(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 2 769 754 A1

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
27.08.2014 Bulletin 2014/35

(51) Int Cl.:
A63B 67/18 *(2006.01)*

(21) Application number: **14154253.0**

(22) Date of filing: **07.02.2014**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

(30) Priority: **20.02.2013 JP 2013030933**

(71) Applicant: **Yonex Kabushiki Kaisha**
Joint-stock company of Japan
Tokyo 113-8543 (JP)

(72) Inventor: **Tanaka, Kensuke**
Tokyo, 113-8543 (JP)

(74) Representative: **Heine, Christian Klaus**
KNH Patentanwälte
Kahlhöfer Neumann Rößler Heine
Postfach 10 33 63
40024 Düsseldorf (DE)

(54) **Shuttlecock**

(57) A shuttlecock includes: a base portion; and a plurality of artificial feathers arranged in an annular form on the base portion, the artificial feathers respectively including vane portions and rachis portions supporting the vane portions, each of the vane portions having a protruding portion protruding, toward an other one of the vane portions adjacent to the each of the vane portions, in a direction intersecting a direction of a face of the other one of the vane portions.

EP 2 769 754 A1

Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to shuttlecocks using artificial feathers.

Description of the Related Art

[0002] As badminton shuttlecocks, there are those using waterfowl feather (natural feather) (natural feather shuttlecocks) and those using artificial feather (artificial feather shuttlecocks) artificially manufactured using nylon resin and the like, for the feathers.

[0003] As is well known, natural feather shuttlecocks have a structure using approximately 16 natural feathers of geese, ducks, or the like, and the ends of the rachises of the feathers are embedded into the hemispherical platform (base portion) made of cork covered with skin, or the like. Then, the feather used for natural feather shuttlecocks has a feature of the specific gravity being small and being extremely light. A feather has high rigidity and thereby a unique flight performance and a comfortable feel when hitting natural feather shuttlecocks can be perceived.

[0004] On the other hand, in artificial shuttlecocks using artificial feathers imitating natural feathers, the rigidity of a rachis portion and a vane portion is lower than that of the natural feathers. For this reason, the adjacent vane portions may intersect (overlapping state of the vane portions may be reversed) when receiving the impact of hitting a shuttlecock.

[0005] Thus, for example, in Japanese Patent Application Laid-open Publication No. 2009-160267, such intersection is prevented by bonding/fusing the adjacent vane portions or sewing them up with a member such as a string or the like.

[0006] The aforementioned shuttlecocks have such a problem that works for preventing the intersection are time-consuming.

[0007] The intersection of the adjacent vane portions depends on an overlap amount between the vane portions, and the intersection can be considered to be able to be suppressed by reducing the overlap amount. However, as will be described later, if the overlap amount is reduced, clearance between the adjacent vane portions is increased, thereby affecting the flight distance and the number of revolutions. For this reason, there is a possibility of being unable to acquire stable flight characteristics.

[0008] The present invention has been made in view of such circumstances, and an object thereof is to provide a shuttlecock capable of acquiring stable flight characteristics regardless of an overlap amount between vane portions.

SUMMARY OF THE INVENTION

[0009] A shuttlecock according to an aspect of the present invention includes: a base portion; and a plurality of artificial feathers arranged in an annular form on the base portion, the artificial feathers respectively including vane portions and rachis portions supporting the vane portions, each of the vane portions having a protruding portion protruding, toward an other one of the vane portions adjacent to the each of the vane portions, in a direction intersecting a direction of a face of the other one of the vane portions.

[0010] According to the shuttlecock of the present invention, stable flight characteristics can be acquired regardless of an overlap amount between the vane portions.

[0011] Other features of the present invention will become apparent from descriptions of the present specification and of the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012]

Fig. 1 is a perspective view of an artificial shuttlecock when viewed from a base portion side.

Fig. 2 is a perspective view of the artificial shuttlecock when viewed from an artificial feather side.

Fig. 3 is an external view of an artificial feather in a comparative example 1.

Fig. 4A to Fig. 4C are explanatory diagrams of the artificial feather in the comparative example 1.

Fig. 5 is a schematic diagram of a plurality of vane portions in the comparative example 1 when viewed from above.

Fig. 6 is a perspective view illustrating an arrangement state of vane portions of an artificial shuttlecock in a comparative example 2.

Fig. 7 is a schematic top view of an arrangement state of the vane portions in the comparative example 2 when viewed from above.

Fig. 8 is a top view illustrating an arrangement state of vane portions in an artificial shuttlecock according to an embodiment of the present invention.

Fig. 9 is a perspective view illustrating an arrangement state of the vane portions in the artificial shuttlecock according to an embodiment of the present invention.

Fig. 10 is a side view illustrating an arrangement state of the vane portions in the artificial shuttlecock according to an embodiment of the present invention.

Fig. 11 is a side view of an arrangement state of the vane portions in the artificial shuttlecock according to an embodiment of the present invention.

Fig. 12A to Fig. 12C are explanatory diagrams of an artificial feather 10 in the artificial shuttlecock according to an embodiment of the present invention,

wherein Fig. 12A is a plan view of the artificial feather when viewed from a front side, Fig. 12B is a plan view of the artificial feather when viewed from a back side, and Fig. 12C is an A-A cross-sectional diagram in Fig. 12A and Fig. 12B.
Fig. 13 is a schematic top view of an arrangement state of the vane portions according to an embodiment of the present invention.
Fig. 14 is an explanatory diagram illustrating a shape of a vane portion in a variation 1.
Fig. 15 is an explanatory diagram illustrating a shape of a vane portion in a variation 2.
Fig. 16 is an explanatory diagram illustrating a skirt portion in a variation 3.
Fig. 17A is an explanatory diagram illustrating a vane portion in a variation 4.
Fig. 17B is an explanatory diagram illustrating the vane portion in the variation 4.

DETAILED DESCRIPTION OF THE INVENTION

=== Summary ===

[0013] At least the following details will become apparent from descriptions of the present specification and of the accompanying drawings.
[0014] A shuttlecock will become apparent which includes: a base portion; and a plurality of artificial feathers arranged in an annular form on the base portion, the artificial feathers respectively including vane portions and rachis portions supporting the vane portions, each of the vane portions having a protruding portion protruding, toward an other one of the vane portions adjacent to the each of the vane portions, in a direction intersecting a direction of a face of the other one of the vane portions.
[0015] According to such a shuttlecock, stable flight characteristics can be achieved regardless of an overlap amount between the vane portions. Further, since an overlap amount between the adjacent vane portions can be reduced, occurrence of intersection can be prevented.
[0016] It is preferable that, in such a shuttlecock, each of the vane portions has a cut-out portion at an end portion in a width direction thereof.
[0017] According to such a shuttlecock, an overlap amount between the adjacent vane portions can easily be reduced, and occurrence of intersection can be prevented.
[0018] It is preferable that, in such a shuttlecock, the protruding portion is provided at the end portion of each of the vane portions.
[0019] According to such a shuttlecock, clearance between the vane portions can be reduced while the overlap amount is reduced.
[0020] In such a shuttlecock, the protruding portion and the cut-out portion may be formed by bending each of the vane portions of a sheet type.
[0021] In such a shuttlecock, the vane portions may be respectively formed integrally with the rachis portions.
[0022] According to such a shuttlecock, manufacturing costs can be reduced, and further an overlap amount and clearance between the vane portions can be improved in accuracy.

=== Embodiments ===

<Basic Structure of Artificial Shuttlecock>

[0023] Fig. 1 and Fig. 2 are external views for explaining a basic structure of an artificial shuttlecock 1 including artificial feathers 10. Fig. 1 is a perspective view of the artificial shuttlecock 1 when viewed from a base portion 2 side. Fig. 2 is a perspective view of the artificial shuttlecock 1 when viewed from the artificial feather 10 side.
[0024] The artificial shuttlecock 1 includes the base portion 2, the plurality of artificial feathers 10 imitating natural feathers, and a string-like member 3 for fixing the artificial feathers 10 to each other. The base portion 2 is structured such that, for example, a cork base is covered with a thin layer. The base portion 2 has a hemispherical shape having a diameter of from 25 mm to 28 mm, and has a flat face. The bases of a plurality of artificial feathers 10 are embedded in an annular form along the circumference of this flat face. A plurality of artificial feathers 10 are arranged in such a manner that each clearance therebetween increases with distance from the base portion 2. Further, as illustrated in the figures, each of the artificial feathers 10 is arranged in such a manner as to overlap with another one of the artificial feathers 10 adjacent thereto. Thus, a skirt portion 4 is formed with a plurality of artificial feathers 10. A plurality of artificial feathers 10 are fixed to each other with the string-like member 3 (for example, a cotton thread).

<Structure of Artificial Feather (Comparative Example 1)>

[0025] Fig. 3 is an external view of an artificial feather 10 in a comparative example 1. Further, Fig. 4A to Fig. 4C are explanatory diagrams of the artificial feather 10 in the comparative example 1. Fig. 4A is a plan view of the artificial feather 10 when viewed from the front side. Fig. 4B is a plan view of the artificial feather 10 when viewed from the back side. Fig. 4C is a diagram of the artificial feather 10 when viewed from above. Note that the members which have already been described are denoted by the same reference numerals.
[0026] The artificial feather 10 includes a vane portion 112 and a rachis portion 14. The vane portion 112 is a portion corresponding to a vane of a natural feather, and the rachis portion 14 is a portion corresponding to a rachis of a natural feather. In the figures, an up-and-down direction is defined along the rachis portion 14, and the side on which the vane portion 112 is provided is defined as "up" while the opposite side is defined as "down". Further, in the figures, a right-and-left direction is defined along a direction (width direction) of the vane portion 112

extending from the rachis portion 14. Further, in the figures, front and back are defined on the basis of a state where the artificial feather 10 has been embedded into the base portion 2. Hereinafter, components may be described according to the up and down, the right and left, and the front and back, which have been defined in the figures.

[0027] The vane portion 112 of the comparative example 1 is a member of a sheet form imitating the shape of the vane of a natural feather. The vane portion 112 can be structured using, for example, a nonwoven fabric, a resin or the like. In the case of the nonwoven fabric, a reinforcement coating is formed on a surface of the vane portion 112, in order to prevent fibers of a nonwoven fabric from being loosen when the shuttlecock is hit. The reinforcement coating can be formed by applying a resin, and various methods are employed therefor such as a dip method, a spray method, a roll coat method and the like. Further, note that the reinforcement coating may be formed on a single side of the vane portion 112 or both sides thereof. Further, the reinforcement coating may be formed on the whole surface of the vane portion 112 or a part thereof.

[0028] The rachis portion 14 is a long and thin member, imitating the shape of a rachis of a natural feather, as well as the member supporting the vane portion 112. The rachis portion 14 includes a vane support portion 14A supporting an area from the upper end to the lower end of the vane portion 112, and a calamus portion 14B protruding from the vane portion 112. The calamus portion 14B is a portion corresponding to a calamus of a natural feather (note that this part is also designated as a quill). The lower end of the calamus portion 14B is embedded in the base portion 2 and fixed to the base portion 2.

[0029] The rachis portion 14 in the figures is illustrated in a quadrangle shape in cross section. However, the rachis portion 14 may be in a rhombic shape, a circular shape, or an elliptical shape in cross section. Further, the rachis portion 14 may be in different shapes in the up-and-down direction so as to be, for example, in a circular shape on the upper side and a quadrangle shape in the lower side.

[0030] Further, the rachis portion 14 in the figures is formed such that the size of a cross sectional shape thereof becomes larger toward the lower side thereof. However, the size of the cross sectional shape may be uniform in the up-and-down direction without any change, or the size of the cross sectional shape may be changed in a smooth manner.

[0031] Note that the rachis portion 14 and the vane portion 112 may be separated or integrated. For example, when a resin is used as a material of the rachis portion 14 and the vane portion 112, the rachis portion 14 and the vane portion 112 can be integrally molded by injection molding using a mold. Further, when they are separated, the vane portion 112 may be supported on the back side of the vane support portion 14A, or the vane portion 112 may be supported on the front side of the vane support portion 14A. Further, the vane portion 112 may be structured with two sheets and may be structured such that the vane support portion 14A is sandwiched between two sheets of the vane portion 112. Further, the vane portion 112 may be embedded into the inside of the vane support portion 14A.

[0032] In the aforementioned artificial feathers 10, "intersection" possibly occurs which indicates that relationship of the front and back (layered state) between the adjacent vane portions 112 becomes reversed relationship when the shuttlecock is hit. If the intersection occurs, it is difficult to recover to their initial front-and-back relationship even when the shuttlecock continues being hit, resulting in a problem of an unstable flight trajectory. Note that, in a natural feather, since a vane is not in a film state but an assembly of feather body called barbs growing from a rachis, the barbs of the vane slip through the barbs of another vane adjacent thereto even if the intersection occurs, thereby being able to easily recover from the intersection state to the initial state while the shuttlecock is being hit.

[0033] Fig. 5 is a schematic diagram of a plurality of vane portions 112 in the comparative example 1 when viewed from above. As illustrated in the figure, a plurality of vane portions 112 are arranged in such a manner that each vane portion overlaps with another vane portion with an angle thereof being gradually changed. Note that, in the following description, an overlap amount between the adjacent vane portions is given as T. Further, clearance between the adjacent vane portions is given as S.

[0034] For example, in Fig. 5, when the adjacent vane portions 112 are spread out once in the right-and-left direction (until they do not overlap) at the time when the shuttlecock is hit, and return to the initial state, the overlapping state of the vane portions 112 may be reversed. When such intersection occurs, stable flight characteristics may not be obtained.

[0035] Thus, it is preferable to take measures to prevent occurrence of the intersection at the time when the shuttlecock is hit. The intersection may be prevented by bonding/fusing the adjacent vane portions 112 together or sewing them up with a member such as a string, however, in such cases, there arises a problem that intersection preventing works require troublesome tasks.

<Structure of Artificial Feather (Comparative Example 2)>

[0036] In a comparative example 2, a cut-out portion is provided in a vane portion, thereby making an overlap amount T between the adjacent vane portions smaller than that in the comparative example 1. By doing so, occurrence of the intersection can easily be suppressed. For example, in a state where the adjacent vane portions 112 do not substantially overlap with each other in Fig. 5 (T is substantially zero), the intersection does not easily occur.

[0037] Fig. 6 is a perspective view illustrating an ar-

rangement state of vane portions 212 of an artificial shuttlecock 1 in the comparative example 2. Fig. 7 is a schematic top view of an arrangement state of the vane portions 212 in the comparative example 2. Note that Fig. 6 and Fig. 7 illustrate only a part of a plurality of vane portions 212 for convenience of description. Further, since the structure thereof is similar to that in the comparative example 1 with the exception of the vane portions, the description thereof will be omitted.

[0038] As compared with the vane portion 112 in the comparative example 1, the vane portion 212 in the comparative example 2 is formed with a cut-out portion 212a at an end on one side in the width direction thereof (right-and-left direction). As such, since the vane portions 212 in the comparative example 2 is provided with the cut-out portion 212a, the length of each of the vane portions 212 in the width direction is shorter than the length of the vane portion 112 in the width direction in the comparative example 1. Thus, each overlap amount T between the adjacent vane portions 212 is smaller than each overlap amount T in the comparative example 1 (Fig. 5).

[0039] As such, by decreasing the overlap amount T, the intersection of the adjacent vane portions 212 (reversal of overlapping state) does not easily occur, even on impact when a shuttlecock is hit. Thus, the intersection of the vane portions 212 can be prevented. However, in this comparative example 2, with the cut-out portion 212a being provided in the vane portions 212, clearance S between the adjacent vane portions 212 becomes greater than that in the comparative example 1.

[0040] In the artificial shuttlecock 1, flight trajectory and rotation are controlled by air flow in each clearance S between the vane portions. If the clearance S between the adjacent vane portions 212 is too great as in this comparative example 2, the number of revolutions is increased to more than the appropriate value. As a result, the flight trajectory greatly curves. In contrast, if the clearance S is too small, the number of revolutions becomes smaller than the appropriate value. As a result, the breaks appropriate for the flight trajectory are not applied.

<Structure of Artificial Feather (Embodiment of the Present Invention)>

[0041] In an embodiment of the present invention, even when an overlap amount T between the vane portions is reduced, the stable flight characteristics are to be obtained regardless of the overlap amount, by appropriately adjusting the clearance S.

[0042] Fig. 8 is a top view illustrating an arrangement state of vane portions 12 of an artificial shuttlecock 1 according to an embodiment of the present invention. Fig. 9 is a perspective view illustrating an arrangement state of the vane portions 12 of the artificial shuttlecock 1 according to an embodiment of the present invention. Fig. 10 and Fig. 11 are side views illustrating an arrangement state of the vane portions 12 of the artificial shuttlecock 1 according to an embodiment of the present invention. These figures illustrate only a part of a plurality of vane portions 12 for convenience of description.

[0043] Further, Fig. 12A to Fig. 12C are explanatory diagrams illustrating an artificial feather 10 of the artificial shuttlecock 1 according to an embodiment of the present invention. Fig. 12A is a plan view of the artificial feather 10 when viewed from the front side. Fig. 12B is a plan view of the artificial feather 10 when viewed from the back side. Fig. 12C is an A-A cross-sectional diagram in Fig. 12A and Fig. 12B. Note that the members which have already been described are denoted by the same reference numerals, and the descriptions thereof will be omitted.

[0044] The vane portion 12 has a cut-out portion 12a similar to the cut-out portion 212a of the vane portions 212 in the comparative example 2. This cut-out portion 12a is in such a shape that an overlap between the adjacent vane portions 12 is reduced. Specifically, the cut-out portion 12a is provided in a curved shape (concave shape) corresponding to a curved shape (convex shape) of a right-side end portion of the vane portion 12. Further, the vane portion 12 has a flap portion 12b (corresponding to a protruding portion) at a left end on the front side thereof. This flap portion 12b protrudes toward another vane portion 12 adjacent to the vane portion 12 (more specifically, toward a direction intersecting a direction of a face of another vane portion 12 adjacent to the vane portion 12). In an embodiment of the present invention, an angle θ formed between the face of the vane portion 12 and the flap portion 12b in Fig. 12C is 90 degrees (with an error of plus or minus several degrees).

[0045] Fig. 13 is a schematic top view of an arrangement state of the vane portions 12 according to an embodiment of the present invention when viewed from above.

[0046] As described above, the vane portion 12 according to an embodiment of the present invention is provided with the cut-out portion 12a and the flap portion 12b. The length of each vane portion 12 in the width direction (right-and-left direction) is reduced by the cut-out portion 12a being provided, and an overlap amount T becomes smaller than that in the comparative example 1 (Fig. 5). For this reason, occurrence of the intersection of the adjacent vane portions 12 can be prevented. Further, since the flap portion 12b is provided, the clearance S between the adjacent vane portions 12 can be adjusted more appropriately than that in the comparative example 2 (Fig. 7). For this reason, a flight distance and rotation can be improved, thereby being able to obtain stable flight characteristics.

[0047] Note that, in an embodiment of the present invention, a thermoplastic resin is used for the vane portion 12. Further, the thermoplastic resin is used for the rachis portion 14 as well. Then, the components of the artificial feather 10 including the vane portion 12 is integrally manufactured (molded) with a mold, not shown, using well-known injection molding techniques such as two-color molding and insert molding. By doing so, manufacturing

costs can be reduced, and further an overlap amount T and clearance S can be improved in accuracy.

[0048] As described hereinabove, the artificial shuttlecock 1 according to an embodiment of the present invention includes the base portion 2 and a plurality of artificial feathers 10 arranged in an annular form on the base portion 2, and the artificial feathers 10 each include the vane portion 12 and the rachis portion 14 supporting the vane portion 12. Each vane portion 12 has the cut-out portion 12a, and has the flap portion 12b at an end portion thereof on the cut-out portion 12a side, the flap portion 12b protruding toward another vane portion 12 adjacent to such each vane portion 12.

[0049] With the flap portion 12b being provided as such, the clearance S between the adjacent vane portions 12 can be appropriately adjusted. Thus, even in the case where an overlap amount T is reduced, stable flight characteristics (flight distance and rotation, etc.) can be obtained.

[0050] Note that, in an embodiment of the present invention, the cut-out portion 12a is provided in the vane portion 12 at one end in the width direction thereof, it is not limited thereto. For example, such cut-out portions that an overlap amount between the adjacent vane portions is reduced may be respectively provided at both ends of each of the vane portions in the width direction. However, if a cut-out portion is provided at one side as in an embodiment of the present invention, an overlap amount T can easily be reduced. Further, the cut-out portion 12a is not necessarily provided. For example, a width of the vane portion 12 may be reduced (narrowed) to such an extent that the adjacent vane portions 12 manage to overlap each other, and the flap portion 12b may be provided at an end of the vane portion in the width direction.

[0051] Further, in an embodiment of the present invention, the flap portion 12b is provided on the front side of the vane portion 12, but it is not limited thereto. For example, it may be provided on the back side of the vane portion 12 (specifically, the back side of the end portion not formed with the cut-out portion 12a). Further, in an embodiment of the present invention, the flap portion 12b is provided along the end portion of the vane portion 12, but it is not limited thereto. For example, it may be arranged in parallel to the end portion and slightly closer to the rachis portion 14. Alternatively, it may be arranged not along the end portion (not in a curved manner) but linearly.

[0052] Further, in an embodiment of the present invention, the cut-out portion 12a is formed in a concave shape in the vane portion 12, but it is not limited thereto. For example, it may be formed linearly. Note that, since an end portion of the vane portion 12 on a side not provided with the flap portion 12b is in a convex shape, the cut-out portion in a concave shape can make an overlap amount T smaller.

=== Variations ===

<Variation 1>

[0053] Fig. 14 is an explanatory diagram illustrating a shape of a vane portion 12 in a variation 1.

[0054] In the variation 1, the cut-out portion 12a is formed only in an upper portion in the vane portion 12. Thus, an overlap amount T (diagonally shaded portion in the figure) between the adjacent vane portions 12 is not uniform over the positions in the overlap amount T in the up-and-down direction. In this example, the overlap amount T is increased around the center of the vane portion 12 in the up-and-down direction. As such, the overlap amount T between the adjacent vane portions 12 does not have to be uniform in the up-and-down direction. Note that structure is not limited to such structure as illustrated in Fig. 14 but, for example, the cut-out portion 12a may be formed at a position opposite to that in Fig. 14 (in other words, a lower portion of the vane portion 12).

[0055] Further, in this variation 1 as well, the flap portion 12b should be provided along the end portion on the cut-out portion 12a side in the vane portion 12. By doing so, the clearance S can be appropriately adjusted, and stable flight characteristics can be obtained.

<Variation 2>

[0056] Fig. 15 is an explanatory diagram illustrating a shape of the vane portion 12 in a variation 2.

[0057] As understood from the figure, the vane portion 12 in the variation 2 varies, in protruding amount (protrusion length) of the flap portion 12b, with the upper side and the lower side. Thus, the clearance S between the adjacent vane portions 12 is not uniform over the positions in the clearance S in the up-and-down direction. Specifically, as understood from the figure, the clearance S increases with decreasing distance from a lower end, and the clearance S decreases with decreasing distance from an upper end. As such, an amount of the clearance S may vary with the position in the clearance S in the up-and-down direction.

[0058] Note that structure in which the clearance S varies with the position in the vane portions is not limited to this example. For example, an inverted case may be possible (that is, the clearance S decreases with decreasing distance from the lower end, and the clearance S increases with decreasing distance from the upper end).

<Variation 3>

[0059] Fig. 16 is an explanatory diagram illustrating a skirt portion 4 in a variation 3. In the variation 3, using a mold for integrally forming the skirt portion 4 (the artificial feather 10 (the vane portion 12 and the rachis portion 14) and the string-like member 3), the skirt portion 4 is integrally formed by injection molding as illustrated in Fig. 16.

[0060] Note that, for this mold, such a mold in which

the positions of the axes of the rachis portions 14 and the angle of the vane portion is fixed is used.

[0061] As such, by integrally forming those portions in the skirt portion 4 by injection molding, more manufacturing costs can be reduced, and further an overlap amount T and clearance S can be improved in accuracy.

<Variation 4>

[0062] In variation 4, each of the cut-out portion 12a and the flap portion 12b is formed by folding (bending) the vane portion 12 of a sheet type (in a planner state).

[0063] Fig. 17A and Fig. 17B are explanatory diagrams illustrating the vane portion 12 in the variation 4. In Fig. 17A is a diagram illustrating a state before folding, and Fig 17B is a diagram illustrating a state after folding.

[0064] In this variation 4, the flap portion 12b and the cut-out portion 12a, as illustrated in Fig. 17B, are formed by folding back the vane portion 12 of a sheet type of Fig. 17A by making a valley fold along a dotted line of the vane portion 12 of Fig. 17A.

[0065] As such, the cut-out portion 12a and the flap portion 12b may be formed by folding back the vane portion 12 of a planner state. Note that when the flap portion 12b is formed as in this variation 4, it is desirable that an angle θ of Fig. 12C is a sharp angle.

=== Others ===

[0066] The above embodiments of the present invention are simply for facilitating the understanding of the present invention and are not in any way to be construed as limiting the present invention. The present invention may variously be changed or altered without departing from its spirit and encompass equivalents thereof.

Claims

1. A shuttlecock comprising:

a base portion; and
a plurality of artificial feathers arranged in an annular form on the base portion,
the artificial feathers respectively including vane portions and rachis portions supporting the vane portions,
each of the vane portions having a protruding portion protruding, toward an other one of the vane portions adjacent to the each of the vane portions, in a direction intersecting a direction of a face of the other one of the vane portions.

2. The shuttlecock according to claim 1, wherein
each of the vane portions has a cut-out portion at an end portion in a width direction thereof.

3. The shuttlecock according to claim 2, wherein
the protruding portion is provided at the end portion of the each of the vane portions.

4. The shuttlecock according to claim 2 or 3, wherein
the protruding portion and the cut-out portion are formed by bending the each of the vane portions of a sheet form.

5. The shuttlecock according to any one of claims 1 to 4, wherein
the vane portions are respectively formed integrally with the rachis portions.

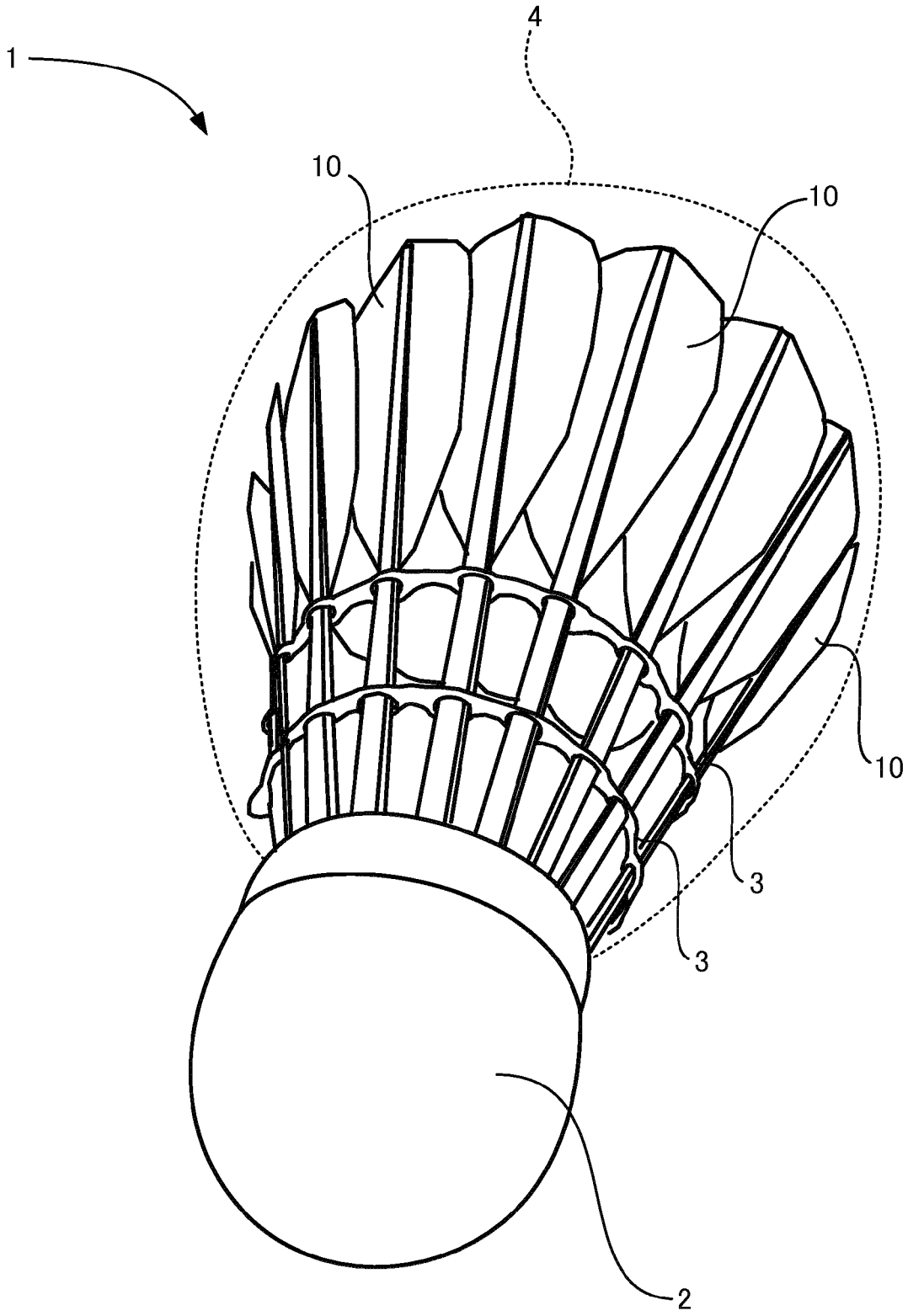

FIG. 1

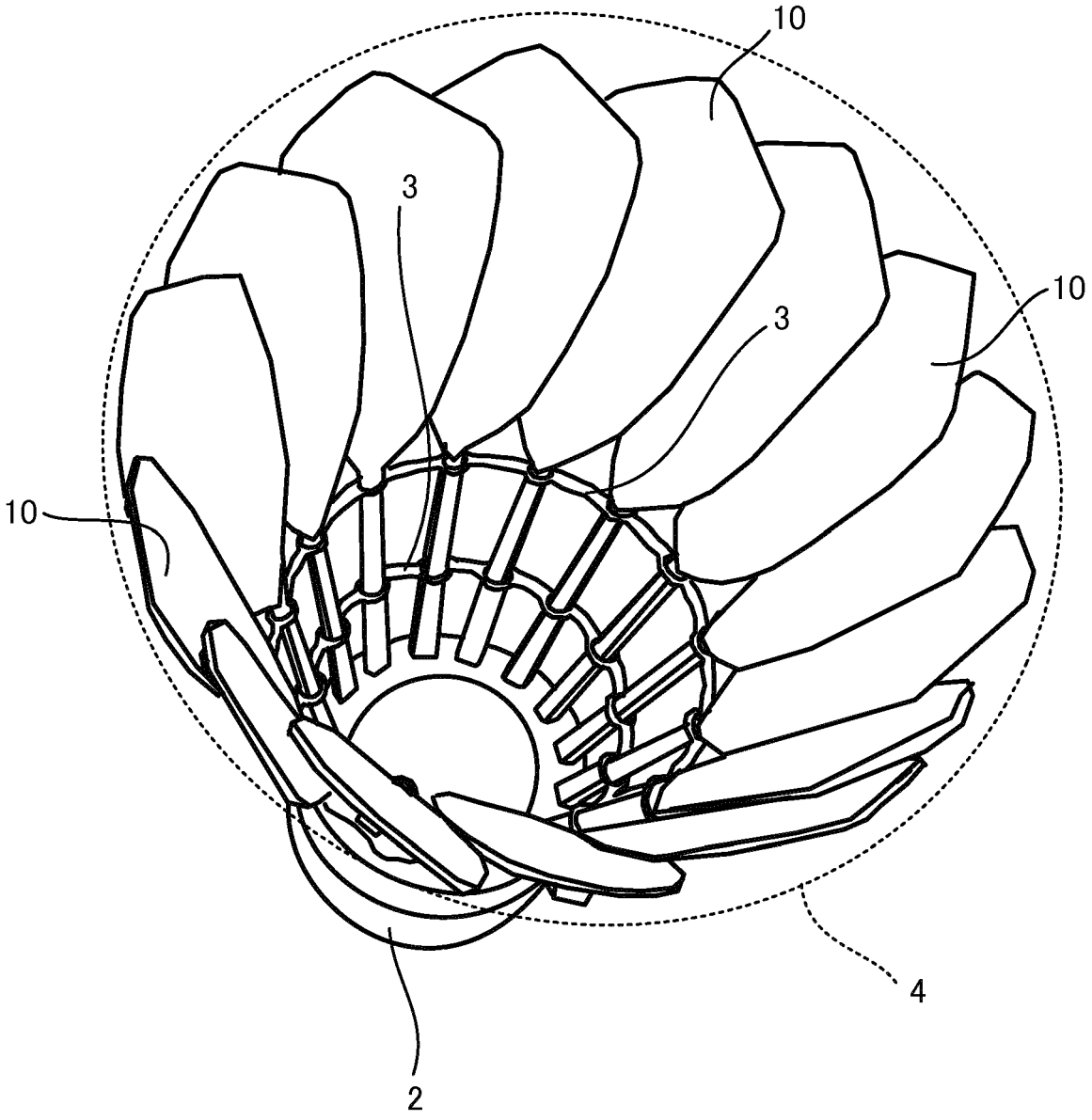

FIG. 2

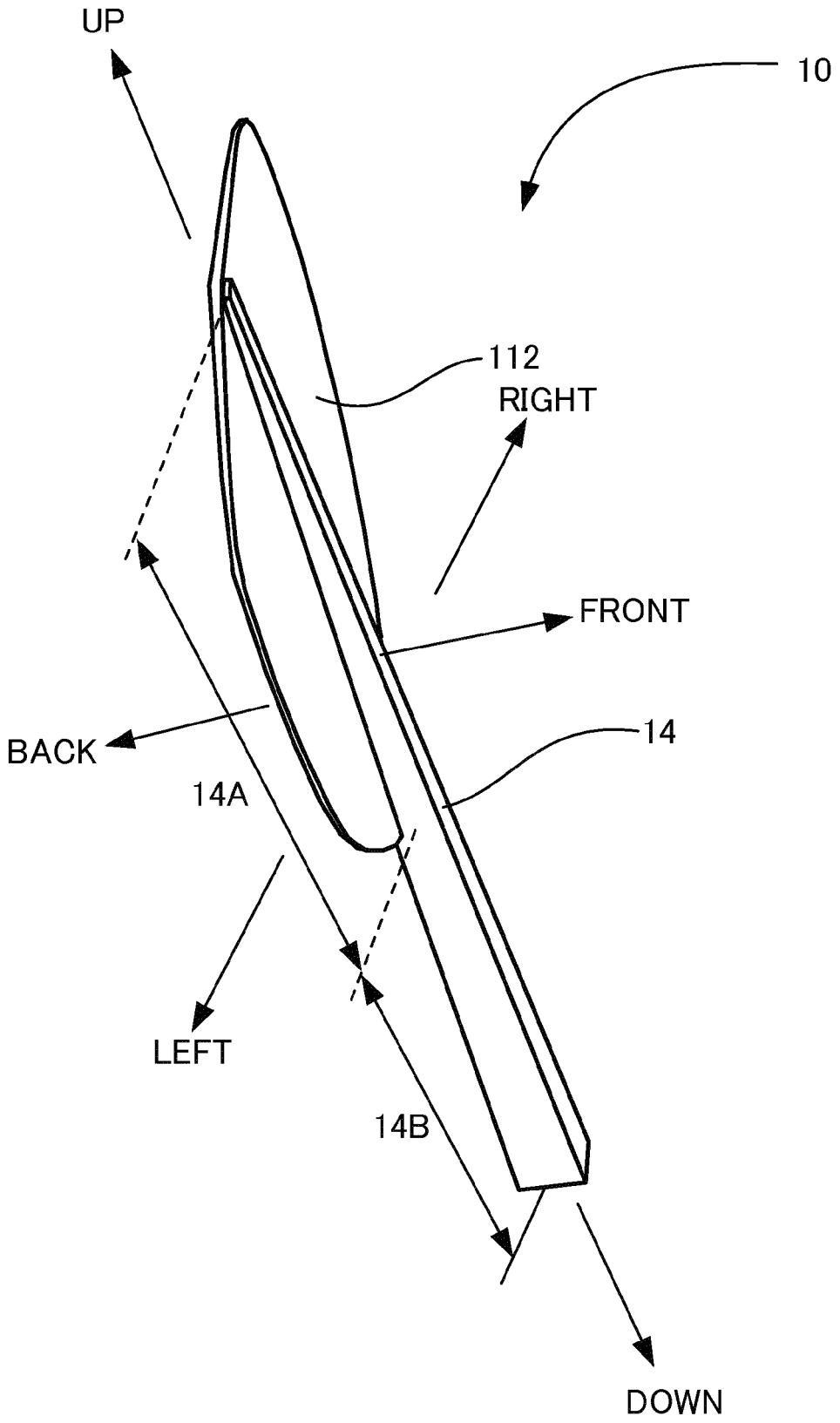

FIG. 3

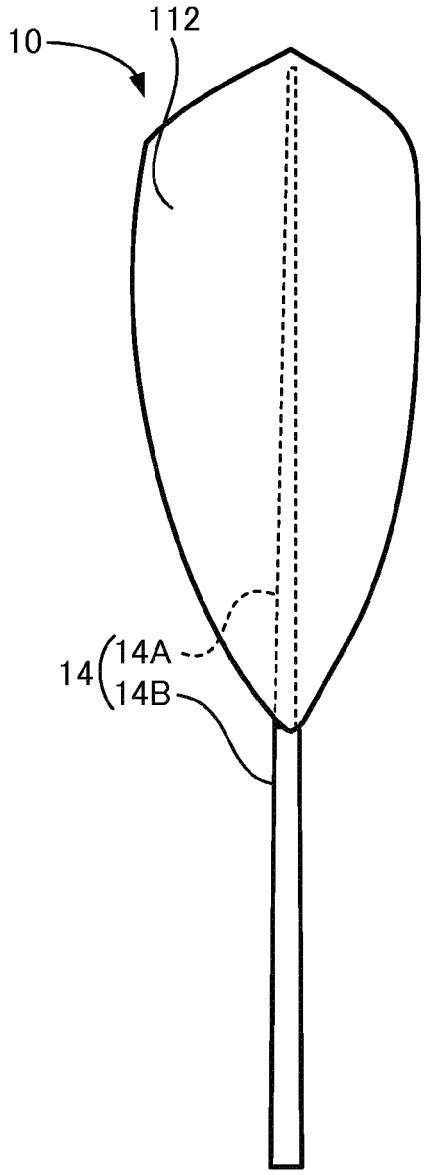

FIG. 4A

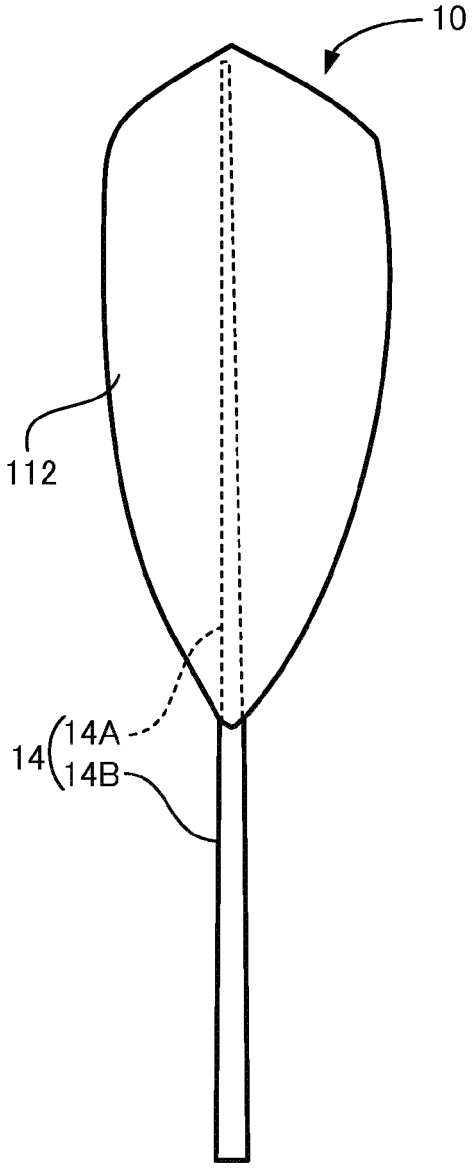

FIG. 4B

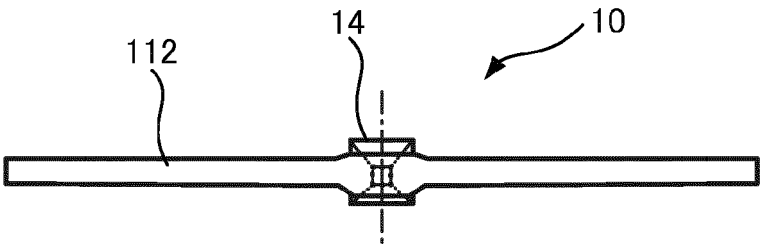

FIG. 4C

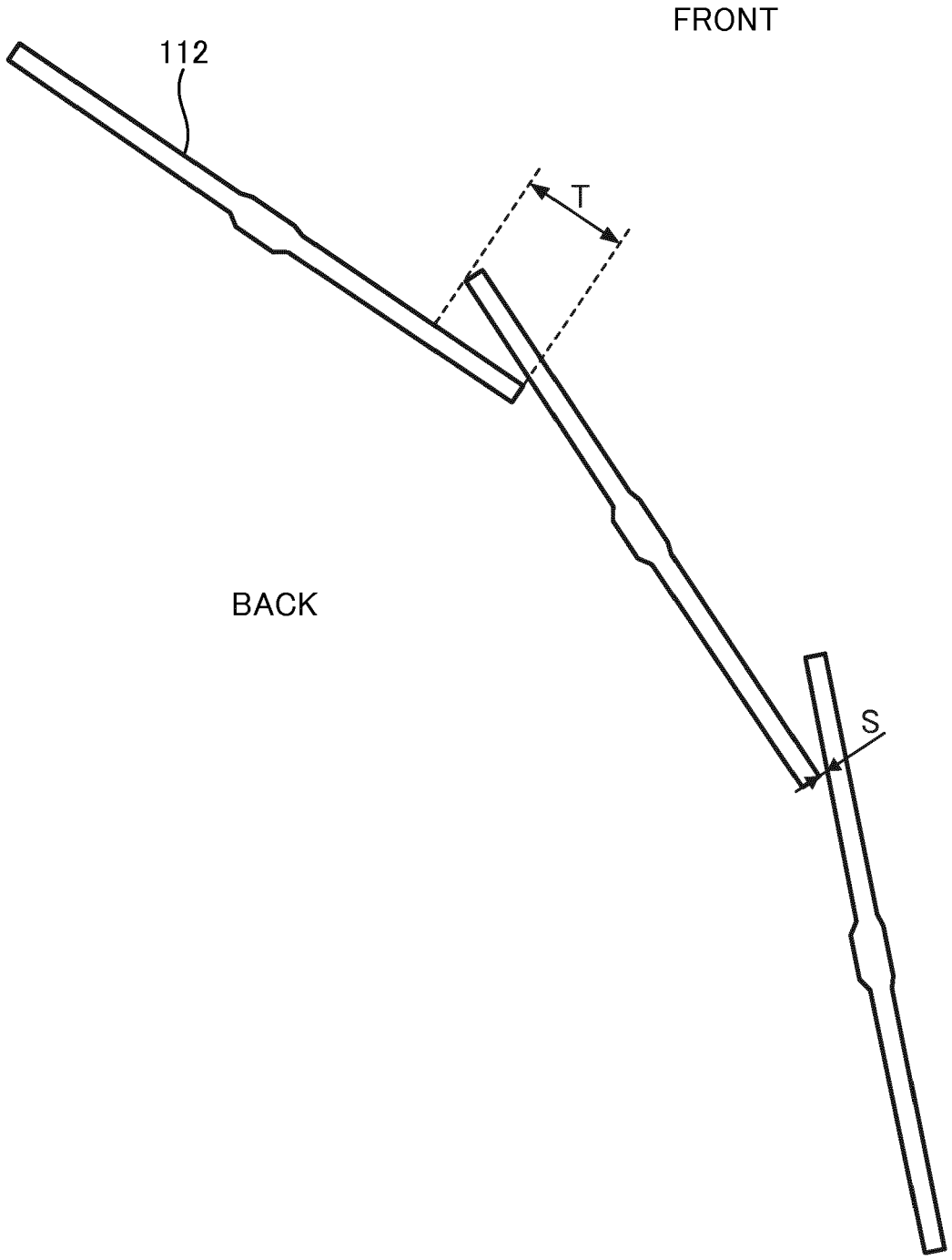

FIG. 5

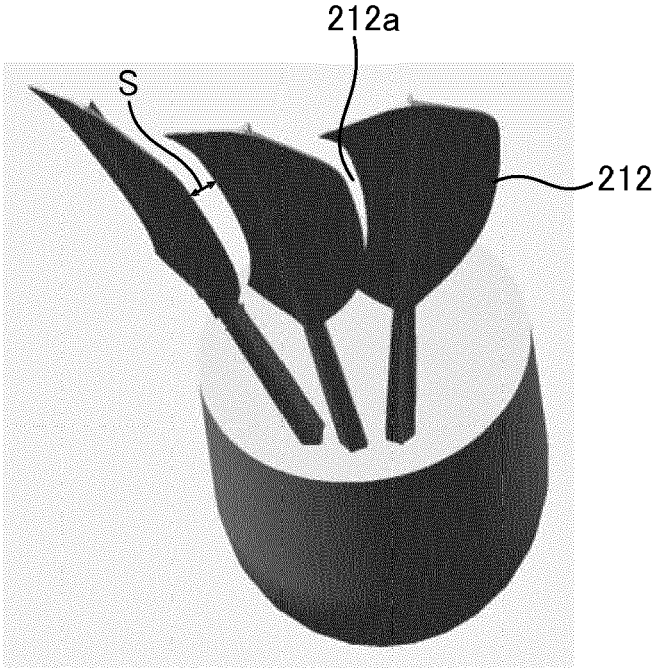

FIG. 6

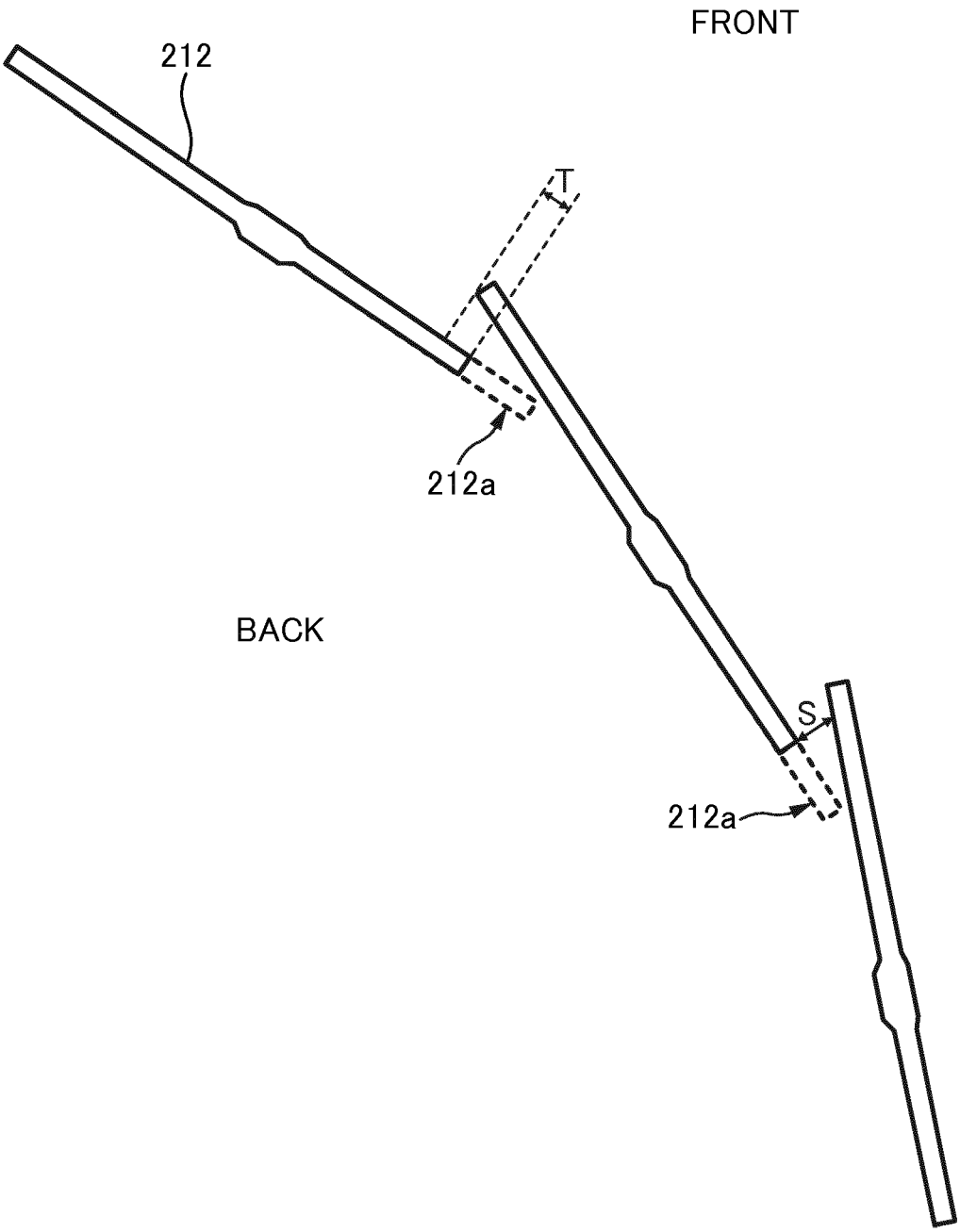

FIG. 7

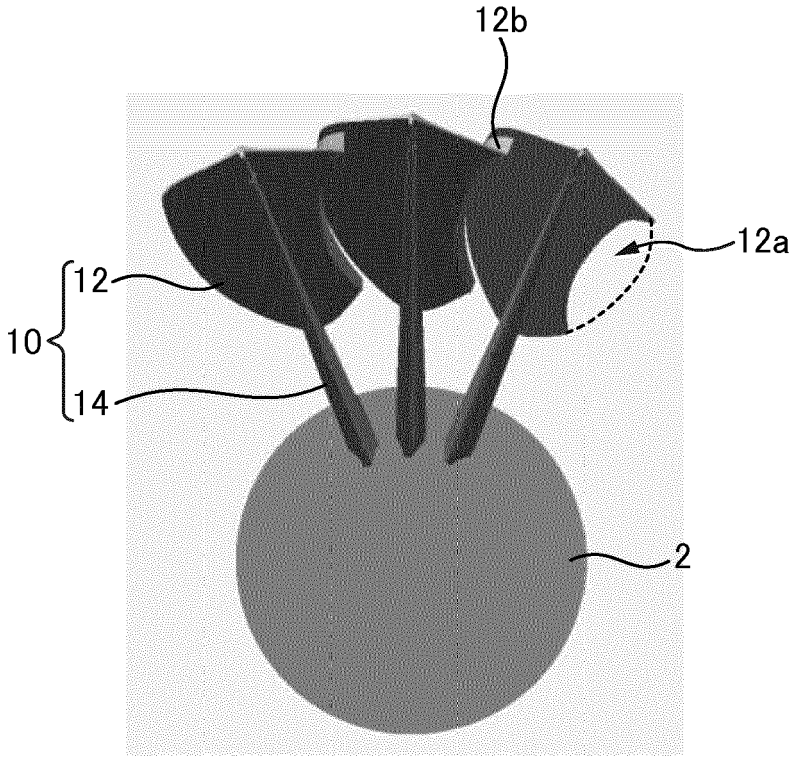

FIG. 8

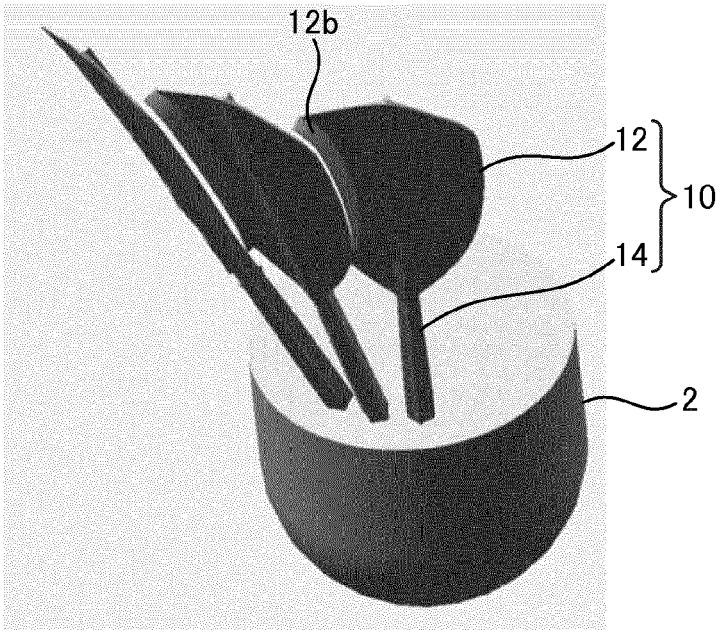

FIG. 9

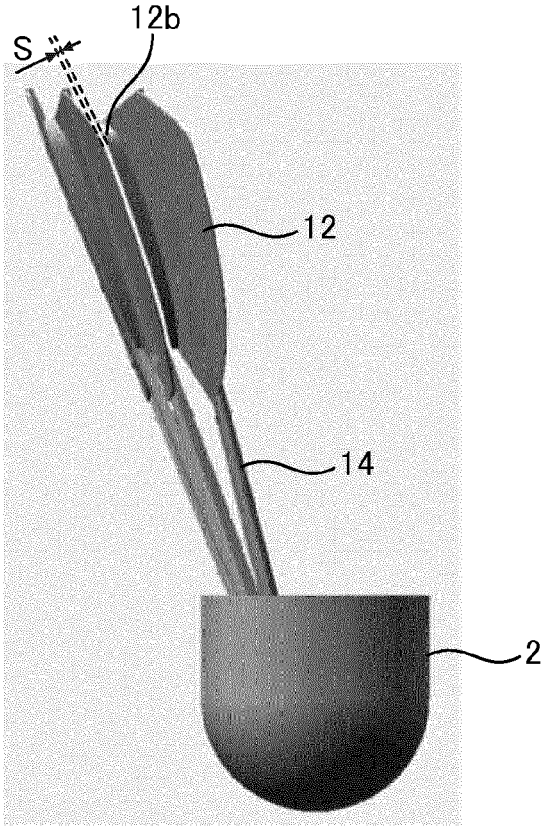

FIG. 10

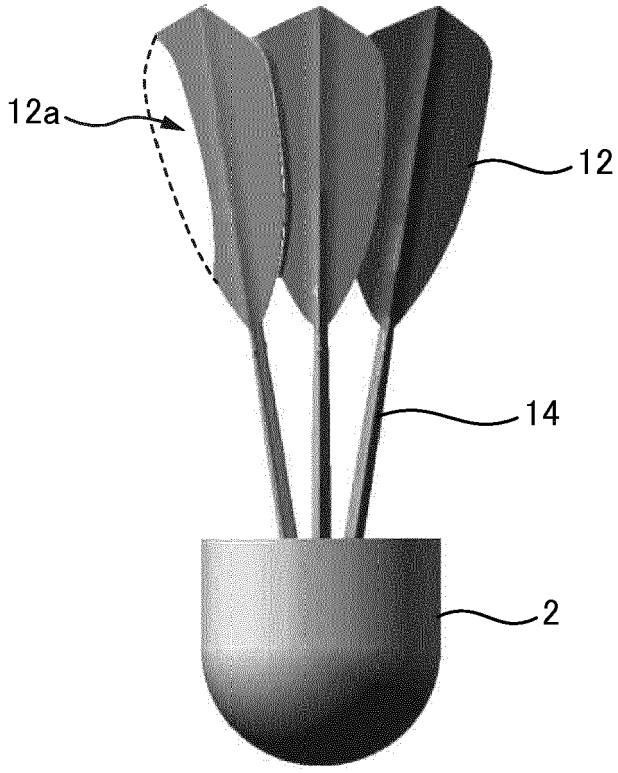

FIG. 11

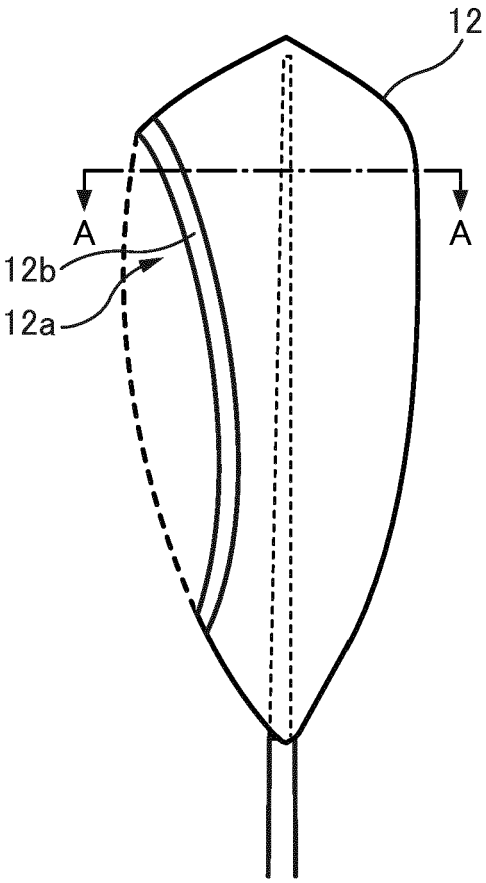

FIG. 12A

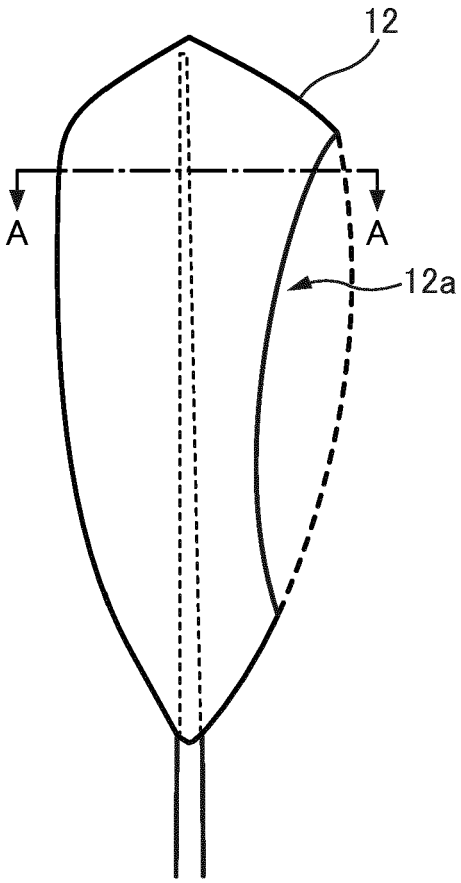

FIG. 12B

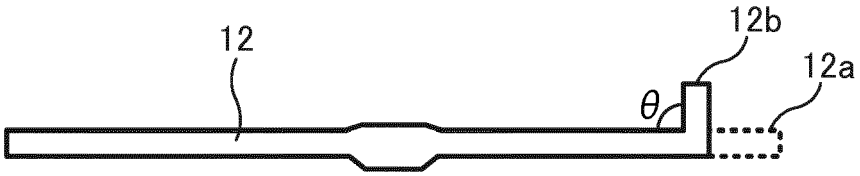

FIG. 12C

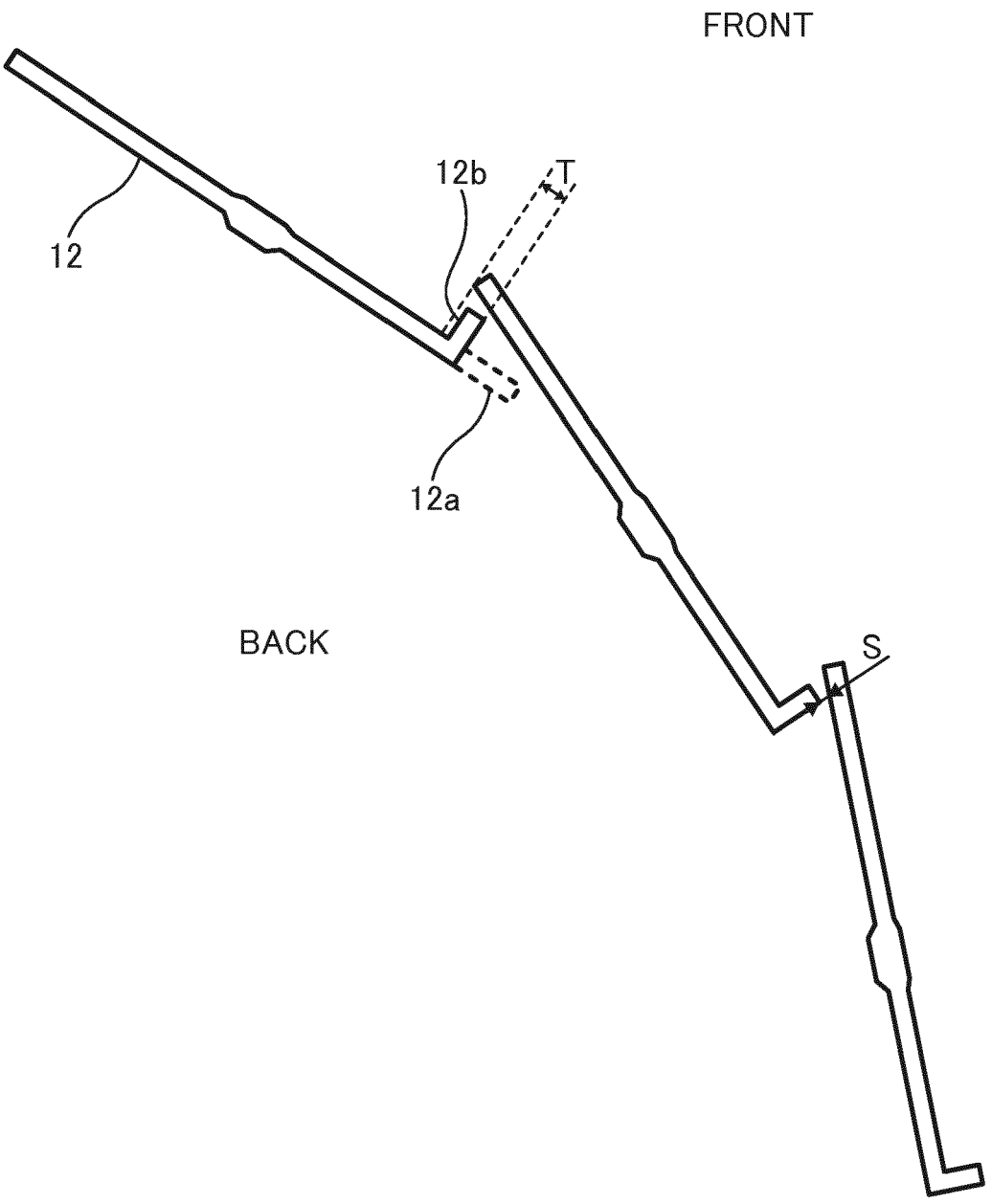

FIG. 13

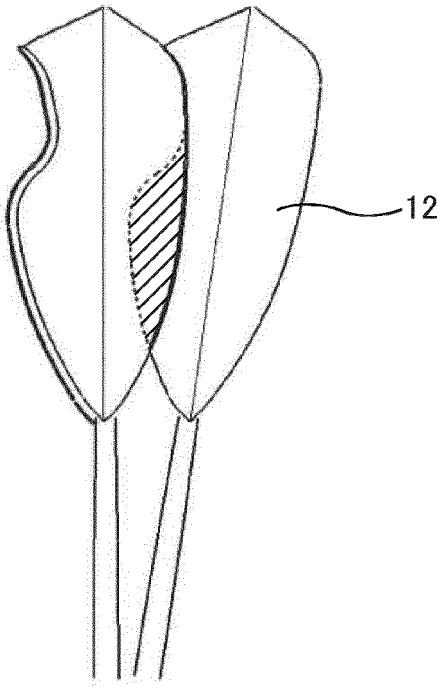

FIG. 14

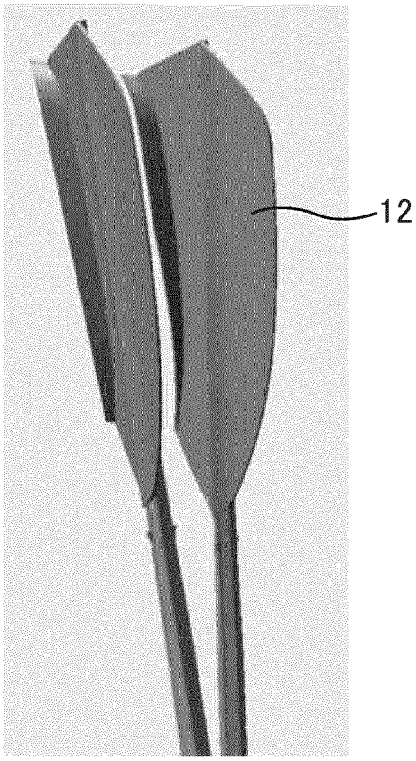

FIG. 15

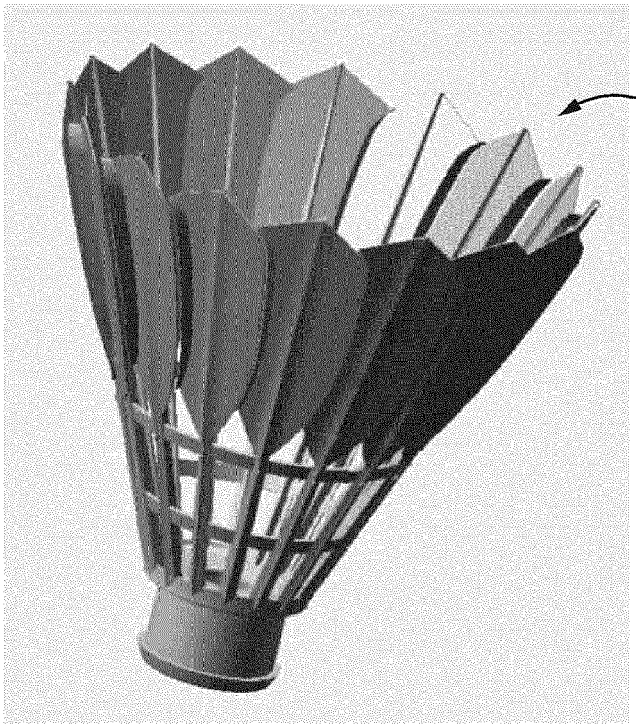

FIG. 16

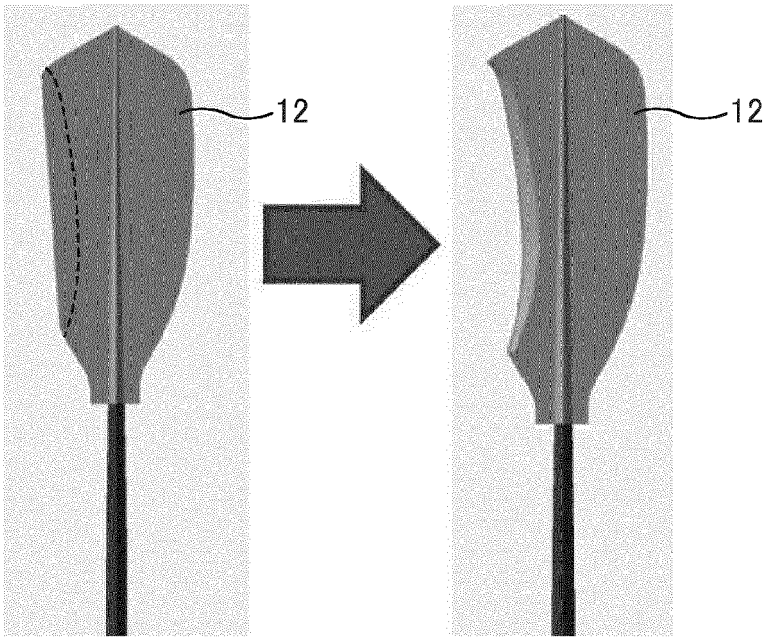

FIG. 17A FIG. 17B

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 14 15 4253

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	WO 2012/033068 A1 (YONEX KK [JP]; YONEYAMA WATARU [JP]; TANAKA KENSUKE [JP]; MIYAZAKI SEI) 15 March 2012 (2012-03-15) * figures 17-23 *	1-5	INV. A63B67/18
X	US 2 338 274 A (YANCEY CHARLES R) 4 January 1944 (1944-01-04) * the whole document *	1-5	
A	GB 1 505 467 A (GOLDFARB A [US]; BENKOE ERWIN [US]) 30 March 1978 (1978-03-30) * the whole document *	1-5	

TECHNICAL FIELDS SEARCHED (IPC)

A63B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	9 May 2014	Tejada Biarge, Diego

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 14 15 4253

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

09-05-2014

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2012033068 A1	15-03-2012	CN 103167897 A	19-06-2013
		EP 2614863 A1	17-07-2013
		US 2013210564 A1	15-08-2013
		WO 2012033068 A1	15-03-2012
US 2338274 A	04-01-1944	NONE	
GB 1505467 A	30-03-1978	AU 1218576 A	22-09-1977
		FR 2323414 A1	08-04-1977
		GB 1505467 A	30-03-1978
		IT 1057459 B	10-03-1982
		SE 7604160 A	13-03-1977
		US 4021041 A	03-05-1977

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JP 2009160267 A **[0005]**