



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
11.03.2015 Bulletin 2015/11

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

(21) Application number: **14179681.3**

(22) Date of filing: **04.08.2014**

(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

(72) Inventors:
• **Yoneyama, Wataru**
Saitama, 340-0021 (JP)
• **Onishi, Fumitomo**
Saitama, 340-0021 (JP)

(30) Priority: **06.08.2013 JP 2013163546**

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

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

(54) **Shuttlecock, and artificial feather for shuttlecock**

(57) A shuttlecock (1) includes: a base portion (2); and a plurality of artificial feathers (10) arranged in an annular form on the base portion, the plurality of the artificial feathers respectively including sheet-like vane portions (12) and rachis portions (14) supporting the vane

portions, one end of each of the rachis portions being fixed to the base portion, each of the vane portions including a rib (22a) in a portion on a tip end side thereof with respect to another end of each of the rachis portions in an extending direction of the rachis.

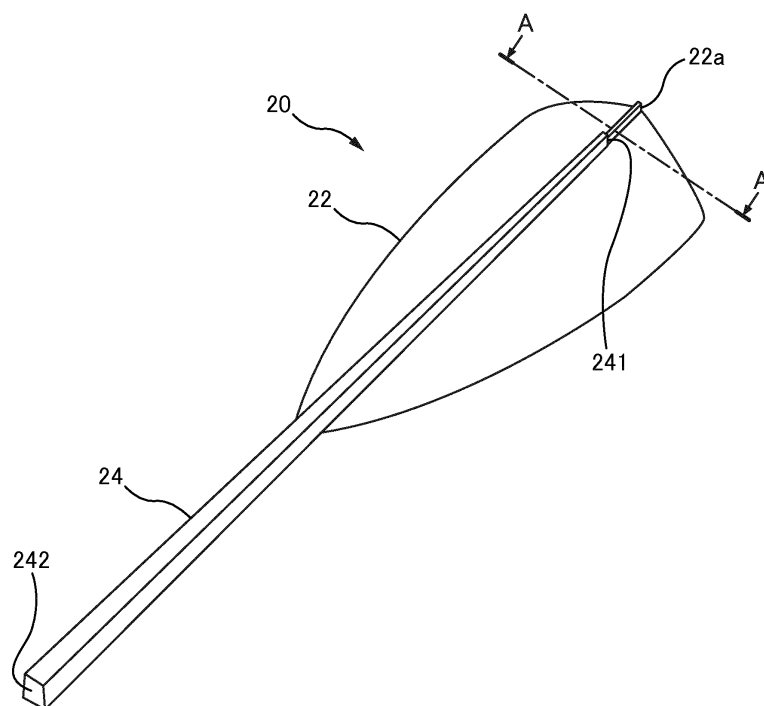


FIG. 5

Description

TECHNICAL FIELD

[0001] The present invention relates to shuttlecocks, and artificial feather for shuttlecocks.

BACKGROUND 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. Further, the rachises of the feathers have high rigidity and high repulsion. Thus, a unique flight performance that the initial velocity is fast and the brakes are applied, and comfortable impression when hitting natural feather shuttlecocks can be perceived.

[0004] On the other hand, in artificial shuttlecocks using artificial feathers imitating feathers, although various shape are devised to achieve enhancement of the strength of the rachis and the weight close to that of natural feather shuttlecocks, there is a problem that air resistance is different compared with natural feather shuttlecocks and flight performance is low.

[0005] Thus, for example, in Patent Literature 1, appropriately adjusting air resistance by forming a thin portion in the rachis portion of the artificial feather so as to protrude from the body has been proposed.

Citation List

Patent Literature

[0006] [Patent Literature 1] International Publication No. WO2011/021512 pamphlet

SUMMARY OF INVENTION

Technical Problem

[0007] However, if the thin portion is protruded from the rachis portion, the weight of the rachis is increased, and thereby the entire weight balance of the shuttlecock deteriorates. Further, if the body of the rachis portion is formed small to suppress the increased weight, rigidity of the rachis portion would decrease. Consequently, there is a problem on deterioration of behavior during flight after hitting as compared to natural feather shuttle-

cocks. Note that, although the rigidity of the rachis can be enhanced by changing a material of the rachis portion, the weight is generally increased if a material having high rigidity is used. Thus, the flight performance such as that of the natural feather shuttlecock cannot be achieved in this case as well.

[0008] The present invention has been made in view of such circumstances, and an object thereof is to enhance flight performance by improving air resistance.

Solution to Problem

[0009] A primary aspect of the invention to achieve the above advantage is a shuttlecock including: a base portion; and a plurality of artificial feathers arranged in an annular form on the base portion, the plurality of the artificial feathers respectively including sheet-like vane portions and rachis portions supporting the vane portions, one end of each of the rachis portions being fixed to the base portion, each of the vane portions including a rib in a portion on a tip end side thereof with respect to another end of each of the rachis portions in an extending direction of the rachis.

Advantageous Effects of Invention

[0010] According to the shuttlecock of the present invention, flight performance can be enhanced.

[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.

Fig. 4A and Fig. 4B are explanatory diagrams of the artificial feather in the comparative example.

Fig. 5 is a perspective view illustrating a structure of the artificial feather in a first embodiment.

Fig. 6 is a cross-sectional view taken along line A - A in Fig. 5.

Fig. 7 is a view for explaining a position of a rachis end of a rachis portion.

Fig. 8 is a view illustrating a variation of the first embodiment.

Fig. 9 is a perspective view illustrating a structure of the artificial feather in a second embodiment.

Fig. 10 is a cross-sectional view taken along line A - A in Fig. 9.

Fig. 11A and Fig. 11B are explanatory diagrams of the artificial feather in a third embodiment.

Fig. 12A to Fig. 12D are explanatory diagrams illustrating a structure of the artificial feather in a fourth embodiment.

Description of Embodiments

=== 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 plurality of the artificial feathers respectively including sheet-like vane portions and rachis portions supporting the vane portions, one end of each of the rachis portions being fixed to the base portion, each of the vane portions including a rib in a portion on a tip end side thereof with respect to another end of each of the rachis portions in an extending direction of the rachis. This rib may be extended in a portion from the rachis end portion to the tip end of the vane portion (hereinafter, referred to as a blade portion).

[0015] According to such a shuttlecock, the portion on the tip end side of the vane portion is not restricted by the rachis, and thus it becomes possible for this portion to move freely during flight. By appropriately adjusting the range of this portion and the rib to be formed, the air resistance during flight can be improved, and thereby flight performance can be enhanced.

[0016] It is preferable that, in such a shuttlecock, the adjacent artificial feathers of the plurality of the artificial feathers are arranged on the base portion in such a manner as to form an overlapped portion where each of the vane portions is overlapped, the other end of each of the rachis portions is positioned on the tip end side with respect to the overlapped portion in the extending direction of the rachis.

[0017] According to such a shuttlecock, occurrence of a phenomenon (hereinafter, referred to as intersection) where the overlapping state of the adjacent blade portions is reversed can be suppressed.

[0018] It is preferable that, in such a shuttlecock, the rib is formed along the extending direction of the rachis.

[0019] According to such a shuttlecock, air resistance during flight can be made appropriate.

[0020] In such a shuttlecock, each of the vane portions is formed by sticking a first sheet member and a second sheet member together, the rib may be formed on the tip end side with respect to the other end of each or the rachis portions by sandwiching each of the rachis portions between the first sheet member and the second sheet member.

[0021] According to such a shuttlecock, the rib can be certainly formed on the tip end side with respect to the rachis end.

[0022] In such a shuttlecock, each of the rachis por-

tions and the rib are a rachis member provided so as to support each of the vane portions, and may be formed by allowing the rachis member, having a weakened portion at a position corresponding to the other end of each of the rachis portions, to be snapped at the weakened portion.

[0023] According to such a shuttlecock, when the artificial feathers are arranged on the base portion during the production process, the positioning thereof is easily performed.

[0024] Further, an artificial feather for a shuttlecock, which is arranged in an annular form on a base portion of the shuttlecock will become apparent which includes: a sheet-like vane portion and a rachis portion supporting the vane portion, one end of the rachis portion being fixed to the base portion, the vane portion including a rib in a portion on a tip end side thereof with respect to another end of the rachis portion in an extending direction of the rachis.

=== Structure of Artificial Shuttlecock ===

<Basic Structure of Artificial Shuttlecock>

[0025] 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.

[0026] The artificial shuttlecock 1 includes the base portion 2, a plurality of artificial feathers 10 imitating natural feathers, and a string-like member 3 for fixing the artificial feathers 10 one another. 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 the plurality of artificial feathers 10 are embedded in an annular form along the circumference of this flat face. The 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. The plurality of artificial feathers 10 are fixed to one another with the string-like member 3 (for example, a cotton thread).

<Structure of Artificial Feather (Comparative Example)>

[0027] Fig. 3 is an external view of an artificial feather 10 in a comparative example. Further, Fig. 4A and Fig. 4B are explanatory diagrams of the artificial feather 10 in the comparative example. 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. Note that, in these drawings, the members which have already been described are denoted by the same reference numerals.

[0028] The artificial feather 10 includes a vane portion 12 and a rachis portion 14. The vane portion 12 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 drawings, an up-and-down direction is defined along the rachis portion 14, and the side on which the vane portion 12 is provided is defined as "up" while the opposite side is defined as "down". Further, in the drawings, a right-and-left direction is defined along a direction (width direction) of the vane portion 12 extending from the rachis portion 14. Further, in the drawings, 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 drawings.

[0029] The vane portion 12 is a sheet member imitating the shape of the vane of a natural feather. The vane portion 12 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 12, in order to prevent fibers of the 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. Note that, the reinforcement coating may be formed on a single side of the vane portion 12 or both sides thereof. Further, the reinforcement coating may be formed on the whole surface of the vane portion 12 or a part thereof. Further, the shape of the vane portion 12 is not limited to the shape illustrated in the drawings. For example, the vane portion 12 may be in an elliptical shape.

[0030] The rachis portion 14 is an elongated member imitating the shape of a rachis of a natural feather, as well as the member supporting the vane portion 12. 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 12, and a calamus portion 14B protruding from the vane portion 12. 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). A rachis end 142 (the lower end of the calamus portion 14B) of the rachis portion 14 is embedded in the base portion 2 and fixed to the base portion 2. On the other hand, a rachis end 141 (the upper end of the vane support portion 14A) of the rachis portion 14 coincides with the upper end of the vane portion 12.

[0031] The rachis portion 14 in the drawing is illustrated in a quadrangle shape in cross section. However, the sectional shape of the rachis portion 14 may be in a rhombic shape, a circular shape, or an elliptical shape. Further, the sectional shape of the rachis portion 14 may be in a

partially protruding shape such as a T-shape or a cross-shape in order to enhance the strength of the rachis portion 14. Further, the sectional shape of 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. Further, the rachis portion 14 in the drawing is formed such that the size of the sectional shape thereof becomes larger towards the lower side. However, the size of the sectional shape may be uniform in the up-and-down direction without any change, or the size of the sectional shape may be changed in a smooth manner. This also applies to the following embodiments.

[0032] Further, the rachis portion 14 and the vane portion 12 may be separated or integrated. For example, when a resin is used as a material of the rachis portion 14 and the vane portion 12, the rachis portion 14 and the vane portion 12 can be integrally molded by injection molding using a mold. Further, the rachis portion 14 and the vane portion 12 can be integrally formed of different materials by injection molding (two-color molding) using two kinds of materials (resins). Note that, the rachis portion 14 and the vane portion 12 of this example (comparative example) are integrally formed by the two-color molding described above.

[0033] Further, the vane portion 12 may be supported on the back side of the vane support portion 14A, or the vane portion 12 may be supported on the front side of the vane support portion 14A. Further, the vane portion 12 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 12. Further, the vane portion 12 may be embedded into the inside of the vane support portion 14A.

<Flight Performance>

[0034] The natural feather shuttlecock can reasonably reduce speed by an appropriate air resistance. Thus, a unique flight performance that the initial velocity is fast and the brakes are applied can be perceived by the natural feather shuttlecock. On the other hand, the flight performance described above cannot be perceived by the artificial shuttlecock 1 using the artificial feathers 10 since the air resistance is different compared to the natural feather shuttlecock. Further, the shuttlecock is largely deformed when being hit, and flies while restoring the deformation. Since the rachis of the natural feather shuttlecock has high rigidity, the shuttlecock is restored to an original shape regardless of the number of accumulated hits. The air resistance becomes large by this restoration and the brakes are applied. On the other hand, in the artificial shuttlecock 1, since the rachis portion 14 is formed with resin, the shuttlecock cannot be restored to the original shape in accordance with the number of accumulated hits. That is, since an external diameter of sixteen vane portions 12 arranged in an annular form on the base portion 2 varies from an original external diam-

eter, air resistance also varies. Thus, the flight performance gradually becomes worse as the hitting is repeated.

[0035] In order to enhance flight performance, changing rigidity of material, or a method using air resistance to be received during flight is commonly applied. Generally, if the rigidity is enhanced (a material having high rigidity is used), the weight is increased. When the weight is increased, the weight balance of the whole shuttlecock becomes worse, and consequently, behavior during flight after hitting deteriorates. Thus, in the present embodiment, air resistance is used to enhance flight performance. Then, in the following embodiments, air resistance is increased without substantially increasing or decreasing the weight. Specifically, the flight performance is enhanced by improving the structure of a tip end of the vane portion which is susceptible to air resistance during flight.

=== First Embodiment ===

[0036] Fig. 5 is a perspective view illustrating a structure of the artificial feather 20 in a first embodiment. Further, Fig. 6 is a cross-sectional view taken along line A - A in Fig. 5. The artificial feather 20 of the first embodiment has a vane portion 22 and a rachis portion 24. The vane portion 22 and the rachis portion 24 correspond to the vane portion 12 and the rachis portion 14 of the comparative example, respectively, and are integrally formed by two-color molding. However, the rachis portion 24 of the first embodiment is not provided up to a top end (tip end) of the vane portion 22. In other words, the vane portion 22 has a portion that is not restricted by the rachis, on the upper side (tip end side in the extending direction of the rachis) from the rachis end 241 of the rachis portion 24. Since the rachis of the natural feather shuttlecock has higher rigidity than the vane thereof, the vane portion 22 of the artificial shuttlecock has lower rigidity than the rachis portion 24 thereof.

[0037] Further, the vane portion 22 has a rib 22a. The rib 22a is formed by the same material as the vane portion 22, and provided in such a manner as to protrude in a convex shape on the extension of the rachis of the rachis portion 24 in the portion on the upper side from the rachis end 241 in the vane portion 22. That is, the artificial feather 20 has a structure in which the rib 22a of the vane portion 22 is formed instead of the rachis of the rachis portion 24, in the portion on the top end side of the vane portion 22.

[0038] In the case of the artificial feather 10 of the comparative example, the rachis portion 14 has been provided up to the top end of the vane portion 12. Thus, the movement of the vane portion 12 has been restricted by the rachis portion 14 in the extending direction of the rachis of the rachis portion 14. On the other hand, the artificial feather 20 has a portion, on the top end (tip end) side of the vane portion 22, which is not restricted by the rachis of the rachis portion 24. Further, the rib 22a provided in that portion is formed by the same material (resin) as the vane portion 22. That is, the portion of the vane

portion 22 which is upper from the rachis end 241 bends more easily in the normal direction of the surface of the vane portion 22 than other portions. Therefore, since the top end (tip end) side of the vane portion 22 is not restricted by the rachis of the rachis portion 24, the portion on the upper side from the rachis is easy to move freely during flight compared to the comparative example.

[0039] Fig. 7 is a view for explaining a position of a rachis end 241 of a rachis portion 24. As explained in Fig. 1 and Fig. 2, in a case where the artificial feather 20 is applied to the artificial shuttlecock 1, each of the artificial feathers 20 (vane portions 22) is arranged in such a manner as to overlap with another one of the artificial feathers 20 (vane portion 22) adjacent thereto (diagonally shaded portion in Fig. 7). In the present embodiment, as shown in Fig. 7, the rachis end 241 of the rachis portion 24 is on the upper side (tip end side) with respect to this overlapping portion (hereinafter, also referred to as a overlapped portion).

[0040] This is because, if the rachis end 241 is on the lower side from the overlapped portion, a phenomenon, where overlapping state of the adjacent vane portions 22 is reversed on impact when the shuttlecock is hit, easily occurs. As shown in the drawings, the position of the rachis end 241 is arranged on the upper side with respect to the overlapped portion of the adjacent vane portions 22, and thus occurrence of intersection in which the adjacent blade portions are reversed can be suppressed.

[0041] As described hereinabove, the artificial feather 20 of the present embodiment includes the sheet-like vane portion 22, and the rachis portion 24 in which the rachis end 242 is fixed to the base portion 2 to support the vane portion 22. The vane portion 22 has a portion on the tip end side thereof with respect to the rachis end 241 of the rachis portion 24 in the extending direction of the rachis, and the rib 22a is formed in that portion.

[0042] In this manner, in the artificial feather 20, since the tip end side of the vane portion 22 is not restricted by the rachis during flight, the artificial feather 20 is easy to move more freely compared to the artificial feather 10 of the comparative example. Thus, the air resistance during flight can be improved by applying this artificial feather 20 to the artificial shuttlecock 1, and thereby the flight performance can be enhanced.

[0043] Note that, the artificial feather 20 may be applied to all of the sixteen vanes of the artificial shuttlecock 1, or the artificial feather 10 and the artificial feather 20 may be combined to be used. For example, several feathers, of sixteen artificial feathers 10 of the artificial shuttlecock 1 in Fig. 1 and Fig. 2, may be changed to the artificial feathers 20.

<Variation of First Embodiment>

[0044] Fig. 8 is a view illustrating a variation of the first embodiment. In the first embodiment described above, the rib 22a has been formed on the extension of the rachis of the rachis portion 24. Further, only one rib 22a has

been formed for one artificial feather 20.

[0045] In this variation, two ribs 22a are formed. Further, two ribs 22a are formed along the rachis not on the extension of the rachis of the rachis portion 24, but on both right and left sides of the rachis. In this case as well, the flight performance can be enhanced. Note that, the two ribs 22a may not symmetrically arranged with respect to the rachis. Further, the number of ribs 22a may be two or more. Further, it would be enough if the rib 22a is formed in the portion that is on the upper side with respect to the rachis end 241 in the vane portion 22, the rib 22a may not be formed along the rachis direction. For example, the rib 22a may be obliquely formed with respect to the rachis.

[0046] Further, in the present embodiment, the shape (sectional shape) of the rib 22a is a trapezoid, but it is not limited thereto. For example, the sectional shape thereof may be a rectangle, a triangle, a polygon, a semicircle or the like.

=== Second Embodiment ===

[0047] In a second embodiment, a structure of the artificial feather differs from that of the first embodiment.

[0048] Fig. 9 is a perspective view illustrating a structure of the artificial feather 30 of the second embodiment. Further, Fig. 10 is a cross-sectional view taken along line A - A in Fig. 9. The artificial feather 30 of the second embodiment includes a vane portion 32 and a rachis portion 34.

[0049] The rachis portion 34 is a member having the same structure as the rachis portion 24 of the first embodiment, and rachis ends 341, 342 correspond to the rachis ends 241, 242, respectively. On the other hand, the vane portion 32 has two vane-like sheet members (a first sheet member 321 and a second sheet member 322). The vane portion 32 is formed by sticking the first sheet member 321 and the second sheet member 322 together so as to sandwich the rachis portion 34 therebetween. In this case, similar to the first embodiment, the rachis end 341 of the rachis portion 34 is on the lower side from the tip end of the vane portion 32. Further, the vane portion 32 has a convex portion 32a formed therein.

[0050] The first sheet member 321 is formed by a non-woven fabric and arranged on the front side of the vane portion 32. Note that, as a nonwoven fabric, a long-fiber nonwoven fabric is used, and a reinforcement coating is formed on a surface of the sheet member.

[0051] The second sheet member 322 is formed by a foamed sheet, and arranged on the back side of the vane portion 32.

[0052] The convex portion 32a (corresponding to a rib) is formed on the upper side (tip end side) with respect to the rachis end 341 of the rachis portion 34. This convex portion 32a is formed by sticking the first sheet member 321 and the second sheet member 322 together so as to sandwich the rachis portion 34 therebetween. That is, since the rachis portion 34 has a thickness, when the

rachis portion 34 is sandwiched between the first sheet member 321 and the second sheet member 322 and the first and second sheet members are stuck together, a space where the first sheet member 321 and the second sheet member 322 are not completely adhered to each other is formed on the tip end side with respect to the rachis end 341, and thereby the convex portion 32a is formed (see Fig. 10). The same effect as the rib 22a of the first embodiment can be obtained by this convex portion 32a.

[0053] In this way, in the second embodiment, the convex portion 32a is certainly formed on the tip end side with respect to the rachis end by sticking the first sheet member 321 and the second sheet member 322 so as to sandwich the rachis portion 34 therebetween. Further, also in the second embodiment, the vane portion 32 has a portion that is not restricted by the rachis, on the tip end side with respect to the rachis end of the rachis portion 34 in the extending direction of the rachis, and the convex portion 32a is formed in that portion. Thus, by using the artificial feather 30 of this second embodiment as a vane of the artificial shuttlecock 1, the air resistance can be improved in the same manner as the first embodiment, and thereby the flight performance can be enhanced.

[0054] Note that, also in the second embodiment, it is preferable that the rachis end 341 of the rachis portion 34 is positioned on the tip end side with respect to the overlapped portion of the adjacent vane portions 32 (see diagonally shaded portion in Fig. 7). In this way, occurrence of intersection where the adjacent blade portions are reversed can be suppressed.

[0055] Further, in the present embodiment, the first sheet member 321 is arranged on the front side of the vane portion 32, and the second sheet member 322 is arranged on the back side thereof. However, an inverted case may be possible. That is, the second sheet member 322 may be arranged on the front side of the vane portion 32, and the first sheet member 321 may be arranged on the back side thereof.

=== Third Embodiment ===

[0056] A third embodiment differs from the embodiments described above in the structure of the rachis portion and the vane portion.

[0057] Fig. 11A and Fig. 11B are explanatory diagrams of an artificial feather 40 in the third embodiment.

[0058] As illustrated in Fig. 11A, the artificial feather 40 includes a vane portion 42 and a rachis portion 44. Note that, the vane portion 42 of the third embodiment is formed in such a manner as to sandwich the rachis portion 44 between two sheet members as same as the second embodiment. However, in the drawing, only one sheet member is illustrated for convenience of explanation.

[0059] As illustrated in the drawing, the rachis portion 44 (corresponding to a rachis member) of the third em-

bodiment is formed up to the top end of the vane portion 42. Further, a depressed portion 44a (corresponding to a weakened portion) is formed at the top end portion of the rachis portion 44, and the width at the depressed portion 44a in the right-and-left direction is much shorter than the width at other portions. Thereby, the rachis portion 44 is allowed to easily snap (for example, on impact by one hit) at the position of the depressed portion 44a.

[0060] Since the rachis portion 44 snaps at the depressed portion 44a, the rachis portion 44 is separated into a rachis portion 44' and a fragment 43 (corresponding to a rib) as illustrated in Fig. 11B. Further, a part where the depressed portion 44a has been formed in the rachis portion 44 becomes a rachis end 441 of the rachis portion 44'.

[0061] The fragment 43 is formed in a portion on the tip end side of the vane portion 42 with respect to the rachis end 441 of the rachis portion 44' in the extending direction of the rachis. Further, since the fragment 43 is separated from the rachis portion 44' while being fixed to the vane portion 42, the portion where the fragment 43 is formed in the vane portion 42 is not restricted by the rachis of the rachis portion 44'.

[0062] Thus, by using the artificial feather 40 of this third embodiment as a vane of the artificial shuttlecock 1, the air resistance can be improved in the same manner as the embodiments described above, and thereby the flight performance can be enhanced. Further, while there is no rachis at the tip end of the vane portion in the embodiments described above, the rachis is arranged up to the tip end in the present embodiment (Fig. 11A). Therefore, in manufacturing the artificial shuttlecock 1, when the artificial feather 40 is arranged on the base portion 2, the positioning is easier than that in the embodiments described above.

[0063] Note that, in the present embodiment, the depressed portion 44a has a width (length in the right-and-left direction) being shorter than that of other portions. However, it would be enough if it is easy to snap at the depressed portion, and other shapes may be possible. For example, the thickness between the front side and the back side may be thin.

[0064] Further, it is preferable that the rachis end 441 of the rachis portion 44' is located on the tip end side with respect to the overlapped portion of the adjacent vane portions 42, in the third embodiment as well. In this manner, occurrence of intersection where the adjacent blade portions are reversed can be suppressed.

=== Fourth Embodiment ===

[0065] In a fourth embodiment, the structure of the vane portion differs from that of the embodiments described above.

[0066] Fig. 12A to Fig. 12D are explanatory diagrams illustrating a structure of an artificial feather 50 in the fourth embodiment. The artificial feather 50 includes a vane portion 52, a rachis portion 54, and rib 52a. Note

that, the vane portion 52, the rachis portion 54, a rachis end 541, and rib 52a correspond to the vane portion 22, the rachis portion 24, the rachis end 241, and the rib 22a of the first embodiment, respectively, and have a similar structure thereto. Therefore, the description thereof will be omitted.

[0067] The artificial feather 50 of Fig. 12A has a slit 521 on the vane portion 52. The slit 521 is formed in a V-shape in a portion on the tip end side with respect to the rachis end 541 of the rachis 54 in the vane portion 52. By providing such a slit 521, a portion which is on an outer side (right side in the drawing) from the slit 521 with respect to the rachis is not restricted by the rachis. Thus, this portion is allowed to move freely. Therefore, air resistance can be improved by applying this artificial feather 50 to the artificial shuttlecock 1, and thereby the flight performance can be enhanced. Note that, it is preferable that the top end of the slit 521 is positioned on the upper side (tip end side) with respect to the overlapped portion of the vane portion 52. More preferably, the bottom end of the slit 521 is also positioned on the upper side (tip end side) with respect to the overlapped portion of the vane portion 52. In this manner, occurrence of intersection where the adjacent blade portions are reversed can be suppressed.

[0068] Note that, it is preferable that a forming position of the slit 521 is a position equivalent to the downstream side of the rotational direction of the artificial shuttlecock 1. Further, in Fig. 12A, only one slit 521 is formed on one vane portion 52, but it is not limited thereto and a plurality of slits may be formed. For example, the slit 521 may be provided on the opposite side (left side in the drawing) with respect to the rachis.

[0069] The artificial feather 50 of Fig. 12B has a slit 522 on the vane portion 52. The slit 522 is linearly formed in a portion on the tip end side with respect to the rachis end 541 of the rachis 54 along the extending direction of the rachis. Further, the artificial feather 50 of Fig. 12C has a slit 523 on the vane portion 52. The slit 523 is formed linearly in an oblique direction with respect to the extending direction of the rachis, in the portion on the tip end side with respect to the rachis end 541 of the rachis 54.

[0070] Note that, since the forming positions of the slit 522 and the slit 523 and the number thereof are similar to those of slit 521 described above, the description thereof will be omitted. In these cases as well, air resistance can be improved by applying them to the artificial shuttlecock 1, and thereby flight performance can be enhanced.

[0071] Note that, in a case where each of the slits (slit 521, 522, 523) is provided as in Fig. 12A to Fig. 12C, stress easily concentrates on the end portion (bottom end) of each slit, and the vane portion is easily torn at this portion. Therefore, it is preferable that the vane portion 52 is formed by sticking two sheet members as in the second embodiment. Further, it is preferable that a nonwoven fabric and a foamed sheet are used for the

two sheet members. If two foamed sheets are stuck together, there is a possibility of occurrence of breakage on impact due to low tear strength.

[0072] The artificial feather 50 of Fig. 12D has a protrusion 524 in the vane portion 52. The protrusion 524 is provided in a substantially triangular shape in such a manner as to protrude to the upper side from the top end of the vane portion 52. This protrusion 524 is allowed to freely move without being restricted by the rachis 54. Note that, in the drawing, only one protrusion 524 is formed for one vane portion 52, but it is not limited thereto and a plurality of protrusions may be formed. For example, the protrusion 524 may also be provided on the opposite side (left side in the drawing) with respect to the rachis 54. Air resistance can be improved by applying the artificial feather 50 provided with the protrusion 524 to the artificial shuttlecock 1 in this way, and thereby flight performance can be enhanced. Note that, the shape of the protrusion 524 is not limited to a triangle. For example, the shape thereof may be a semicircle or a trapezoid.

=== Others ===

[0073] 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.

Reference Signs List

[0074]

1 artificial shuttlecock,
2 base portion,
3 string-like member,
4 skirt portion,
10, 20, 30, 40, 50 artificial feather,
12, 22, 32, 42, 50 vane portion,
14, 24, 34, 44, 44', 54 rachis portion,
14A vane support portion,
14B calamus portion,
141, 241, 341, 441, 541 rachis end, 142, 242, 342 rachis end,
22a, 52a rib,
321 first sheet member,
322 second sheet member,
32a convex portion,
43 fragment
44a depressed portion,
521, 522, 523 slit,
524 protrusion

Claims

1. A shuttlecock comprising:

a base portion; and
a plurality of artificial feathers arranged in an annular form on the base portion,
the plurality of the artificial feathers respectively including sheet-like vane portions and rachis portions supporting the vane portions, one end of each of the rachis portions being fixed to the base portion,
each of the vane portions including a rib in a portion on a tip end side thereof with respect to another end of each of the rachis portions in an extending direction of the rachis.

2. A shuttlecock according to claim 1, wherein the adjacent artificial feathers of the plurality of the artificial feathers are arranged on the base portion in such a manner as to form an overlapped portion where each of the vane portions is overlapped, the other end of each of the rachis portions is positioned on the tip end side with respect to the overlapped portion in the extending direction of the rachis.

3. A shuttlecock according to claim 1 or 2, wherein the rib is formed along the extending direction of the rachis.

4. A shuttlecock according to any one of claims 1 to 3, wherein,
each of the vane portions is formed by sticking a first sheet member and a second sheet member together,
the rib is provided by sandwiching each of the rachis portions between the first sheet member and the second sheet member so as to form, on the tip end side with respect to the other end of each of the rachis portions, a space where the first sheet member and the second sheet member are not adhered.

5. A shuttlecock according to any one of claims 1 to 3, wherein
each of the rachis portions and the rib are a rachis member provided so as to support each of the vane portions, and are formed by allowing the rachis member, having a weakened portion at a position corresponding to the other end of each of the rachis portions, to be snapped at the weakened portion.

6. An artificial feather for a shuttlecock, which is arranged in an annular form on a base portion of the shuttlecock, comprising:

a sheet-like vane portion and
a rachis portion supporting the vane portion, one end of the rachis portion being fixed to the base portion,
the vane portion including a rib in a portion on a tip end side thereof with respect to another end

of the rachis portion in an extending direction of the rachis.

5

10

15

20

25

30

35

40

45

50

55

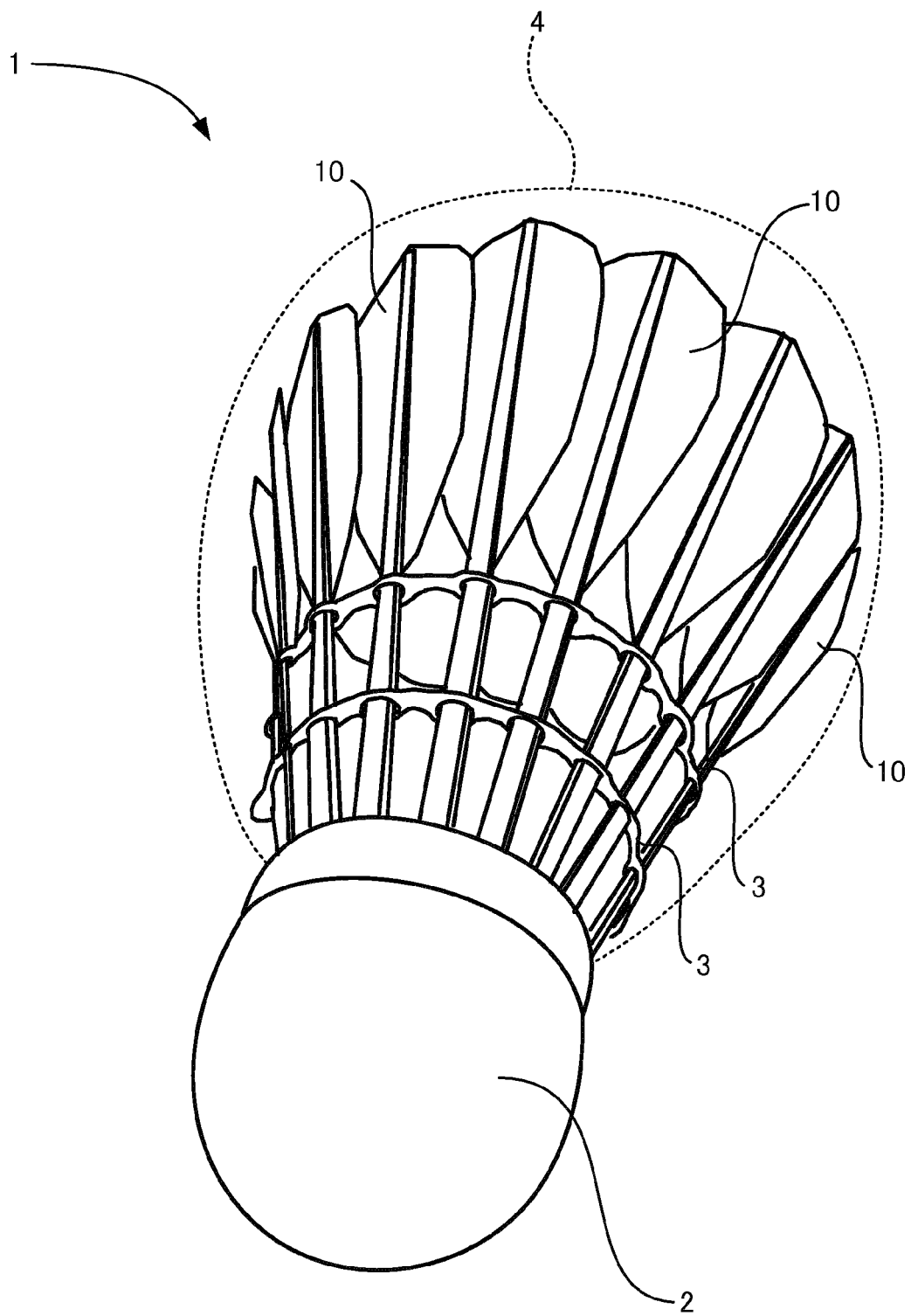


FIG. 1

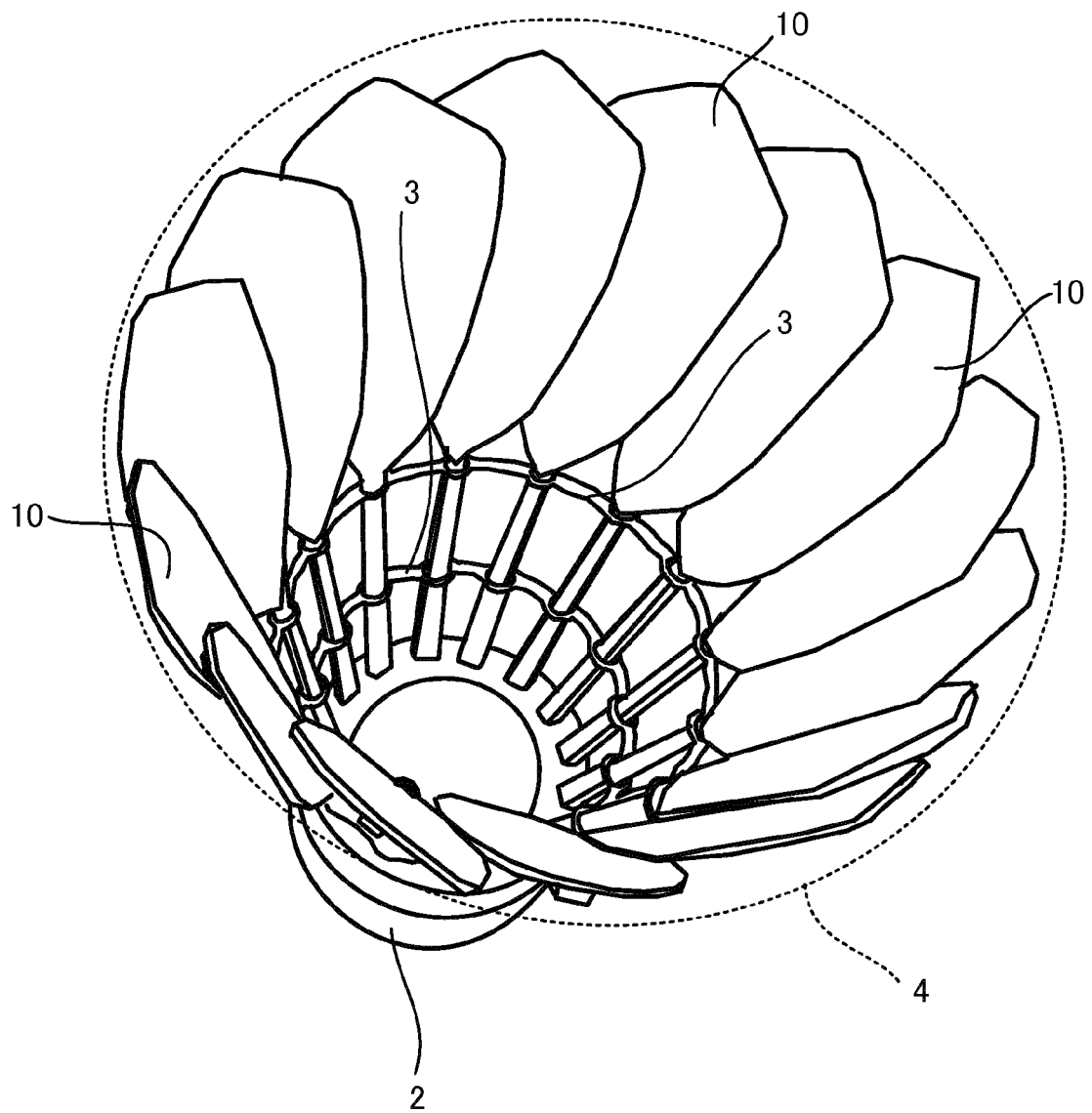


FIG. 2

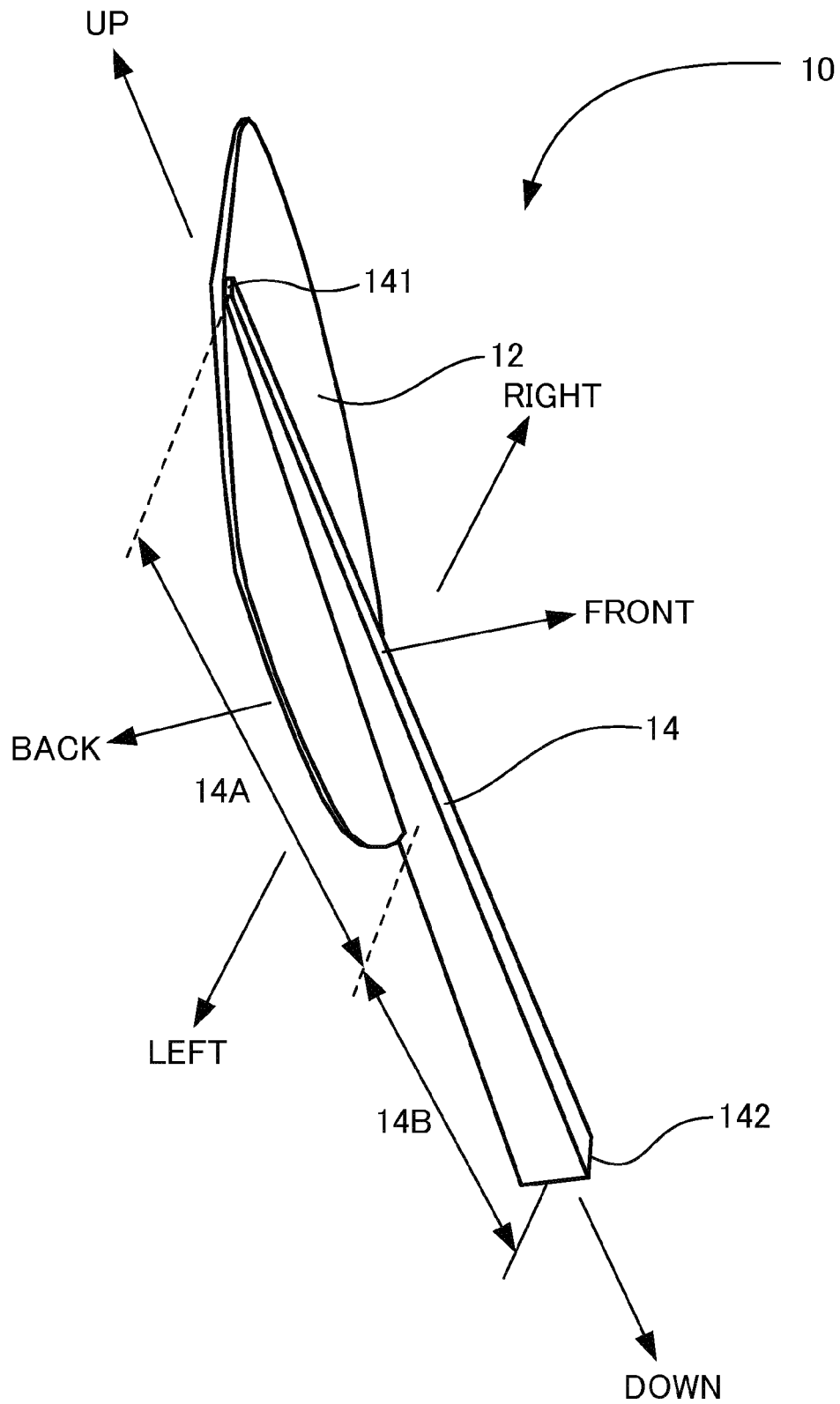


FIG. 3

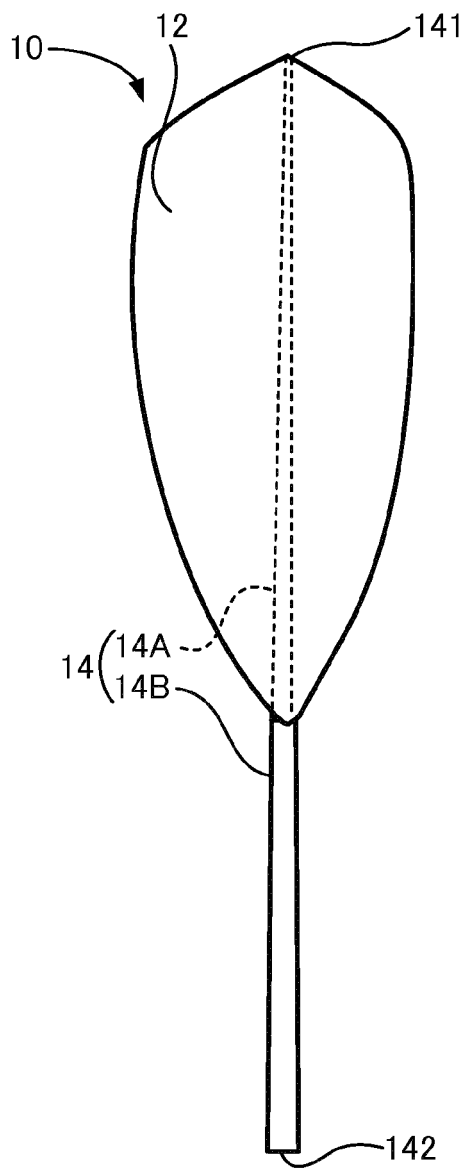


FIG. 4A

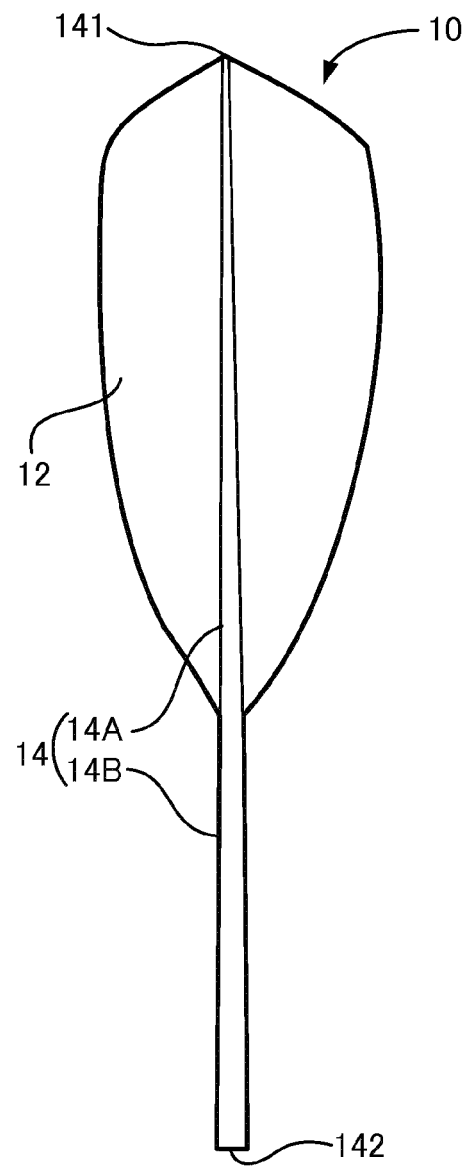


FIG. 4B

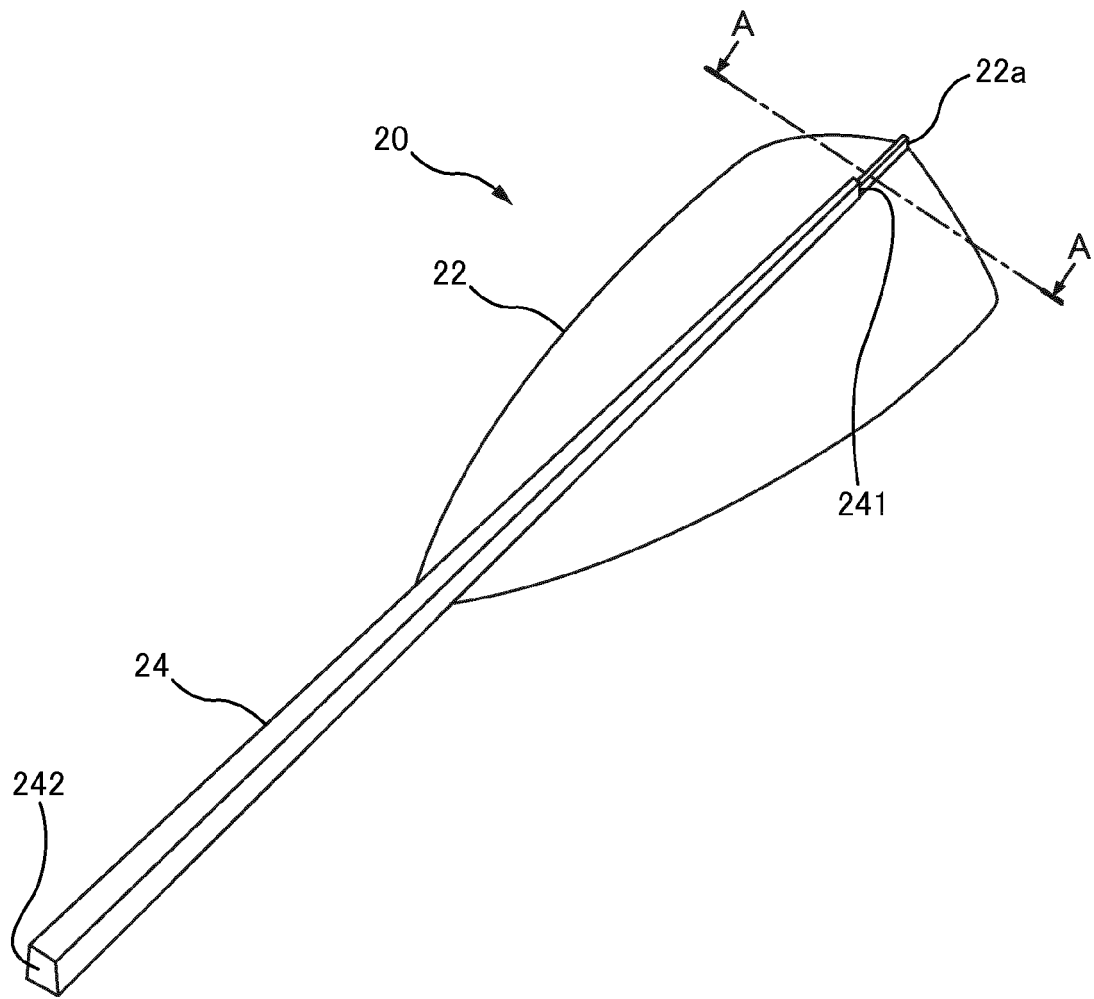


FIG. 5

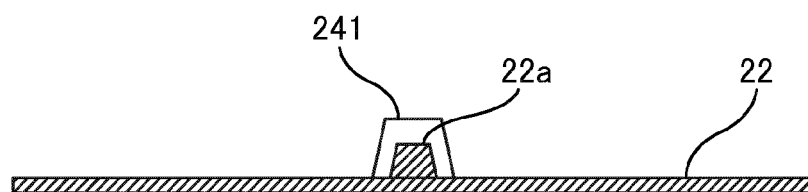


FIG. 6

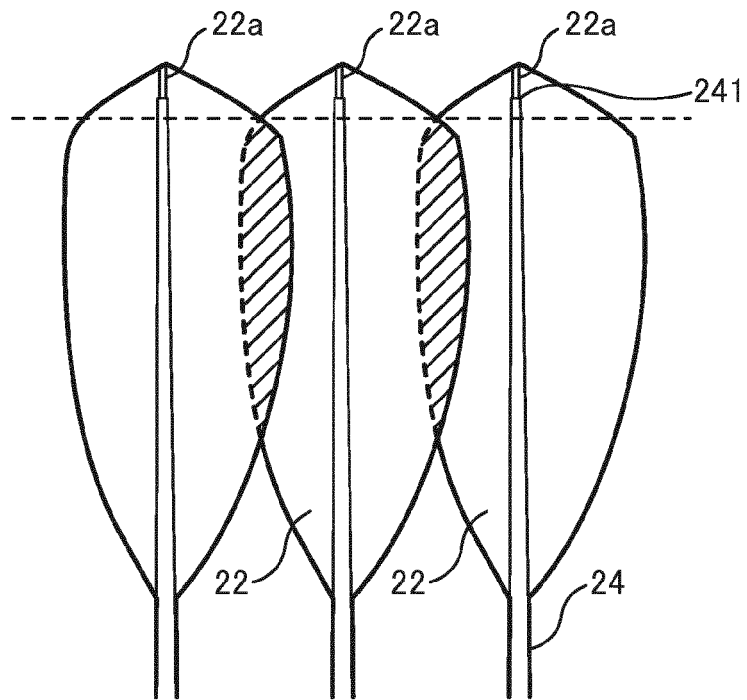


FIG. 7

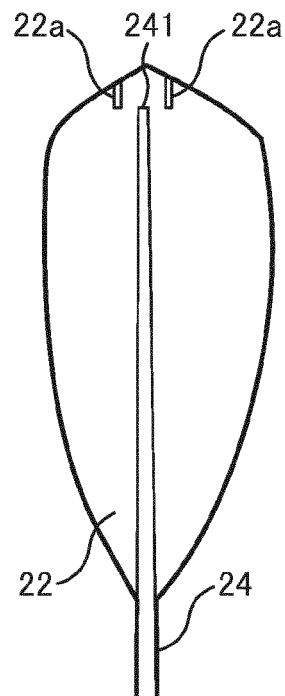


FIG. 8

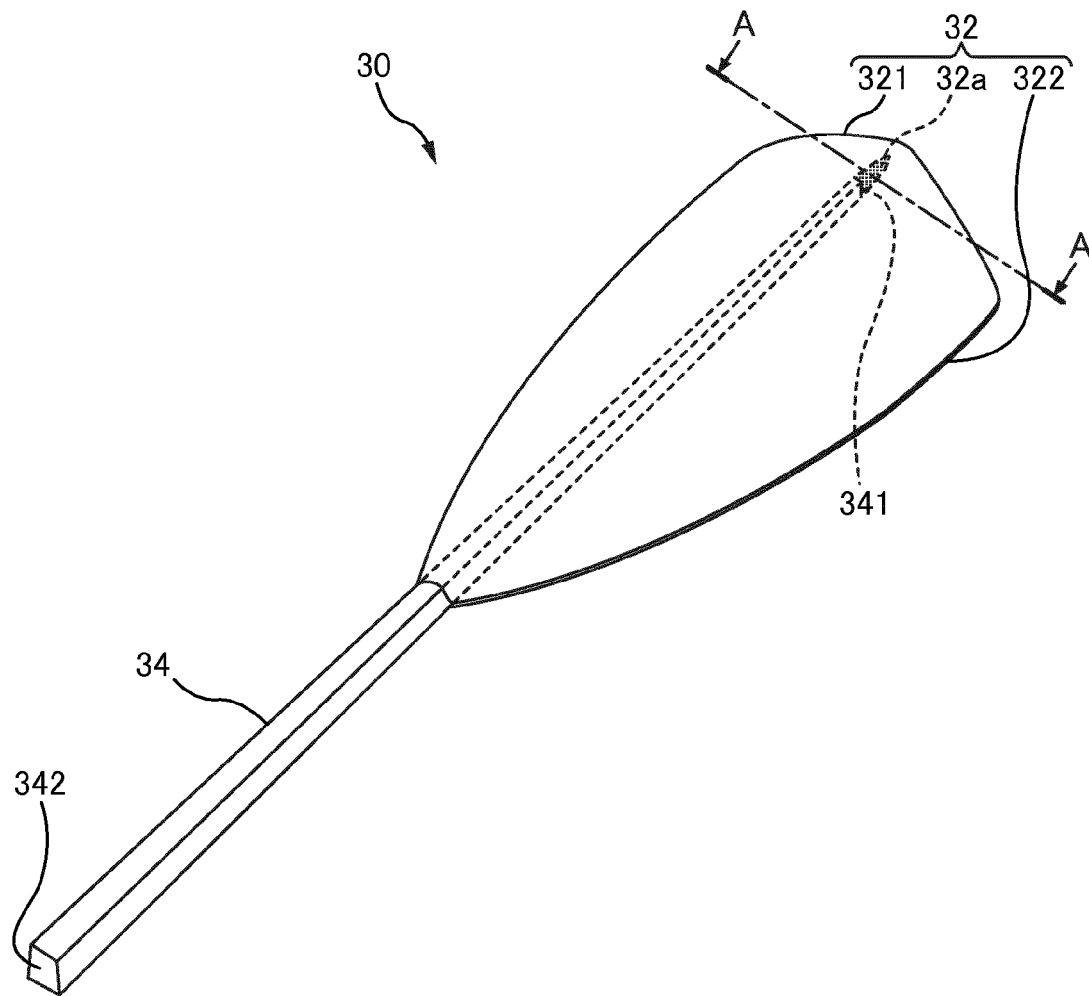


FIG. 9

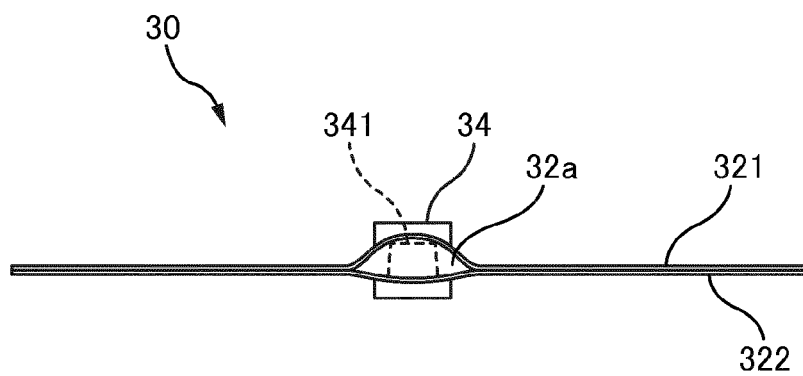


FIG. 10

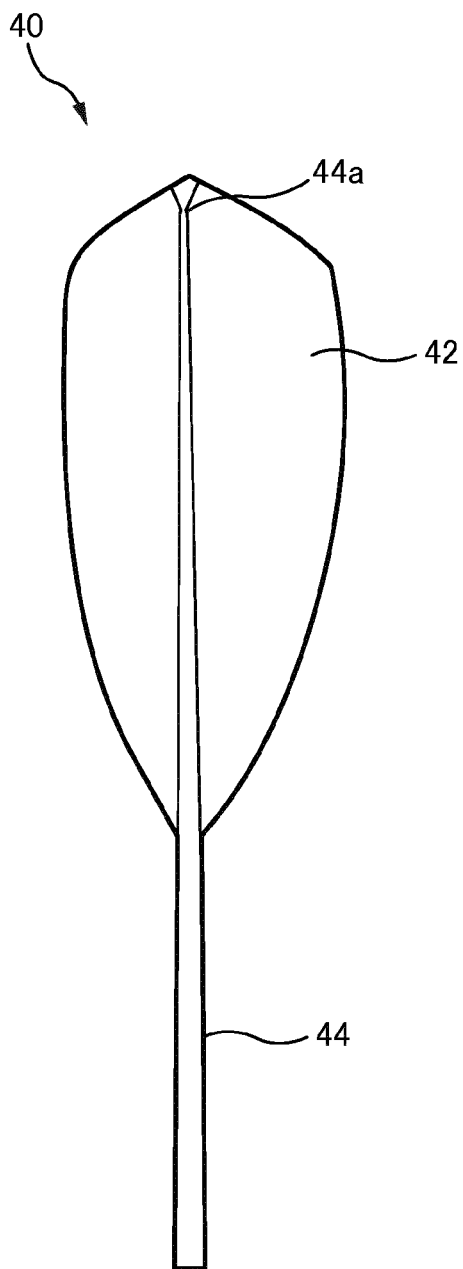


FIG. 11A

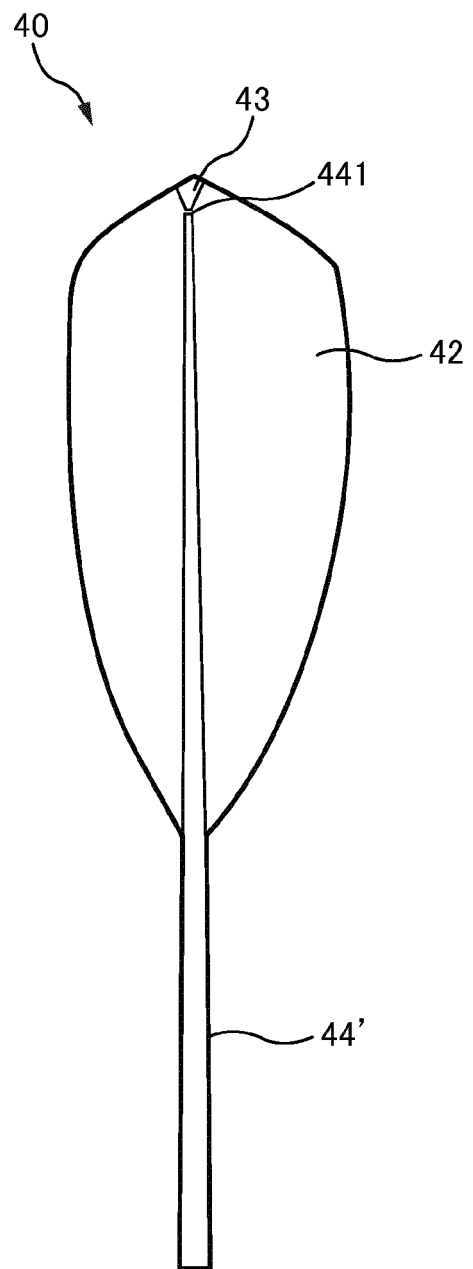


FIG. 11B

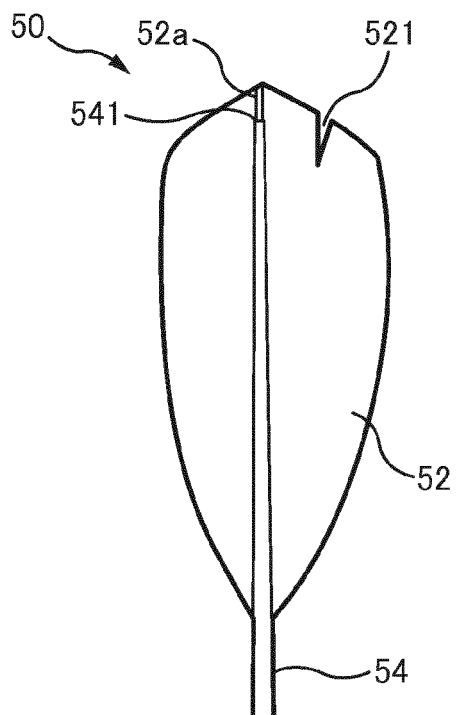


FIG. 12A

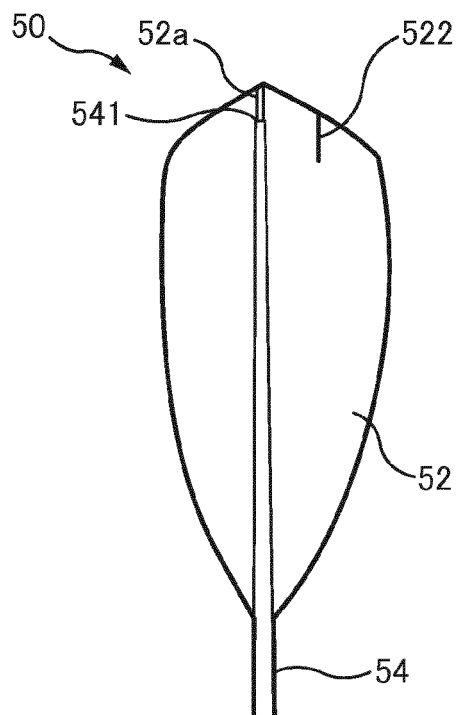


FIG. 12B

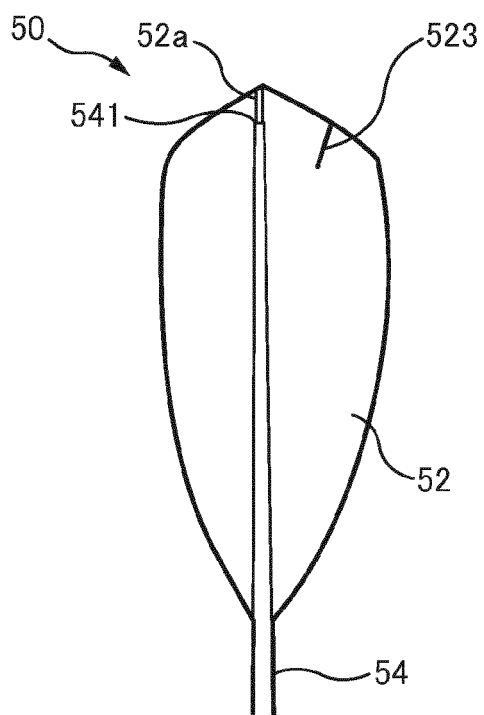


FIG. 12C

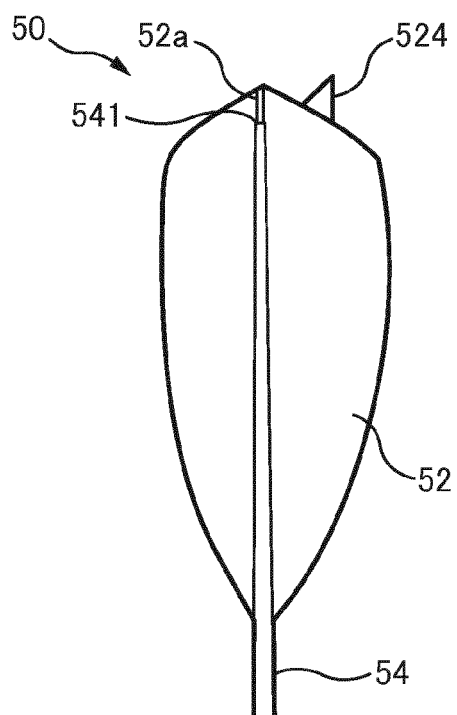


FIG. 12D



EUROPEAN SEARCH REPORT

Application Number
EP 14 17 9681

5

10

15

20

25

30

35

40

45

50

55

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	EP 2 383 023 A1 (MIZUNO KK [JP]) 2 November 2011 (2011-11-02) * figures 1,6,4,21 *	1-4,6	INV. A63B67/18
X	EP 2 606 943 A1 (YONEX KK [JP]) 26 June 2013 (2013-06-26) * paragraph [0063]; figures *	1,5	
X	CN 202 015 465 U (WENGUANG ZHANG) 26 October 2011 (2011-10-26) * figure 2 *	1-4	
A	GB 2 096 473 A (RASMUSSEN JOHN ERLING) 20 October 1982 (1982-10-20) * figure 6 *	5	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
			A63B
Place of search		Date of completion of the search	Examiner
Munich		27 January 2015	Lundblad, Hampus
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			

2

EPO FORM 1503 03 82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 14 17 9681

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.

27-01-2015

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 2383023 A1	02-11-2011	CN 102264441 A	30-11-2011
		DK 2383023 T3	30-06-2014
		EP 2383023 A1	02-11-2011
		JP 5198582 B2	15-05-2013
		KR 20110099136 A	06-09-2011
		WO 2010074234 A1	01-07-2010

EP 2606943 A1	26-06-2013	CN 103068448 A	24-04-2013
		EP 2606943 A1	26-06-2013
		KR 20130091762 A	19-08-2013
		US 2013225339 A1	29-08-2013
		WO 2012023587 A1	23-02-2012

CN 202015465 U	26-10-2011	NONE	

GB 2096473 A	20-10-1982	DK 173581 A	16-10-1982
		GB 2096473 A	20-10-1982
		JP S57177782 A	01-11-1982

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

- WO 2011021512 A [0006]