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(54) **COMPOSITE BALL BAT**

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(57) **ABSTRACT**

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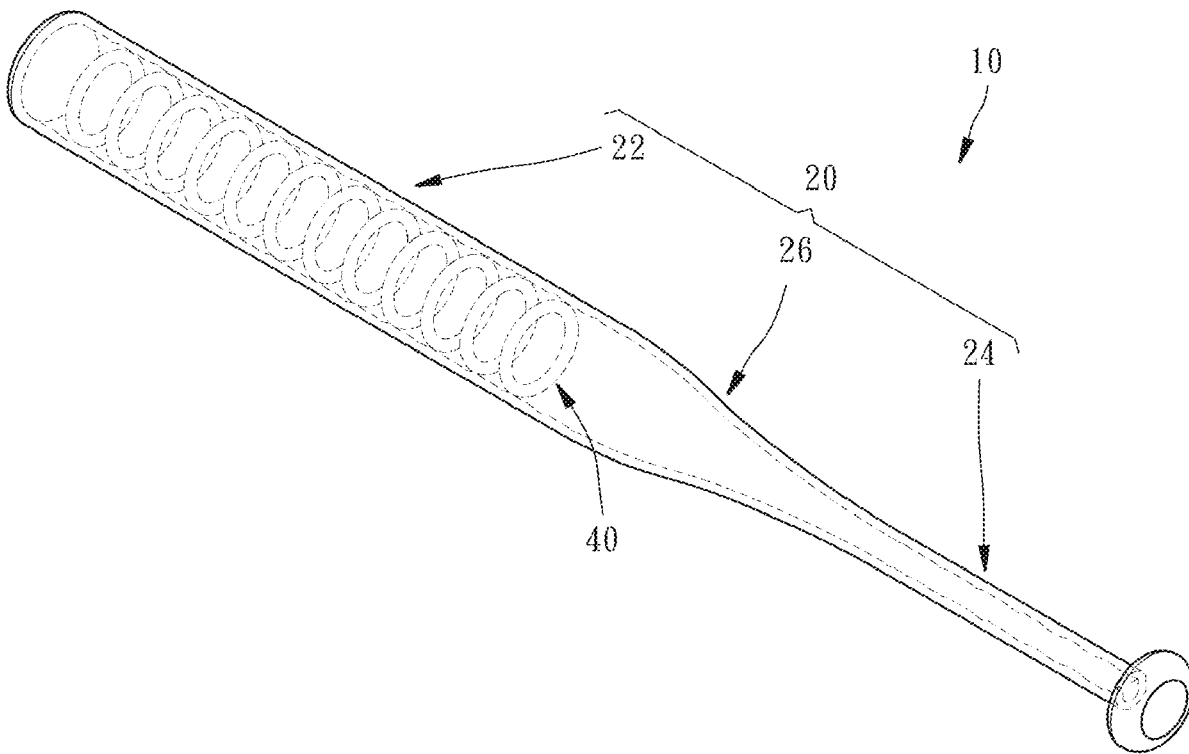
A composite ball bat includes a bat body made of a multi-layer fiber composite material and including a hollow barrel, a handle and a tapered section joining the hollow barrel to the handle and having an outer diameter reducing gradually from the hollow barrel toward the handle, and a plurality of rings arranged in the hollow barrel of the bat body and spaced along the axis of the bat body with the outer circumferences thereof fixed on the inner circumference of the hollow barrel of the bat body. In this way, the composite ball bat of the invention can use these rings to improve the hitting effect while reducing weight.

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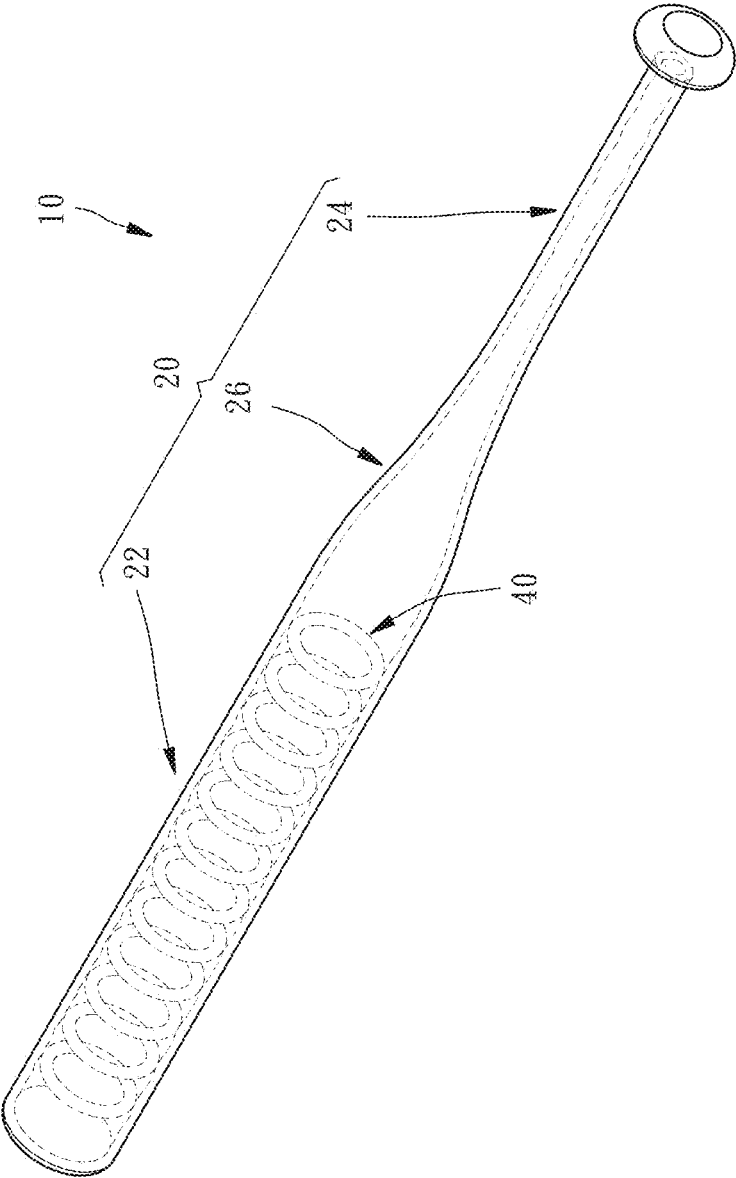


FIG. 1

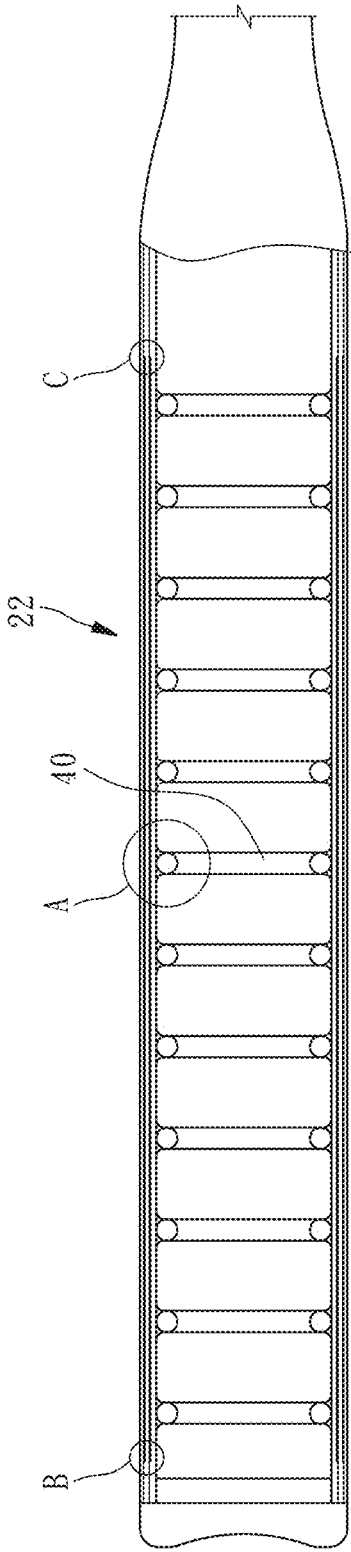


FIG. 2

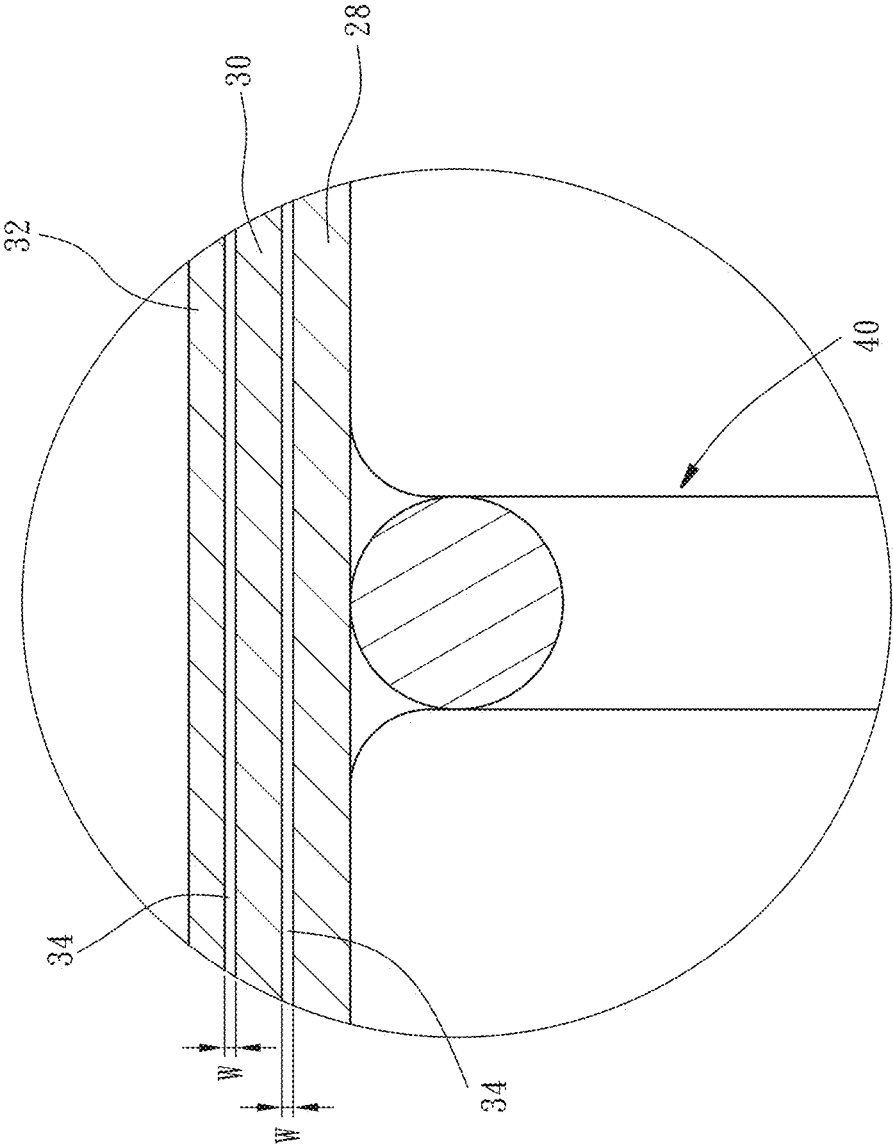


FIG. 3

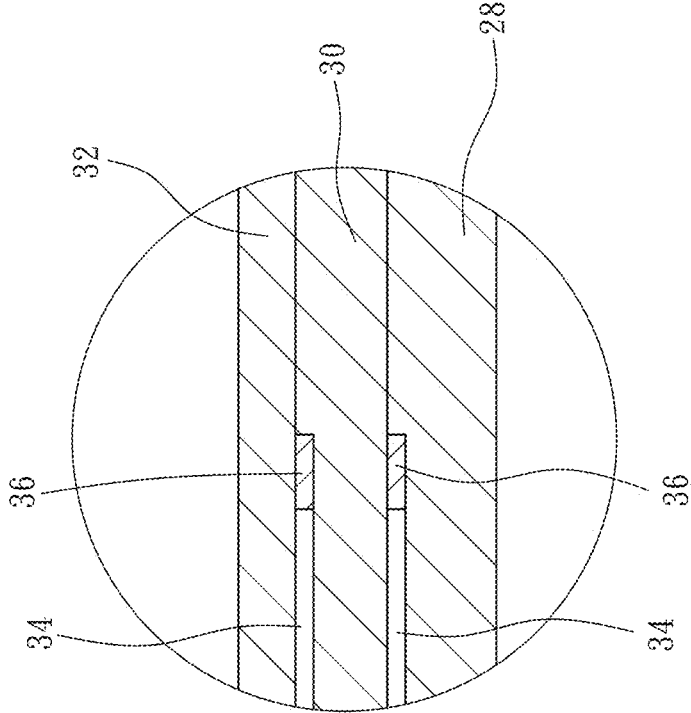


FIG. 4

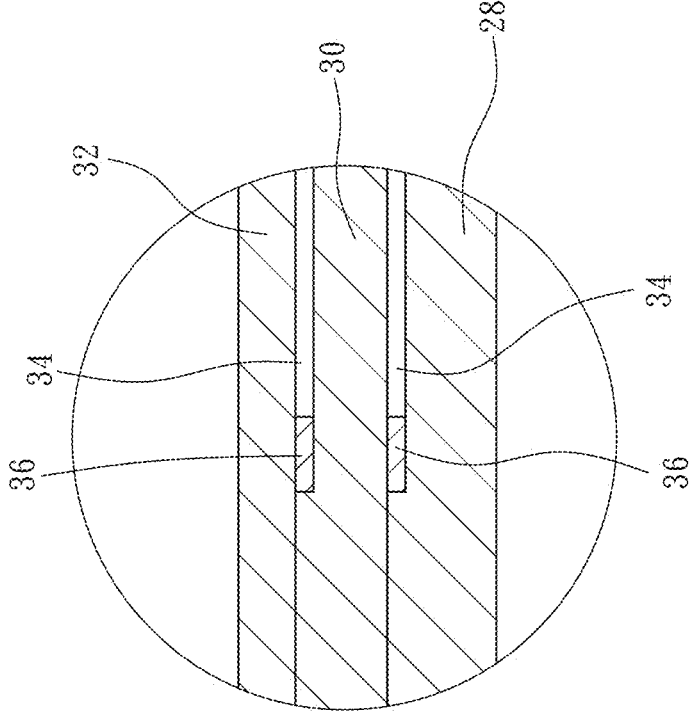


FIG. 5

## COMPOSITE BALL BAT

### BACKGROUND OF THE INVENTION

#### 1. Field of the Invention

[0001] The present invention relates to ball bat technology, and more particularly to a composite ball with reduced weight and improved hitting effect.

#### 2. Description of the Related Art

[0002] Generally speaking, ball bats are mainly divided into two types, wooden ball bats and aluminum ball bats. As for the wooden ball bat, due to the heavy weight of the wooden ball bat, the average hitter is more strenuous when swinging the ball bat, and the swing speed is slower, so the shot is often not strong enough. As for the aluminum ball bat, it is lighter than the wooden ball bat in weight and has a higher rebound coefficient relative to the wooden ball bat, so it can hit the ball farther with its own good elasticity. However, the disadvantage of aluminum ball bats is that the rigidity is weak. As a result, depressions are prone to occur at the impact. In order to solve the problems of the aforementioned conventional ball bats, ball bats made of composite materials have been developed in recent years, but the current composite ball bats are difficult to achieve a balance between weight reduction and improvement of the hitting effect, so composite ball bats are not widely used.

### SUMMARY OF THE INVENTION

[0003] The present invention has been accomplished under the circumstances in view. It is the main object of the present invention to provide a composite ball bat, which can achieve a good balance between weight reduction and improvement of the hitting effect.

[0004] To achieve this and other objects of the present invention, a composite ball bat comprises a bat body and a plurality of rings. The bat body is made of a multilayer fiber composite material, comprising a hollow barrel, a handle and a tapered section joining the hollow barrel to the handle. The tapered section has an outer diameter reducing gradually from the hollow barrel toward the handle. The rings are arranged in the hollow barrel of the bat body and spaced along the axis of the bat body with the outer circumferences thereof fixed on the inner circumference of the hollow barrel of the bat body. The hardness of the rings is higher than the hardness of the hollow barrel.

[0005] As can be seen from the above, the composite ball bat of the present invention on the one hand uses the bat body made of a multilayer fiber composite material to increase the rigidity and reduce weight, and on the other hand uses the rings set in the hollow barrel to enhance the hitting effect, thereby achieving the purpose of the present invention.

[0006] Preferably, the multilayer fiber composite material comprises an outer layer, an inner layer and at least one intermediate layer. The thickness of the inner layer is greater than the thickness of the intermediate layer, and the thickness of the intermediate layer is greater than the thickness of the outer layer.

[0007] In this way, because the outer layer is thin, it is easy to deform and has poor elasticity and the contact time of the outer layer with the ball can be increased to improve the ball control performance, and, because the inner layer is thicker,

it has better elasticity but is not conducive to ball control. This way of using multilayer gradients can have both advantages. In addition, the use of the multilayer fiber composite material in the amount of deformation can provide a better rebound force than a single layer.

[0008] Preferably, a buffer space is defined in the hollow barrel between each adjacent two layers of the multilayer fiber composite material. That is, there is a buffer space between the inner layer and the intermediate layer, and another buffer space between the intermediate layer and the outer layer. These two buffer spaces are used to buffer the shock force generated when hitting the ball.

[0009] Preferably, each buffer space is partitioned by two spacers embedded in the front and back ends of the hollow barrel within the adjacent two layers of the multilayer fiber composite material.

[0010] Preferably, each adjacent two layers of the multilayer fiber composite material beyond the hollow barrel are bonded together to ensure sufficient rigidity.

[0011] Preferably, the rings are arranged in the barrel of the bat body at equal intervals along the axis of the bat body, so that the rings can be evenly distributed in the sweet spot of the hollow barrel.

[0012] The detailed structure, characteristics, assembly or use of the composite ball bat provided by the present invention will be described in the subsequent detailed description of the preferred embodiment. However, those with ordinary skill in the art should be able to understand that the detailed description and the specific preferred embodiment listed in the implementation of the present invention are only used to illustrate the present invention, not to limit the scope of patent applications for this invention.

### BRIEF DESCRIPTION OF THE DRAWINGS

[0013] FIG. 1 is a perspective view of a composite ball bat in accordance with the present invention.

[0014] FIG. 2 is a sectional view of a part of the composite ball bat in accordance with the present invention.

[0015] FIG. 3 is an enlarged view of part A of FIG. 2.

[0016] FIG. 4 is an enlarged view of part B of FIG. 2.

[0017] FIG. 5 is an enlarged view of part C of FIG. 2.

### DETAILED DESCRIPTION OF THE INVENTION

[0018] The applicant first states here that throughout the specification, including the preferred embodiment described below and the claims in the scope of patent application, the terms related to directionality are based on the directions in the drawings. Secondly, in the preferred embodiment and drawings to be described below, the same element numbers represent the same or similar elements or their structural features.

[0019] Referring to FIG. 1, a composite ball bat 10 in accordance with the present invention comprises a bat body 20 and a plurality of rings 40.

[0020] The bat body 20 comprises a hollow barrel 22, a handle 24 and a tapered section 26. The tapered section 26 joins the hollow barrel 22 to the handle 24. The outer diameter of the tapered section 26 reduces gradually from the hollow barrel 22 toward the handle 24.

[0021] As shown in FIG. 3, the bat body 20 is made of a multi-layer fiber composite material. In terms of the number

of layers, three or four layers can be used according to actual needs. In the present preferred embodiment, there are three layers, namely, the inner layer, the intermediate layer and the outer layer. The thickness of the inner layer **28** is greater than the thickness of the intermediate layer **30**, and the thickness of the intermediate layer **30** is greater than the thickness of the outer layer **32**. In this way, because the outer layer **32** is thin, it is easy to deform and has poor elasticity and the contact time of the outer layer **32** with the ball can be increased to improve the ball control performance, and, because the inner layer **28** is thicker, it has better elasticity but is not conducive to ball control. This way of using multilayer gradients can have both advantages. In addition, the use of the multilayer fiber composite material in the amount of deformation can provide a better rebound force than a single layer. But it is not limited to the above arrangement, the thickness of each of the multiple layers of the multilayer fiber composite materials can also be the same.

**[0022]** In addition, as shown in FIGS. 3-5, the front and back ends of the hollow barrel **22** embed a spacer **36** (the material used here is polyurethane but can also be silicone or rubber) between each adjacent two layers of the multilayer fiber composite material, so that a buffer space **34** is partitioned by the two spacers **36** embedded in the front and back ends of the hollow barrel **22** within the adjacent two layers of the multilayer fiber composite material. That is, there is a buffer space **34** between the inner layer **28** and the intermediate layer **30**, and another buffer space **34** between the intermediate layer **30** and the outer layer **32**. These two buffer spaces **34** have the same width *W*, and the both buffer spaces **34** are closed, so the air inside will create a cushioning effect like an air cushion. In this way, when the composite ball bat **10** hits the ball, not only the deformation of the multilayer fiber composite material is used to absorb the impact force of the ball, but also the two buffer spaces **34** can be used to increase the shock absorption effect. As for the positions other than the hollow barrel **22** (that is, the positions of the tapered section **26** and the handle **24**), the adjacent two layers of the multilayer fiber composite material are bonded together, that is, the inner layer **28** and the intermediate layer **30** are bonded to each other, and the intermediate layer **30** and the outer layer **32** are bonded to each other to ensure that the bat body **20** has sufficient rigidity. In addition, it is worth mentioning here that the aforementioned fiber composite material may be carbon fiber, glass fiber, or other polyester fiber, and in this embodiment, carbon fiber is used as an illustration.

**[0023]** The rings **40** can be made of a composite material such as carbon fiber or plastics such as PP or metal such as aluminum alloys, and the number can be increased or decreased according to actual needs, which is not limited here.

**[0024]** As shown in FIGS. 1 and 2, the rings **40** are arranged in the hollow barrel **22** of the bat body **20** and are arranged at equal intervals along the axis of the bat body **20**, and the outer circumferences of the rings **40** are fixed on the inner circumference of the hollow barrel **22** of the bat body **20**. The hardness of the rings **40** is higher than that of the hollow barrel **22** of the bat body **20**, that is, the elasticity of the rings **40** is worse than that of any layer of the fiber composite material of the hollow barrel **22** of the bat body **20**.

**[0025]** As can be seen from the above, the composite ball bat **10** of the present invention is provided with multiple rings **40** on the sweet spot of hollow barrel **22** on the one hand to improve the hitting effect, and on the other hand, the deformation of the multilayer composite material and the buffer space **34** between each adjacent two layers of the multilayer fiber composite material are used to absorb the shock generated when hitting the ball. In this way, you can achieve a good balance between weight reduction and improvement of the hitting effect, thereby achieving the purpose of the present invention.

What is claimed is:

1. A composite ball bat, comprising:

a bat body made of a multilayer fiber composite material, said bat body comprising a hollow barrel, a handle and a tapered section joining said hollow barrel to said handle, the outer diameter of said tapered section reducing gradually from said barrel toward said handle; and

a plurality of rings arranged in said hollow barrel of said bat body and spaced along the axis of said bat body, and the outer circumferences of said rings being fixed on the inner circumference of said hollow barrel of said bat body.

2. The composite ball bat as claimed in claim 1, wherein said multilayer fiber composite material comprises an outer layer, an inner layer and at least one intermediate layer, the thickness of said inner layer being greater than the thickness of said at least one intermediate layer, the thickness of said at least one intermediate layer being greater than the thickness of said outer layer; the hardness of said rings is higher than the hardness of each layer of said multilayer fiber composite material.

3. The composite ball bat as claimed in claim 1, further comprising a buffer space defined in said hollow barrel between each adjacent two layers of said multilayer fiber composite material.

4. The composite ball bat as claimed in claim 2, further comprising a buffer space defined in said hollow barrel between each adjacent two layers of said multilayer fiber composite material.

5. The composite ball bat as claimed in claim 3, wherein said buffer spaces have the same width.

6. The composite ball bat as claimed in claim 3, wherein opposing front and back ends of said hollow barrel embed a spacer between each adjacent two layers of said multilayer fiber composite material, so that a buffer space is partitioned by the two said spacers embedded in said front and back ends of said hollow barrel within each adjacent two layers of said multilayer fiber composite material.

7. The composite ball bat as claimed in claim 3, wherein each adjacent two layers of said multilayer fiber composite material beyond said hollow barrel are bonded together.

8. The composite ball bat as claimed in claim 4, wherein said buffer spaces have the same width.

9. The composite ball bat as claimed in claim 4, wherein opposing front and back ends of said hollow barrel embed a spacer between each adjacent two layers of said multilayer fiber composite material, so that a buffer space is partitioned by the two said spacers embedded in said front and back ends of said hollow barrel within each adjacent two layers of said multilayer fiber composite material.

**10.** The composite ball bat as claimed in claim 4, wherein each adjacent two layers of said multilayer fiber composite material beyond said hollow barrel are bonded together.

**11.** The composite ball bat as claimed in claim 1, wherein said rings are arranged in said hollow barrel of said bat body at equal intervals along the axis of said bat body.

**12.** The composite ball bat as claimed in claim 1, wherein the multiple layers of said multilayer fiber composite material have the same thickness, and the hardness of said rings is higher than each layer of said multilayer fiber composite material of said hollow barrel of said bat body.

**13.** The composite ball bat as claimed in claim 1, wherein said rings are made of a fiber composite material.

**14.** The composite ball bat as claimed in claim 1, wherein said rings are made of a metal material.

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