squeezed by a mangle, dried, and heat cured at 170°C for 10 minutes so that the water-repellent agent (including the cross-linking agent) was cross-linked. The fluorine content of the resulting water-repellent cotton was measured by a fluorescent X-ray analyzer (ZSX100e: EZ scanning method) manufactured by Rigaku Corporation and was 0.4% by mass.

<Production of spun yarn>

[0027] Thereafter, as shown in FIG. 1, the water-repellent cotton was returned to the blending process, thus forming an opened web. The opened web was drawn out to produce a sliver. The sliver was spun into yarn by roving and fine spinning (ring spinning). The English count of the spun yarn was 7. The passage of the water-repellent cotton through the spinning process was not different from that of normal cotton.

<Production of woven fabric>

[0028] Normal spun yarns having an English count of 7.2 (single yarn) were arranged as the warp and the spun yarns (English count 7, single yarn) made of the above water-repellent cotton were arranged as the weft to create a fabric with a warp density of 65 thread/inch, a weft density of 40 thread/inch, and a 3/1 twill weave as textile design. This fabric was singed, desized, scoured, bleached, and mercerized in the usual manner. Then, the fabric was impregnated with a reactive dye in the usual manner, and thus the reactive dye imparted color

to the fabric and was fixed to the fabric. Finally, the fabric was subjected to a finishing treatment with a softening agent, providing a denim-like fabric in which the warp was dyed. The finished mass (weight per unit area) of the fabric was 380 g/m². The passage of the water-repellent cotton from the weaving process to the dyeing process was not different from that of normal cotton. The water-repellent spun yarns serving as the weft appeared on the back side of the denim-like fabric. The fluorine content of these water-repellent spun yarns was measured from the back side with the same apparatus and method as those used for the water-repellent cotton and was 0.3% by mass.

<Evaluation>

[0029] The fabric thus obtained was made of 100% cotton yarn and had good texture. A washing test was performed by washing this fabric 20 times with water in accordance with the method defined in JIS L 0001: 2014 (code number 141). Consequently, the fabric caused neither color fading nor color transfer. Moreover, the results of a wash fastness test (JIS L 0844: 2011 A-2) showed that the fabric was grade 4 to 5 for color change and grade 4 to 5 for staining, which were about the same as the typical piece dyeing (e.g., alkali-steaming method) of cotton fabrics. Further, the fabric had better fastness than the denim in which the warp had been indigo-dyed before the yarns were woven into cloth. In particular, with respect to the fastness to rubbing (JIS L 0849: 2013 type II method), the typical indigo-dyed denim was grade 2 for dry (warp direction) and grade 1 for wet (warp direction), while the fabric of this example was grade 4 to 5 for dry (warp direction) and grade 2 for wet (warp direction). Accordingly, the fabric of this example achieved good results.

Industrial Applicability

[0030] The fabrics of the present invention are applicable to, e.g., denim-like fabrics, sports clothing, and summer clothing. Moreover, the fabrics of the present invention can also be used for, e.g., shoes, hats, bags, curtains, and sofa covers.

Claims

1. A fiber assembly comprising cellulose water-repellent fibers,
wherein the fiber assembly is at least one selected from cotton, a fiber bundle, a yarn, and a gray fabric, and
a water-repellent agent is in a cross-linked state and fixed to a surface of cellulose fibers.
2. The fiber assembly according to claim 1, wherein the fiber assembly comprising the cellulose water-repel-

lent fibers is a fiber assembly for resist dyeing.

3. The fiber assembly according to claim 1 or 2, wherein the cellulose fibers are natural cellulose fibers.
4. The fiber assembly according to any one of claims 1 to 3, wherein the water-repellent agent is a fluorine-based water-repellent agent.
5. The fiber assembly according to claim 4, wherein the cellulose water-repellent fibers have a fluorine content of 0.01 to 1.4% by mass.
6. A method for producing the fiber assembly comprising the cellulose water-repellent fibers according to any one of claims 1 to 5, the method comprising:

applying a water-repellent agent to at least one fiber assembly selected from cotton, a fiber bundle, a yarn, and a gray fabric; and
cross-linking the water-repellent agent to a surface of cellulose fibers by drying and then heat curing.
7. The method according to claim 6, wherein heat curing is performed at a temperature of 150 to 190°C for 2 to 20 minutes.
8. The method according to claim 6 or 7, wherein when the water-repellent agent is cross-linked to the surface of the cellulose fibers in the cotton or the fiber bundle, the cotton or the fiber bundle is opened.
9. The method according to any one of claims 6 to 8, wherein the fiber assembly comprises cellulose fibers before piece dyeing.
10. A fiber product comprising the fiber assembly comprising the cellulose water-repellent fibers according to any one of claims 1 to 5.
11. The fiber product according to claim 10, wherein the fiber product is a piece dyed denim-like fabric.

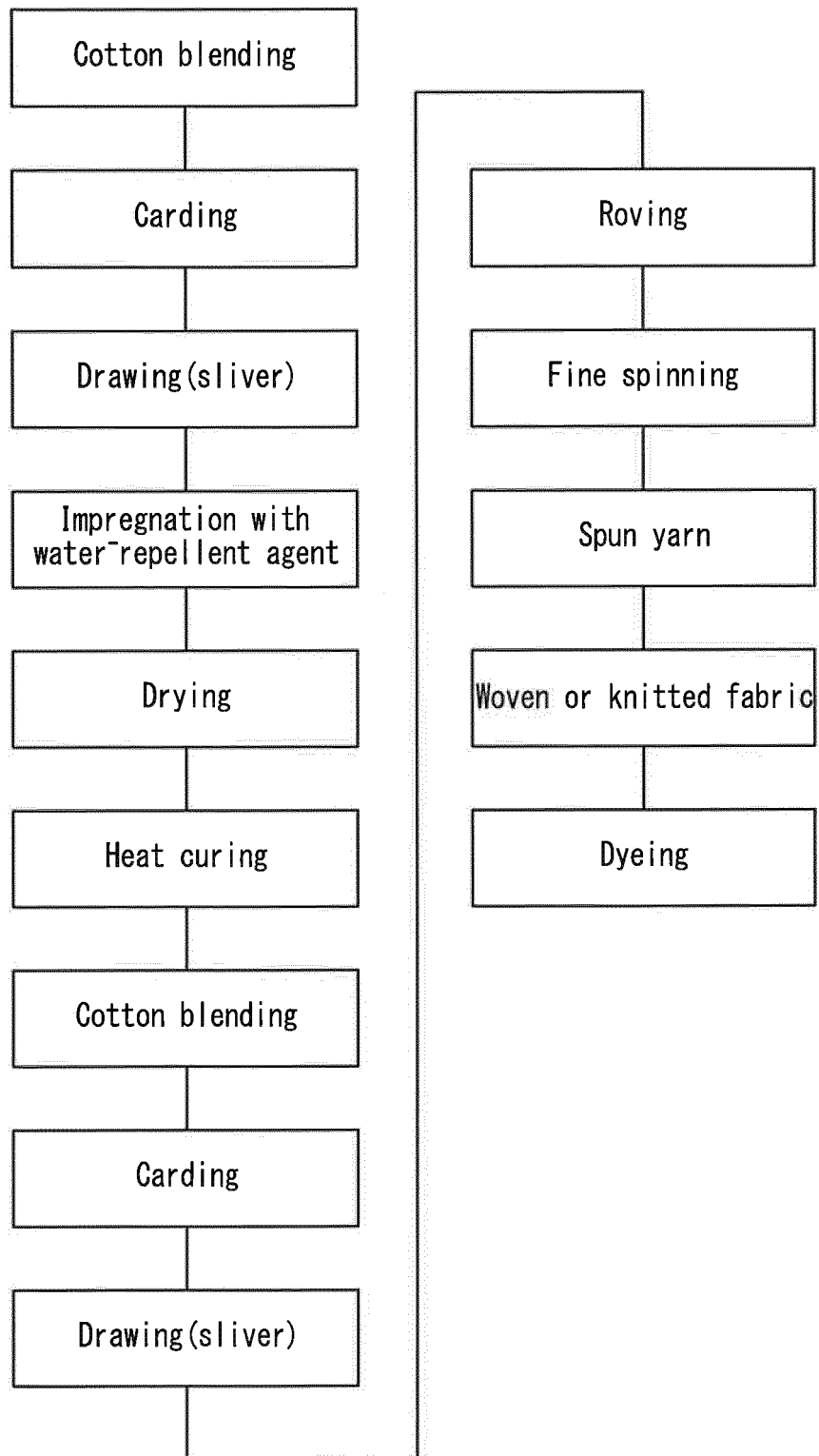


FIG. 1

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2018/019467

A. CLASSIFICATION OF SUBJECT MATTER

Int.Cl. D06M15/277(2006.01)i, D02J1/18(2006.01)i, D03D1/00(2006.01)i,
D06M15/256(2006.01)i, D06M15/295(2006.01)i, D06M101/06(2006.01)n

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. D06M13/00-15/715, D02G1/00-3/48, D02J1/00-13/00, D03D1/00-27/18,
D06P1/00-7/00

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	1971-2018
Registered utility model specifications of Japan	1996-2018
Published registered utility model applications of Japan	1994-2018

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	JP 4-82980 A (KANEBO LIMITED) 16 March 1992, claims, column 3, lines 2-6, column 3, line 19 to column 4, line 10, column 5, lines 6-9, column 6, lines 3-10, column 8, line 20 to column 9, line 9, example 1 (Family: none)	1-11
X A	JP 3-269185 A (MIKI RIKEN KOGYO KK) 29 November 1991, claims, page 1, lower right column, lines 8- 14, page 2, lower right column, lines 1-13, examples (Family: none)	1-7, 9-11 8
X A	JP 11-302970 A (TORAY INDUSTRIES, INC.) 02 November 1999, claims, paragraphs [0013], [0014], [0016], examples (Family: none)	1, 3-11 2



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

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Date of the actual completion of the international search
23.07.2018

Date of mailing of the international search report
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INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2018/019467

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	JP 2009-197386 A (MIYAMOTO, Hiroshi) 03 September 2009, claims, paragraphs [0015], [0049], examples & WO 2008/041570 A1	1, 3-11 2
A	JP 2003-96673 A (KURASHIKI BOSEKI KK) 03 April 2003, claims, examples (Family: none)	1-11

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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- JP H41992272247 A [0003]
- JP S60198575678 A [0003]
- JP 2013520579 A [0003]