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# DESCRIPTION

## BACKGROUND

### Technical Field

[0001] The present invention relates to a racket used in badminton and the like.

### Related Art

[0002] Badminton is a sport which requires a shuttlecock to be hit down to an accurate position. When hitting down the shuttlecock to the accurate position, there may be cases of hitting down the shuttlecock at high speed, and there may be cases of hitting the shuttlecock lightly so that it springs back.

[0003] It should be noted that, in Japanese Patent Application Laid-open Publication No. 2012-147846, there is disclosed a badminton racket having a carbon fiber prepreg molded body including carbon nanotubes.

[0004] In the case where the shuttlecock is to be hit down with a smash and the like, it is advantageous to hit back so as to increase the power of the shuttlecock. On the other hand, in the case where the shuttlecock is to spring back lightly, it is necessary to hit back so as to slow down the power of the shuttlecock. Thus, it is desired that with one racket the hitting power to a hitting target such as a shuttlecock can be made different and the manner of hitting can be made different.

## SUMMARY

[0005] An advantage of some aspects of the present invention is that it is possible to provide a racket that can change hitting power to a hitting target and that can hit differently.

[0006] An aspect of the invention is a racket including:

a frame;

a handle;

a shaft connecting the frame and the handle; and

a cap fixed to the handle, the cap supporting a part of the shaft from a circumferential side of the shaft,

a shape of the cap in one surface side of the frame and a shape of the cap in another surface side of the frame being asymmetrical with respect to a surface of the frame.

[0007] Other features of the present invention will be made clear through the present specification with reference to the accompanying drawings.

## BRIEF DESCRIPTION OF THE DRAWINGS

[0008] For a more complete understanding of the present invention and the advantages thereof, reference is now made to the following description taken in conjunction with the accompanying drawings wherein:

Fig. 1A is a front view of a badminton racket 1 in a first embodiment, and Fig. 1B is a side view of the badminton racket 1 in the first embodiment;

Fig. 2A is a front view of an enlarged cap 50, and Fig. 2B is a side view of the enlarged cap 50;

Fig. 3 is drawing explaining a manner of deformation of a shaft in the first embodiment;

Fig. 4A is a partial front view of a racket 201 in a second embodiment, and Fig. 4B is a section view of a cap 250 in the second embodiment;

Fig. 5 is an enlarged view of a cap 350 in a third embodiment; and

Fig. 6 is a side view of a cap 450 in a fourth embodiment.

#### DESCRIPTION OF EXEMPLARY EMBODIMENTS

**[0009]** At least the following matters will become clear through the description of the present specification and the accompanying drawings.

**[0010]** In other words, a racket comprising: a frame; a handle; a shaft connecting the frame and the handle; and a cap fixed to the handle, the cap supporting a part of the shaft from a circumferential side of the shaft, a shape of the cap in one surface side of the frame and a shape of the cap in another surface side of the frame being asymmetrical with respect to a surface of the frame.

**[0011]** With such a racket, the shape of the cap in one surface side of the frame and the shape of the cap in another surface side of the frame are asymmetrical with respect to the surface of the frame, so that the stiffness of the cap that supports the shaft is also asymmetrical in one surface side of the frame and in the other surface side of the frame. Thus, the deformation of the shaft itself differs in the case of hitting the hitting target with one surface and in the case of hitting the hitting target with the other surface. When the deformation differs, the force of repulsion also differs, so that making the deformation different in this way, the hitting power to the hitting object can be made different in the case of hitting with one surface side and in the case of hitting with the other surface side. Namely, a racket can be provided which can make the hitting power to the hitting object different and change the manner of hitting.

**[0012]** According to such a racket, wherein the cap has a notch in the one surface side of the frame and near to the frame.

**[0013]** With such a racket, a notch is provided in the cap near to the frame, thus the shape of the cap in one surface side of the frame and the shape of the cap in the other surface side of the frame can be made asymmetrical with respect to the surface of the frame. The hitting power to the hitting object in the case of hitting with one surface and in the case of hitting with the other surface can be made different and the manner of hitting can be made different.

**[0014]** According to such a racket, wherein a cross-sectional shape of the cap in the one surface side of the frame and a cross-sectional shape of the cap in the other surface side of the frame are asymmetrical with respect to the surface of the frame.

**[0015]** With such a racket, the cross-sectional shape of the cap in one surface side of the frame and the cross-sectional shape of the cap in the other surface side of the frame are made asymmetrical with respect to the surface of the frame, so that the deformation of the shaft itself supported in the circumference with the cap can be made different in the case where the shaft bends to one surface side of the frame and in the case in where the shaft bends to the other surface side of the frame. The hitting power to the hitting object can be made different and the manner of hitting can be changed in the case of hitting with one surface and in the case of hitting with the other surface.

**[0016]** According to such a racket, further wherein an arrangement of a material of the cap in the one surface side of the frame and an arrangement of a material of the cap in the other surface side of the frame are asymmetrical with respect to the surface of the frame.

**[0017]** With such a racket, the arrangement of the material of the cap in one surface side of the frame and the arrangement of the material of the cap in the other surface side of the frame are made asymmetrical with respect to the surface of the frame, thus the deformation of the shaft itself that is supported in the circumference by the cap can be made different. The hitting power to the hitting object can be made different and the manner of hitting can be made different in the case of hitting with one surface and in the case of hitting with the other surface.

[0018] Further, according to the description of this specification and the drawings, at least the below matters will become clear.

[0019] In other words, a racket comprising: a frame; a handle; a shaft connecting the frame and the handle; and a cap fixed to the handle, the cap supporting a part of the shaft from a circumferential side of the shaft, an arrangement of a material of the cap in one surface side of the frame and an arrangement of a material of the cap in another surface side of the frame being asymmetrical with respect to the surface of the frame.

[0020] With such a racket, the arrangement of the material of the cap in one surface side of the frame and the arrangement of the material of the cap in the other surface side of the frame are made asymmetrical with respect to the surface of the frame. Thus, the deformation of the shaft itself is different in the case of hitting the hitting object with one surface and in the case of hitting the hitting object with the other surface. When the deformation is different, the force of repulsion also becomes different, so that by making the deformation different in this way, the hitting power to the hitting object can be made different in the case of hitting with one surface and in the case of hitting with the other surface. There can be provided a racket that can make the hitting power to the hitting object different and that can change the hitting manner.

==== First Embodiment ===

[0021] Below, a badminton racket is described as an example of a racket according to a first embodiment.

[0022] Fig. 1A is a front view of a badminton racket 1 in the first embodiment, and Fig. 1B is a side view of the badminton racket 1 in the first embodiment.

[0023] The badminton racket 1 (below, referred to as "racket 1") includes an annular frame 10, a handle 30 gripped by a player, and a shaft 20 connecting the frame 10 and the handle 30. Further, the racket 1 has a cap 50. The cap 50 is fixed to the handle 30 and supports a lower part of the shaft 20 from a circumferential side of the shaft 20. Further, the frame 10 of the racket 1 is strung with strings 40.

[0024] An upper surface side of the handle 30 is provided with an inserting hole to insert the shaft 20 through and to hold it. A bottom part of the shaft 20 is inserted through the inserting hole of the handle 30 and fixed with an adhesive and the like. In other words, the bottom of the shaft 20 is to be supported with the handle 30.

[0025] Further, a part of a tip end of the handle 30 is inserted to a bottom surface side of the cap 50, and they are fixed together with an adhesive or a tape. Further, the cap 50 is also provided with an inserting hole through which the shaft 20 passes, and an inner wall of the inserting hole through which the shaft 20 passes supports a part of the shaft 20 from the circumferential side thereof.

[0026] With the racket 1 in the first embodiment, the shape of the cap 50 is an asymmetrical shape in a side view (Fig. 1B). In other words, the shape of the cap 50 in an A surface side of the frame 10 and the shape of the cap 50 in a B surface side of the frame 10 can be said to be asymmetrical with respect to a surface of the frame 10.

[0027] Fig. 2A is a front view of the cap 50 that has been enlarged. Fig. 2B is a side view of the enlarged cap 50. As can be understood from referring to Fig. 2A and Fig. 2B, the cap 50 has a notch that extends in an axial direction of the shaft in one surface side of the frame 10 and in a tip end side (frame 10 side) of the cone. In this way, the shape of the cap 50 in the A surface side of the frame 10 and the shape of the cap 50 in the B surface side of the frame 10 can be made asymmetrical with respect to the surface of the frame 10. The stiffness of the cap 50 that supports the shaft 20 can also be made asymmetrical with respect to the surface of the frame 10 in the A surface side of the frame 10 and in the B surface side of the frame 10.

[0028] It should be noted that, with the racket 1 in this embodiment, for the sake of convenience of explanation, the side with the notch of the cap 50 is the A surface and the surface with no notch in the cap 50 is the B surface.

[0029] Fig. 3 is a diagram explaining the manner of deformation of the shaft in the first embodiment. In Fig. 3, the left drawing shows the racket 1 to which a force has been applied to the A surface side of the frame 10, and the right drawing shows the racket 1 to which a force has been applied to the B surface side of the frame 10. The force applied to the frame 10 is under the same condition, and the deformation of the shaft 20 that has deformed then is shown as d1 and d2. It should be noted that, the force applied to the frame 10 includes a force applied when a shuttlecock contacts the frame 10 and an inertial force that the

frame 10 receives when swinging through the racket 1. Further, the deformation shown in Fig. 3 has been drawn in an exaggerated manner for better understanding.

[0030] As shown in Fig. 3, the deformation d2 is larger than the deformation d1. In other words, the deformation is larger when the force is applied from the B surface side of the frame 10 than when the force is applied from the A surface side of the frame 10. This is because a part of the cap 50 to its upper part in the A surface side that supports the shaft 20 from the circumferential direction is notched, and the shaft 20 is deformable so that it bends further to the A surface side since the stiffness is low.

[0031] When swinging through the racket 1 the shaft 20 deforms, and the deformation of the shaft 20 itself becomes different as described above, in the case of swinging through the racket so as to hit a shuttlecock with the A surface side and in the case of swinging through the racket so as to hit a shuttlecock with the B surface side, thus the hitting power to the shuttlecock can be made different in the case of hitting with the A surface side and in the case of hitting with the B surface side.

[0032] Specifically, in the case where the player wants to hit so as to slow down the speed of the shuttlecock and make the shuttlecock spring back, the shuttlecock is hit with the A surface side of the racket 1. When swinging the racket 1 so as to hit the shuttlecock with the A surface side, the shaft 20 deforms slightly. Since the deformation is small, the hitting power of the racket 1 to the shuttlecock is small, thus the shuttlecock can be hit so as to slow down the power of the shuttlecock.

[0033] On the other hand, in the case where the player wants to hit the shuttlecock so as to increase its speed in such as a smash, the shuttlecock is hit on the B surface side of the racket 1. When the racket 1 is swung so as to hit the shuttlecock on the B surface side, the shaft 20 deforms largely. Since the deformation is large, the hitting power with the racket 1 to the shuttlecock becomes large, so that the shuttlecock can be hit to increase its speed.

### == Second Embodiment ==

[0034] Fig. 4A is a partial front view of a racket 201 in the second embodiment. Fig. 4B is a sectional view of a cap 250 in the second embodiment. It should be noted that, in the second embodiment, explanation is given with the reference number of each of the parts of the racket 1 in the first embodiment added with a number in the two hundreds.

[0035] Fig. 4A and Fig. 4B show a part of a shaft 220, a part of a handle 230, and a cap 250 of the racket 201. A sectional diagram of the cap 250 in Fig. 4B is an A-A section diagram of Fig. 4A. In Fig. 4B, an A surface side and a B surface side are shown to indicate the direction of the cap 250.

[0036] As shown in the sectional diagram in Fig. 4B, with the racket 201 in the second embodiment, the sectional shape of the cap 250 in the A surface side of a frame 210 and the sectional shape of the cap 250 in the B surface side of the frame 210 are made asymmetrical with respect to a surface of the frame 210. The cross sectional area in the B surface side of the cap 250 is thicker than the cross sectional area in the A surface side of the cap 250. The part that is not shown in Fig. 4B has been molded so that the cross sectional area gradually becomes thicker transitioning from the A surface side to the B surface side.

[0037] With such a racket 201, the sectional shape of the cap 250 in the A surface side of the frame 210 and the sectional shape of the cap 250 in the B surface side of the frame 210 are made asymmetrical with respect to the surface of the frame 210, thus the stiffness of the cap 250 that supports the shaft 220 can also be made asymmetrical with respect to the surface of the frame 210 in the A surface side of the frame 210 and in the B surface side of the frame 210. Thus, the deformation of the shaft 220 itself can be made different in the case of swinging through the racket so as to hit the shuttlecock with the A surface side and in the case of swinging through the racket so as to hit the shuttlecock with the B surface side.

[0038] When comparing specifically, the shaft 220 bends more (deforms largely) in the case that the shaft 220 is deformed from the B surface side and is bent to the A surface side than in the case that the shaft 220 is deformed from the A surface side and is bent to the B surface side.

[0039] Thus, the shuttlecock is hit with the A surface side of the racket 201 in the case where the player wants to hit so as to slow down the speed of the shuttlecock and so that the shuttlecock springs back. When swinging the racket 201 so as to hit the shuttlecock with the A surface side, the shaft 220 deforms slightly. Since the deformation is small, the hitting power of the racket 201 to the shuttlecock is small, thus the shuttlecock can be hit so as to slow down the power of the shuttlecock.

[0040] On the other hand, in the case where the player wants to hit the shuttlecock so as to increase the speed of the

shuttlecock with such as a smash, the shuttlecock is hit with the B surface side of the racket 201. When the racket 201 is swung so as to hit the shuttlecock with the B surface side, the shaft 220 deforms largely. Since the deformation is large, the hitting power of the racket 201 to the shuttlecock is large, thus the shuttlecock can be hit so as to increase the power of the shuttlecock.

[0041] The above explanation is regarding a case where the sectional shape of the cap 250 is made asymmetrical, however a cap can be adopted with the sectional shape in an asymmetrical manner as described above, and further having a notch as in the above described first embodiment.

**== Third Embodiment ==**

[0042] Fig. 5 is an enlarged diagram of a cap 350 in a third embodiment. In the third embodiment, explanation is given with the reference number of each of the parts of the racket 1 in the first embodiment added with a number in the three hundreds.

[0043] Fig. 5 shows a lower part 350a of the notched portion to the A surface side of the cap 350 and the rest of the parts 350b of the cap 350 (for the sake of convenience, referred to as a "part to the B surface side"). In Fig. 5, the cap 350 has a similar shape as that in the first embodiment described above, and further a material configuring the cap 350 is made different in the lower part 350a in the notched portion in the A surface side and the part 350b in the B surface side. In other words, the arrangement of the material of the cap 350 in the A surface side of a frame 310 and the arrangement of the material of the cap 350 in the B surface side of the frame 310 are made asymmetrical with respect to a surface of the frame 310. As described above, making the arrangement of the material of the cap 350 in the A surface side of the frame 310 and the arrangement of the material of the cap 350 in the B surface side of the frame 310 asymmetrical with respect to the surface of the frame 310 includes adopting different materials in the A surface side and the B surface side in the side view of a racket 301.

[0044] As the material of the cap 350 to be used, materials listed in Table 1 to be shown in a fourth embodiment that will be described later can be selected. A harder material is adopted in the part 350b in the B surface side than the lower part 350a of the notched part in the A surface side. For example, the lower part 350a of the notched part to the A surface side adopts a 66 nylon and the part 350b to the B surface side adopts a polycarbonate.

[0045] In this way, with the cap 350 supporting the shaft 320, the stiffness of the B surface side can be further increased than the stiffness of the A surface side. The difference in the deformation shown in the above described first embodiment can be made even larger. The hitting power to the shuttlecock in the case of hitting with the A surface side and in the case of hitting with the B surface side can be made even more different.

[0046] It should be noted that, in this way, the arrangements of the materials configuring the cap 350 may be made asymmetrical, and also the sectional shape may be made asymmetrical as in the above described second embodiment.

**== Fourth Embodiment ==**

[0047] Fig. 6 is a side view of a cap 450 in a fourth embodiment. It should be noted that, in the fourth embodiment, explanation is given with the reference number of each of the parts of the racket 1 in the first embodiment added with a number in the four hundreds. Fig. 6 shows a part 450a in an A surface side of the cap 450 and a part 450b in a B surface side of the cap 450.

[0048] As shown in Fig. 6, the sectional shape of the cap 450 in the fourth embodiment has a symmetrical shape with respect to a surface of a frame 410. Furthermore, the cap 450 in the fourth embodiment has a shape that is axially symmetrical in an axial direction of a shaft 420.

[0049] On the other hand, in the fourth embodiment the arrangement of the material of the cap 450 in the A surface side of the frame 410 and the arrangement of the material of the cap 450 in the B surface side of the frame 410 are made asymmetrical with respect to the surface of the frame 410, so as to make the manner in which the shaft 420 bends to the A surface side and to the B surface side different.

[0050] Table 1 is a diagram showing an example of the material of the cap that may be adopted in the fourth embodiment. Table 1 shows the material name to be used for the cap, the code of the material, and further its degree of hardness. Here, the degree of hardness is schematically shown in seven simplified degrees of hardness of "very soft", "soft", "slightly soft", "normal", "slightly hard", "hard", and "very hard". It should be noted that, the degree of hardness increases gradually in the order of "very soft",

"soft", "slightly soft", "normal", "slightly hard", "hard", and "very hard".

Table 1

Material name	Code	Hardness
6 Nylon	PA6	slightly soft
11 Nylon	PA11	soft
12 Nylon	PA12	soft
612 Nylon	PA612	slightly soft
66 Nylon	PA66	normal
Polyurethane	PU	very soft
Polypropylene	PP	slightly hard
ABS	ABS	slightly soft
Polycarbonate	PC	hard
Polyacetals	POM	very hard

[0051] With regards to the material of the cap 450 used here, specifically a harder material is adopted for the part 450b in the B surface side than the part 450a in the A surface side. For example, 66 Nylon is adopted for the part 450a in the A surface side, and polycarbonate is adopted for the part 450b in the B surface side.

[0052] It should be noted that, the above "hardness" classification is a general classification, and in actuality, different materials will have a different hardness from each other to some extent. Thus, it is possible to adopt different materials for the part 450a in the A surface side and the part 450b in the B surface side, even in the case where the materials are shown to have the same degree of hardness in the above classification.

[0053] According to such a racket 401, the arrangement of the material of the cap 450 in the A surface side of the frame 410 and the arrangement of the material of the cap 450 in the B surface side of the frame 410 are made asymmetrical with respect to the surface of the frame 410, thus the deformation of the shaft 420 itself supported in the circumference with the cap 450 can be made different in the case where the shaft bends to the A surface side of the frame 410 and in the case where the shaft bends to the B surface side of the frame 410. The hitting power can be made different in the case where the shuttlecock is hit with the A surface, and in the case where the shuttlecock is hit with the B surface.

[0054] When compared specifically, the shaft 420 bends more (largely deforms) in the case in which the shaft 420 is deformed from the B surface side and the shaft 420 is bent to the A surface side than in the case in which the shaft 420 is deformed from the A surface side and the shaft 420 is bent to the B surface side.

[0055] Thus, in the case where a player wants hit the shuttlecock so as to slow down the speed of the shuttlecock and so that it springs back, the shuttlecock is hit with the A surface side of the racket 401. When the racket 401 is swung so as to hit the shuttlecock with the A surface side, the shaft 420 deforms slightly. Since the deformation is small, the hitting power of the racket 401 to the shuttlecock is small, thus the shuttlecock can be hit so as to slow down the power of the shuttlecock.

[0056] On the other hand, in the case where the player wants to hit the shuttlecock to increase the speed of the shuttlecock such as in a smash, the shuttlecock is hit with the B surface side of the racket 401. When the racket 401 is swung so as to hit the shuttlecock with the B surface side, the shaft 420 deforms largely. Since the deformation is large, the hitting power with the racket 401 to the shuttlecock is large, thus the shuttlecock can be hit so as to increase its power.

[0057] It should be noted that, in the fourth embodiment, the arrangement of the material adopted for the cap 450 is arranged to be symmetrical in the A surface side and the B surface side, but the embodiment is not limited thereto. Further, the type of the material to be adopted is not limited to two types.

==== Other Embodiments ====

[0058] The above embodiments are to facilitate understanding of this invention, and do not limit understanding of this invention in any way. It is needless to say that this invention can be altered and improved without departing from its scope as defined by the

appended claims. For example, mixing a reinforcing agent to the B surface side of the cap is also an equivalent of this invention.

<Racket>

**[0059]** In the above embodiments, a badminton racket was described as an example, but it is not limited thereto. For example, this invention can be applied to a racket for tennis, squash and the like.

**[0060]** Further, in the above embodiment, the badminton racket 1 strung with the string 40 is described as an example, and as a badminton racket 1 body a racket that is not strung with the string is also included in the technical idea of this invention.

## 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

- JP2012147846A [0002]

## Patentkrav

1. Ketcher, der omfatter:

en ramme;

5 et greb;

et skaft, der forbinder rammen og grebet; og  
en kappe, der er fastgjort til grebet, hvor kappen støtter en  
del af skaftet fra en rundtgående side af skaftet,  
hvor en form af kappen i en overfladeside af rammen og en form  
10 af kappen i en anden overfladeside af rammen er asymmetriske i  
forhold til en overflade af rammen.

2. Ketcher ifølge krav 1, hvor

kappen har et indsnit i den ene overfladeside af rammen og nær  
15 ved rammen.

3. Ketcher ifølge krav 1 eller 2, hvor

en tværnitsform af kappen i den ene overfladeside af rammen  
og en tværnitsform af kappen i den anden overfladeside af  
20 rammen er asymmetriske i forhold til overfladen af rammen.

4. Ketcher ifølge et hvilket som helst af kravene 1 til 3,  
hvor

en indretning af et materiale af kappen i den ene  
25 overfladeside af rammen og en indretning af et materiale af  
kappen i den anden overfladeside af rammen er asymmetriske i  
forhold til overfladen af rammen.

5. Ketcher, der omfatter:

30 en ramme;

et greb;

et skaft, der forbinder rammen og grebet; og  
en kappe, der er fastgjort til grebet, hvor kappen støtter en  
del af skaftet fra en rundtgående side af skaftet,  
35 en indretning af et materiale af kappen i en overfladeside af  
rammen og en indretning af et materiale af kappen i en anden  
overfladeside af rammen er asymmetriske i forhold til  
overfladen af rammen.

## DRAWINGS

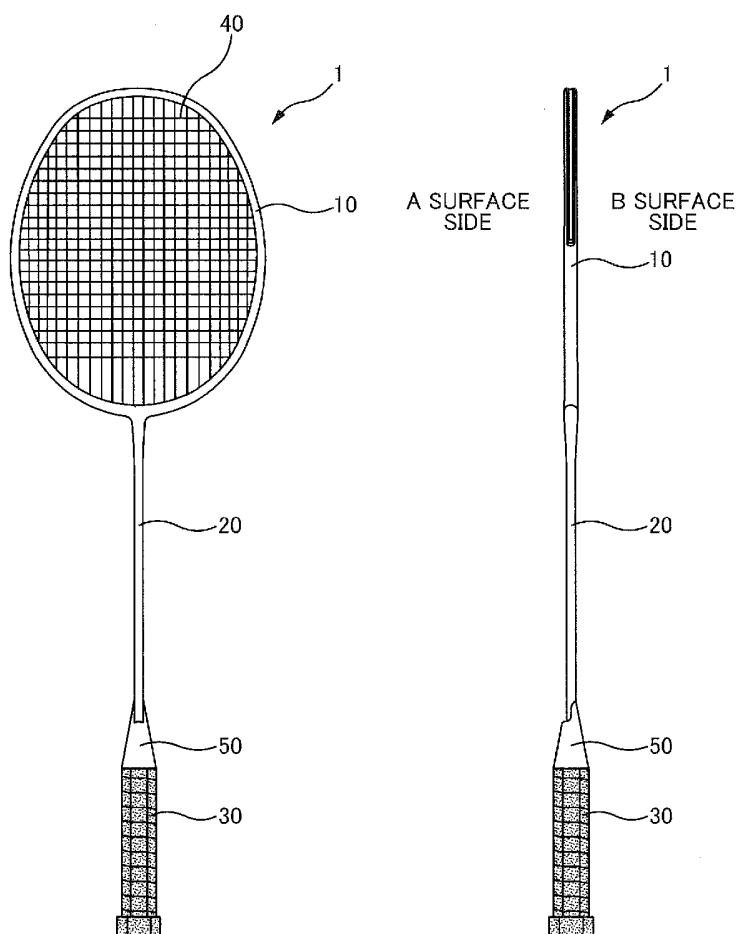


FIG. 1A

FIG. 1B

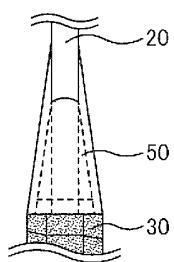


FIG. 2A

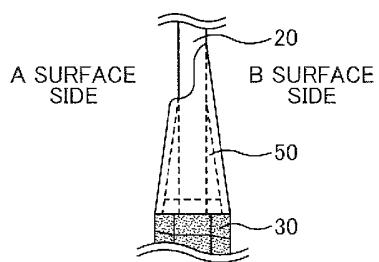
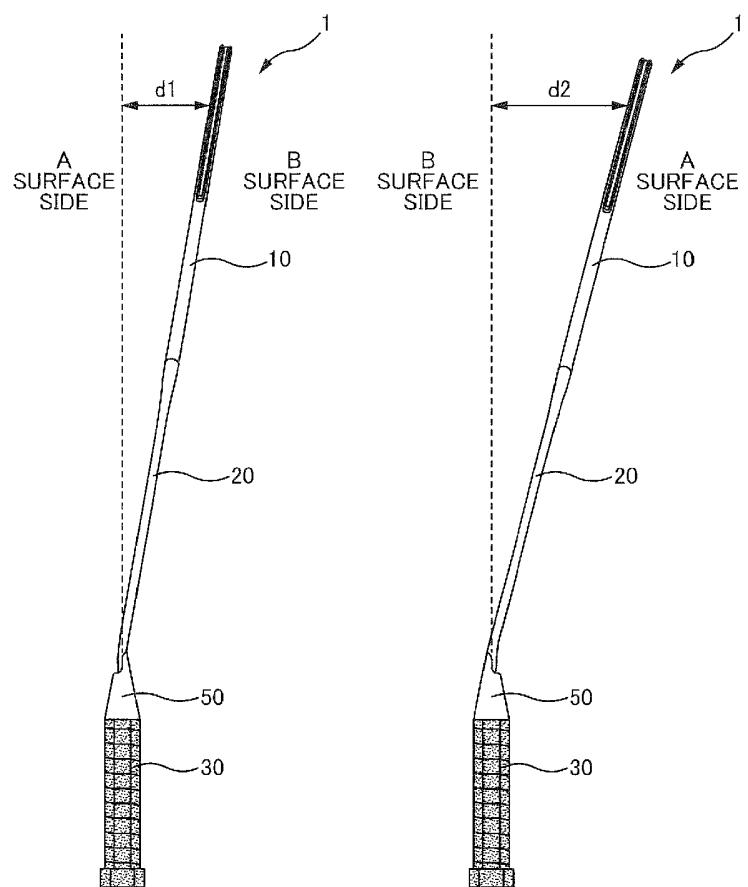


FIG. 2B



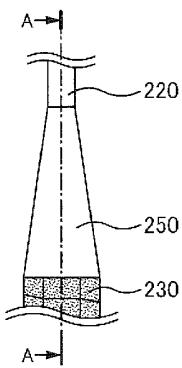


FIG. 4A

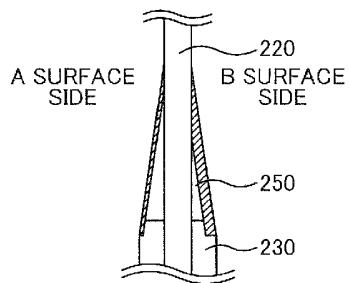


FIG. 4B

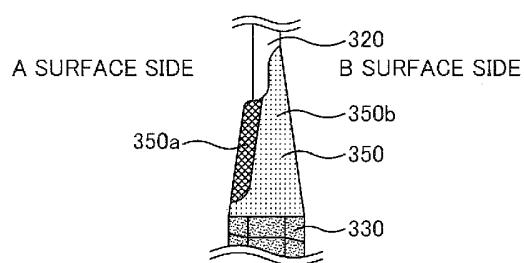


FIG. 5

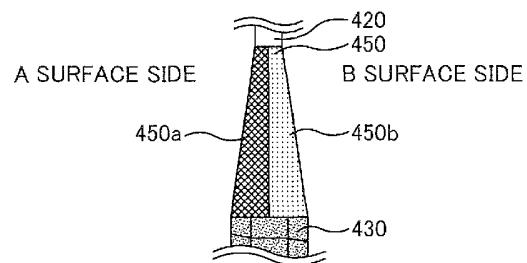


FIG. 6