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Dai

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(54) **SHUTTLECOCK AND MANUFACTURING METHOD THEREOF**

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(72) Inventor: **Jianlin Dai**, Maanshan (CN)

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Nov. 28, 2011 (CN) 2011 1 0426157

(51) **Int. Cl.**
A63B 67/18 (2016.01)

(52) **U.S. Cl.**
CPC ***A63B 67/18*** (2013.01); ***A63B 67/187*** (2016.01); ***A63B 67/19*** (2016.01)

(58) **Field of Classification Search**
CPC A63B 67/18
See application file for complete search history.

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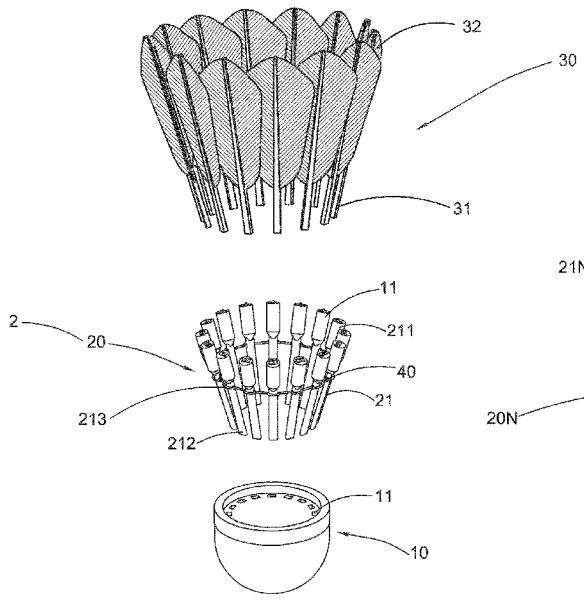
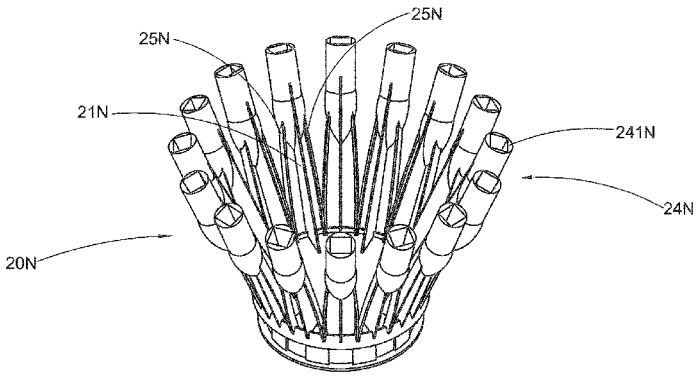
(57) **ABSTRACT**

A shuttlecock includes: a set of feather units, a shuttlecock head, and a connecting arrangement which including a feather planting arrangement. The feather planting arrangement includes a set of feather planting members of the same number as the number of the feather units, each feather planting member has a feather planting end portion and an insertion end portion, a shaft member of each feather unit is inserted in the feather planting end portion while the insertion end portion of each feather planting member is inserted in the shuttlecock head. Further disclosed is a method of manufacturing the shuttlecock.

6 Claims, 18 Drawing Sheets





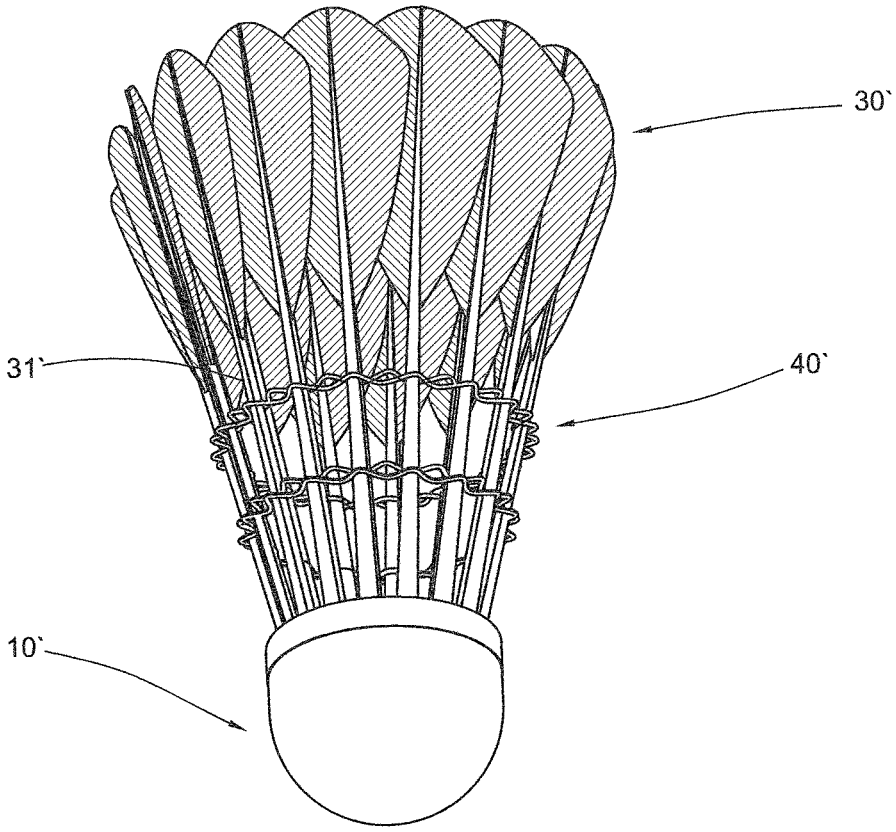


FIG. 1
PRIOR ART

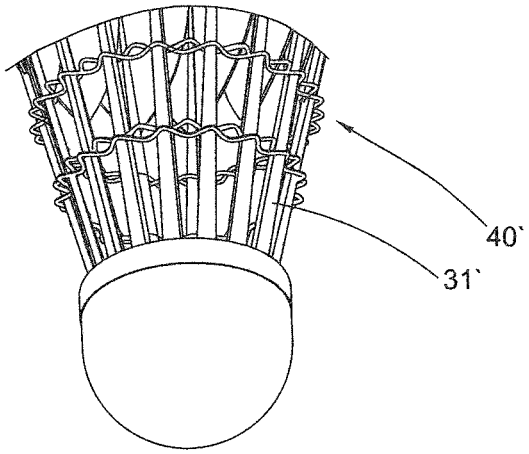


FIG. 2

PRIOR ART

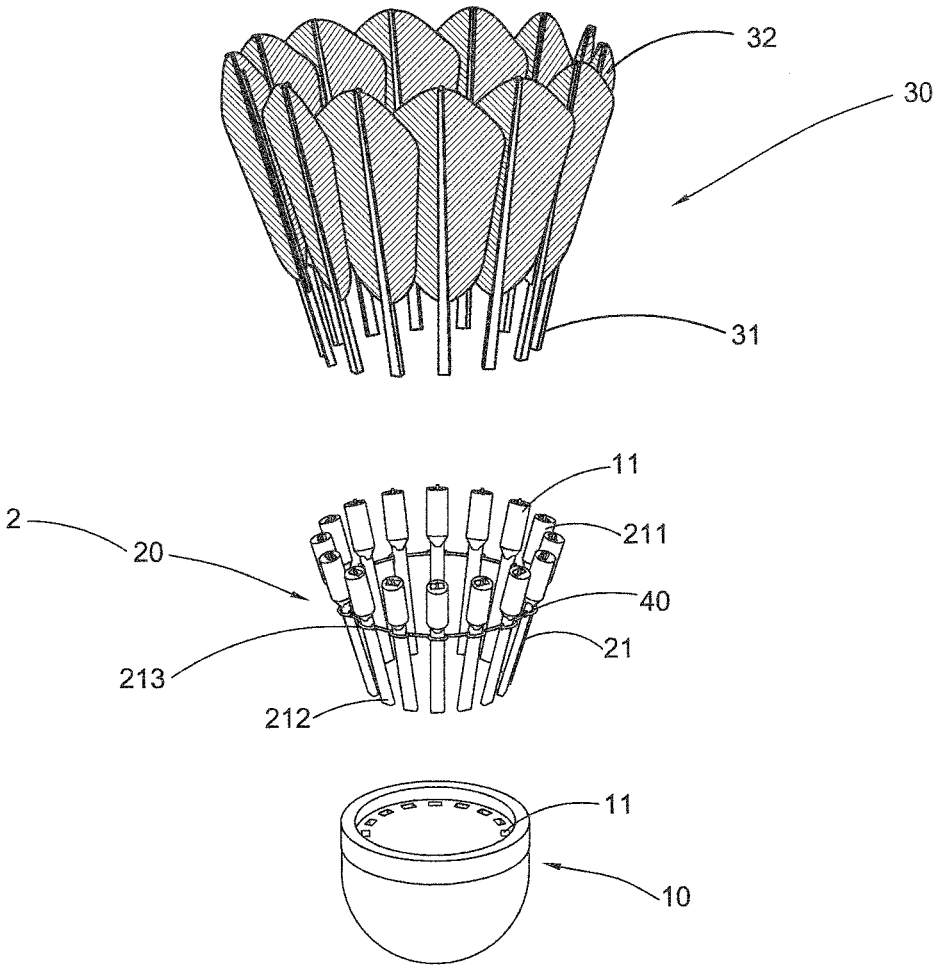


FIG. 3

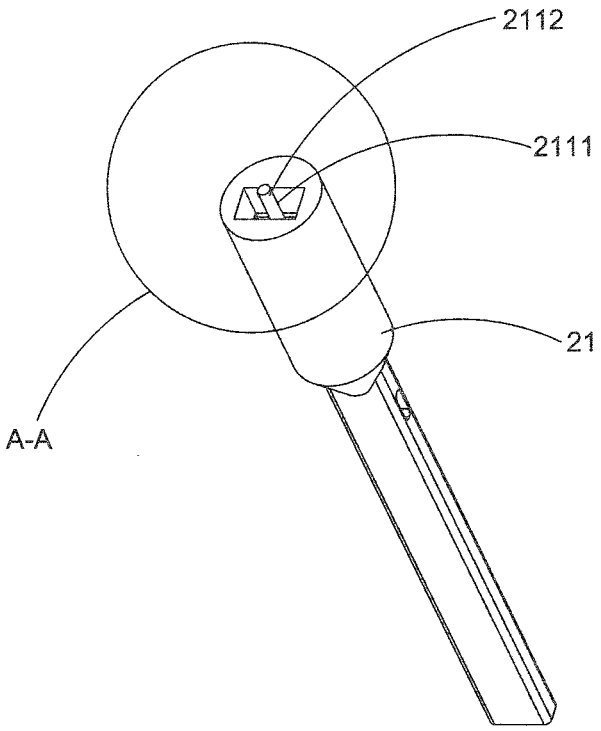


FIG. 4A

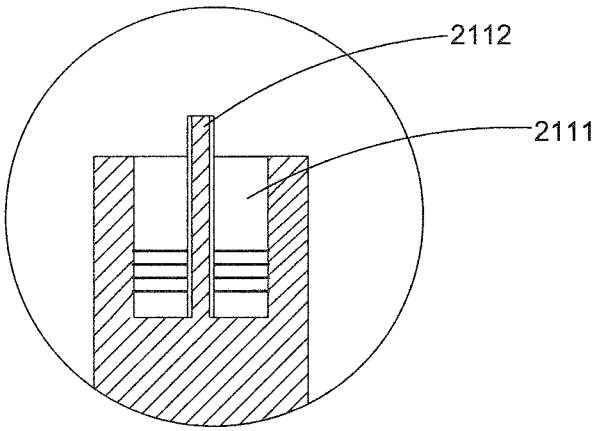


FIG. 4B

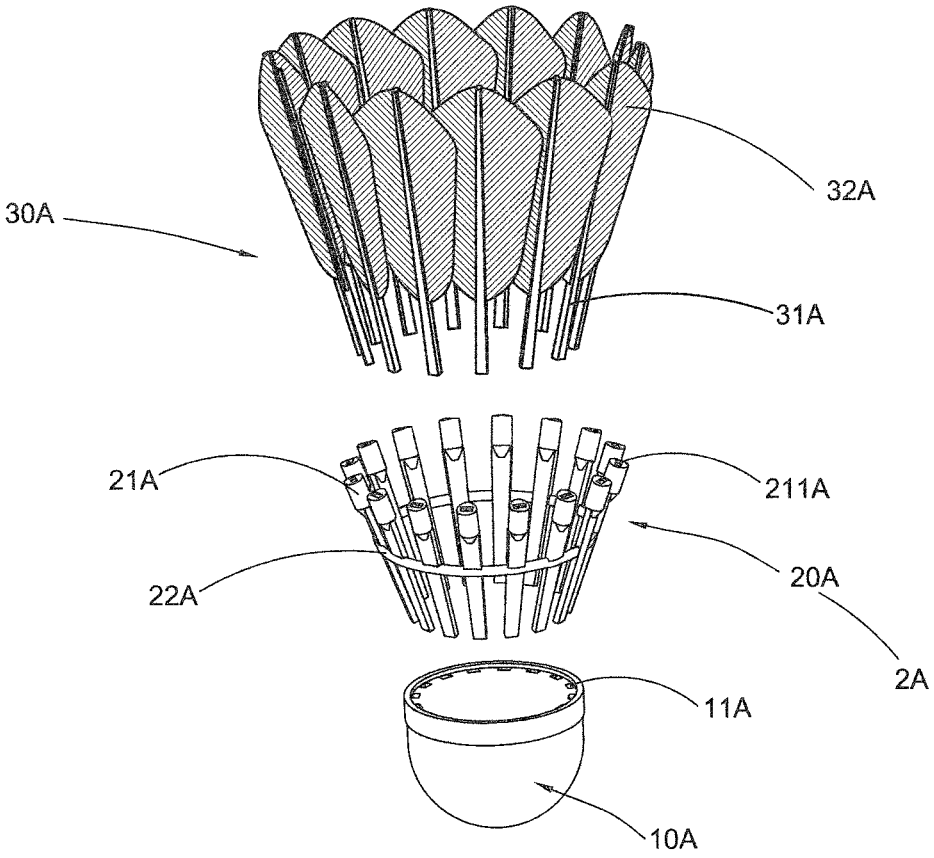


FIG. 5

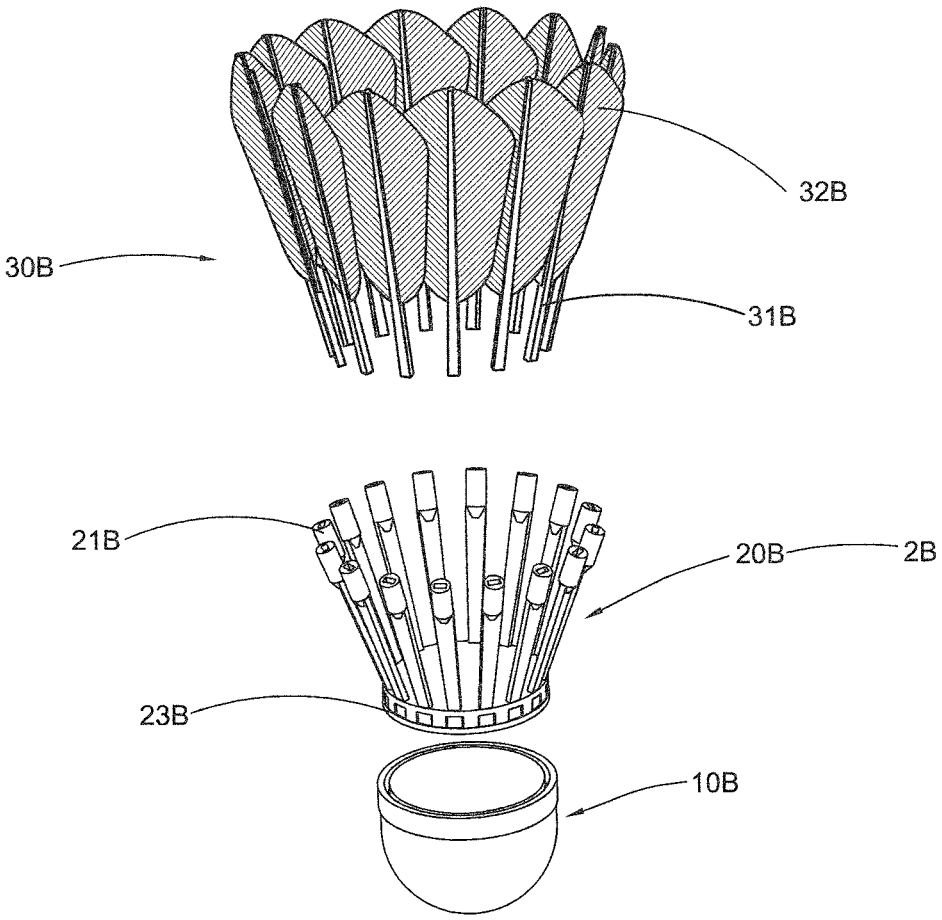


FIG. 6

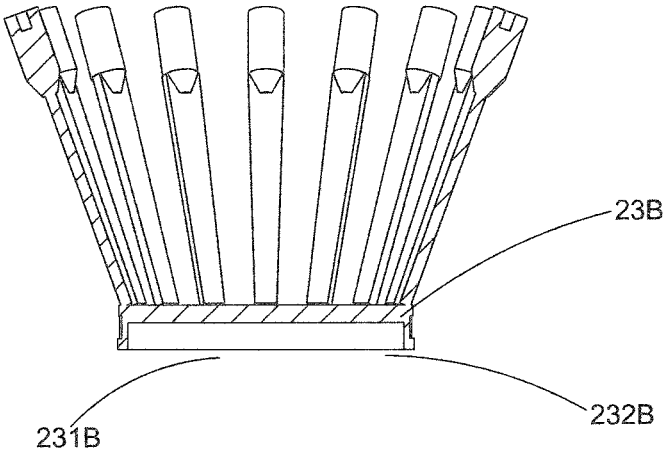


FIG. 7

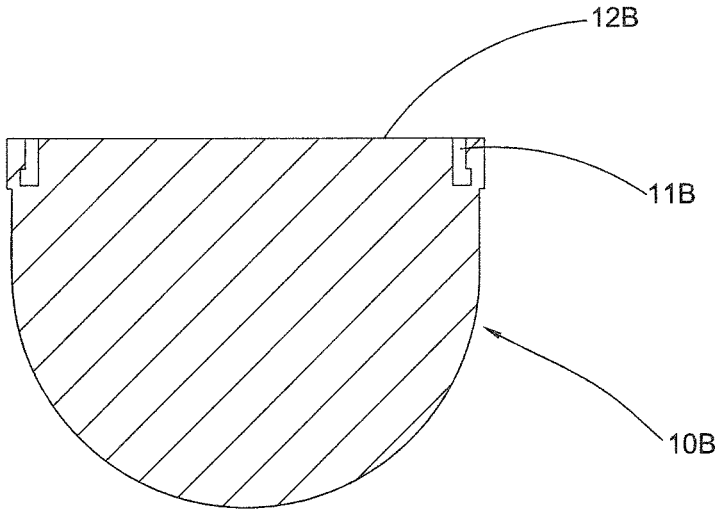


FIG. 8

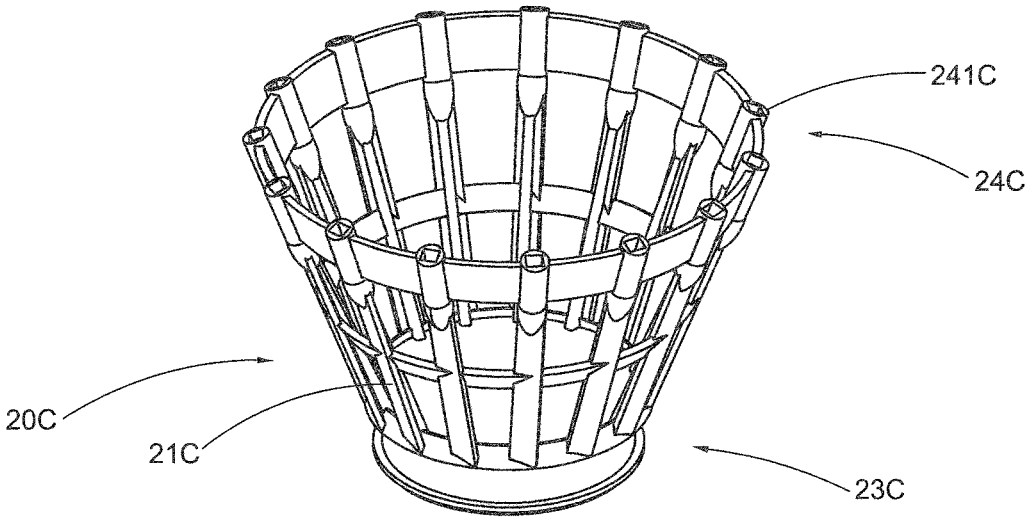


FIG. 9

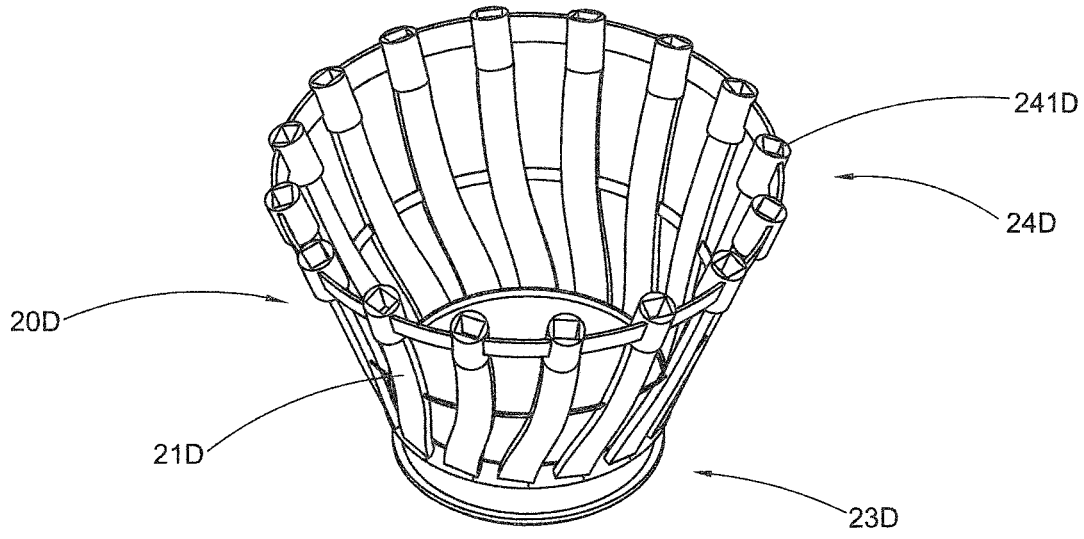


FIG. 10

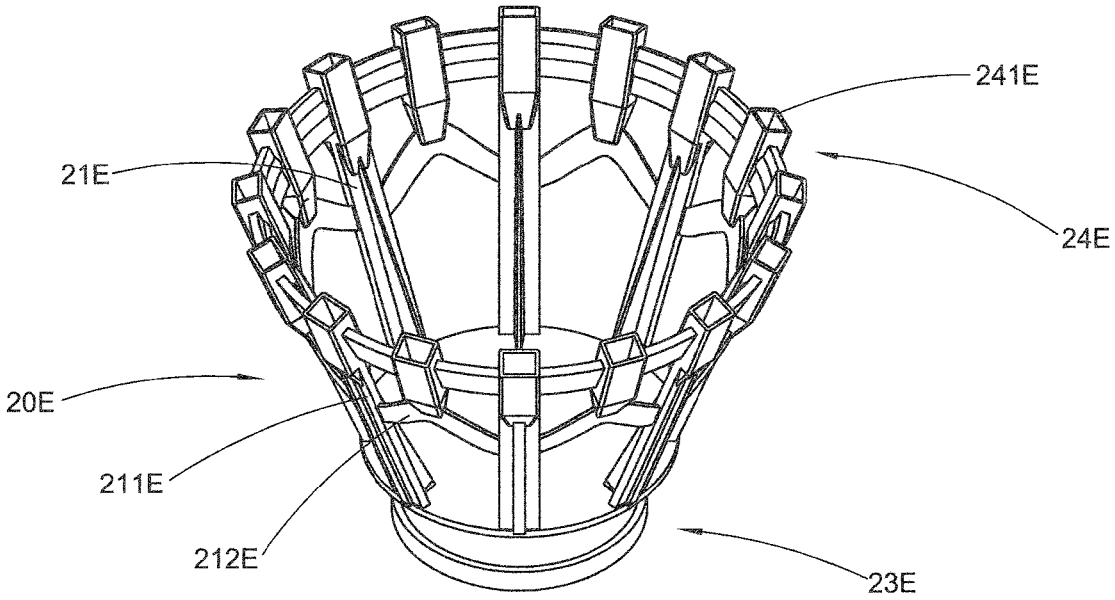


FIG. 11

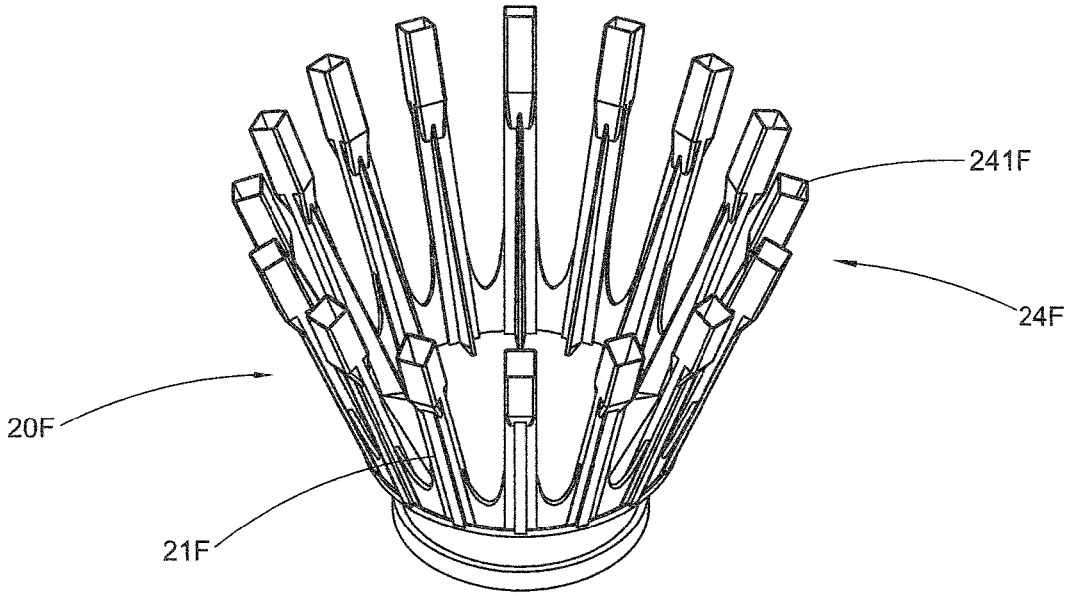


FIG. 12

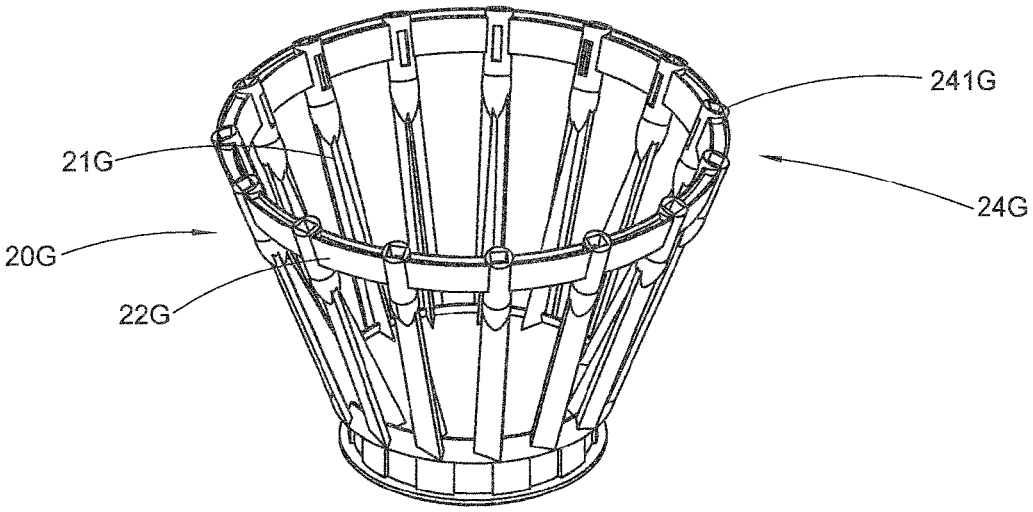


FIG. 13

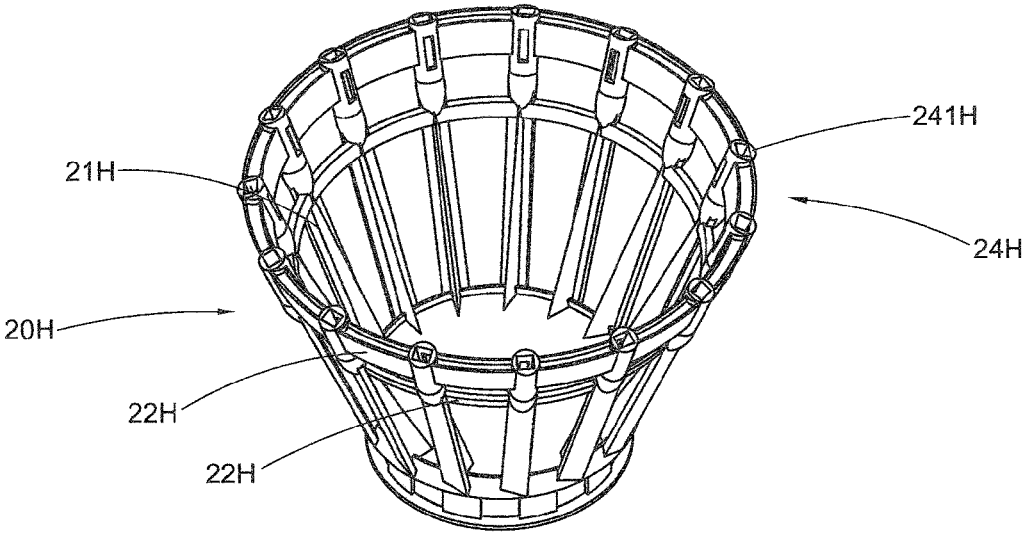


FIG. 14

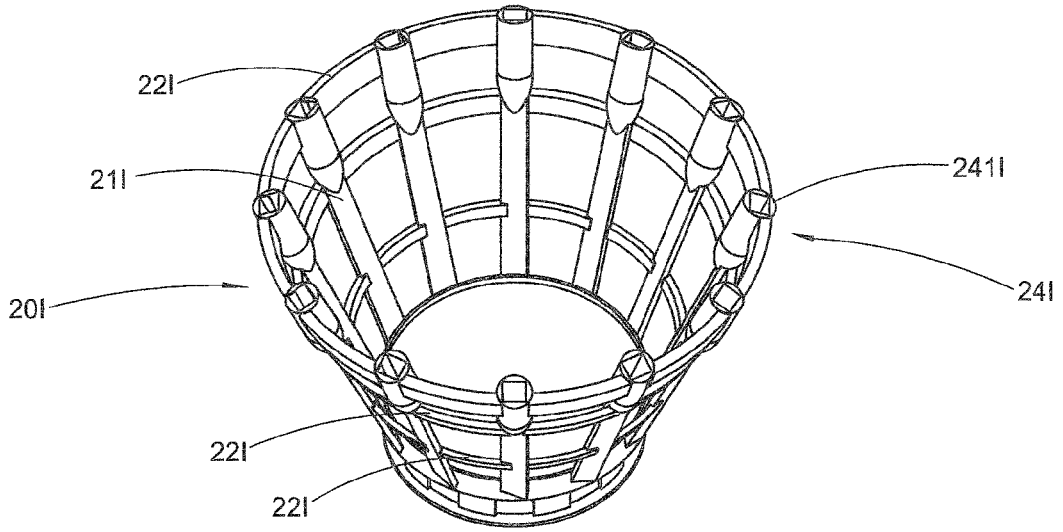


FIG. 15

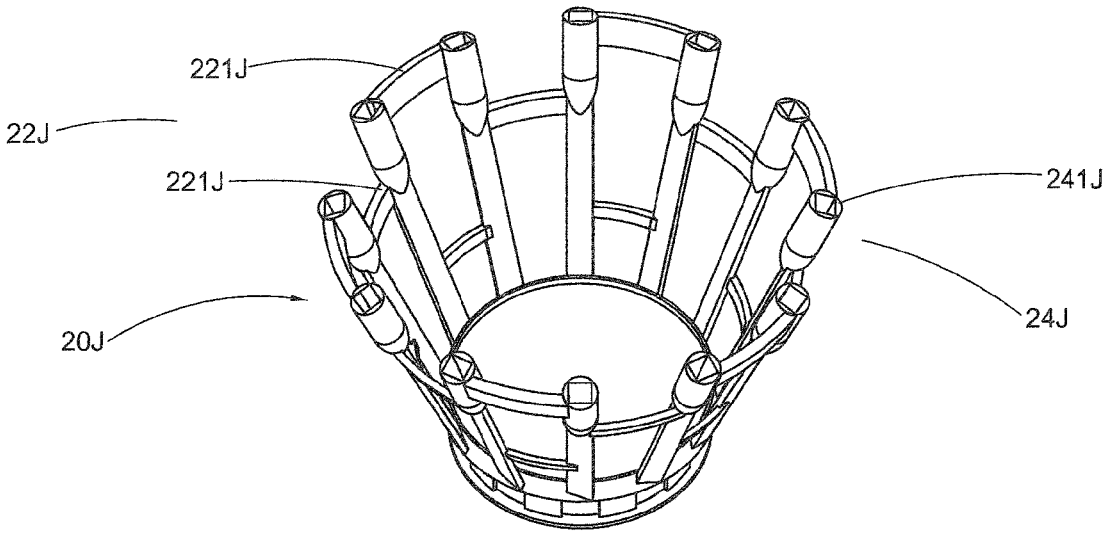


FIG. 16

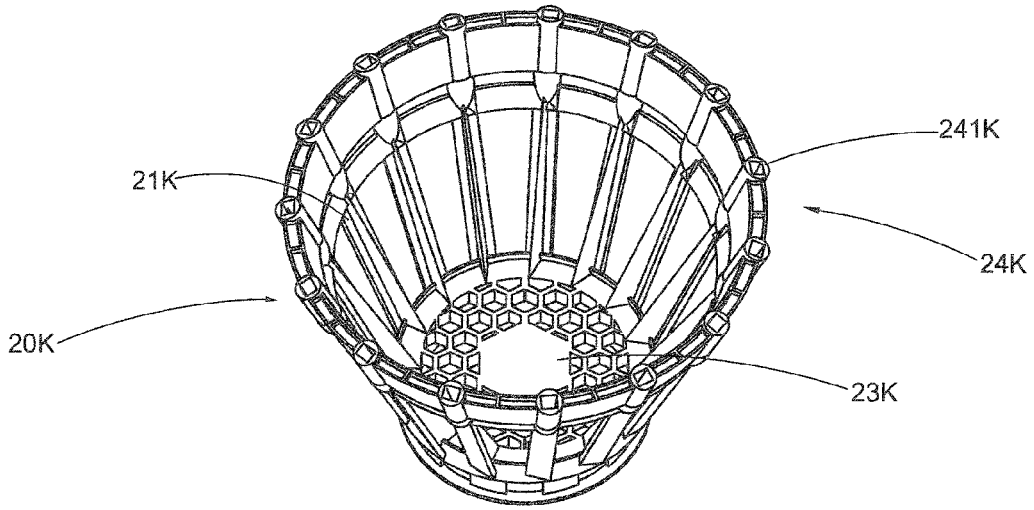


FIG. 17

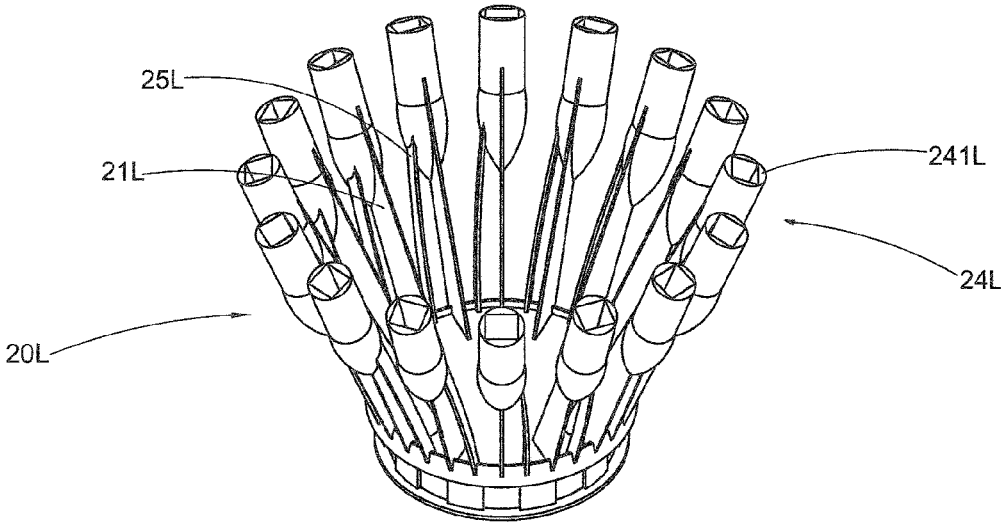


FIG. 18

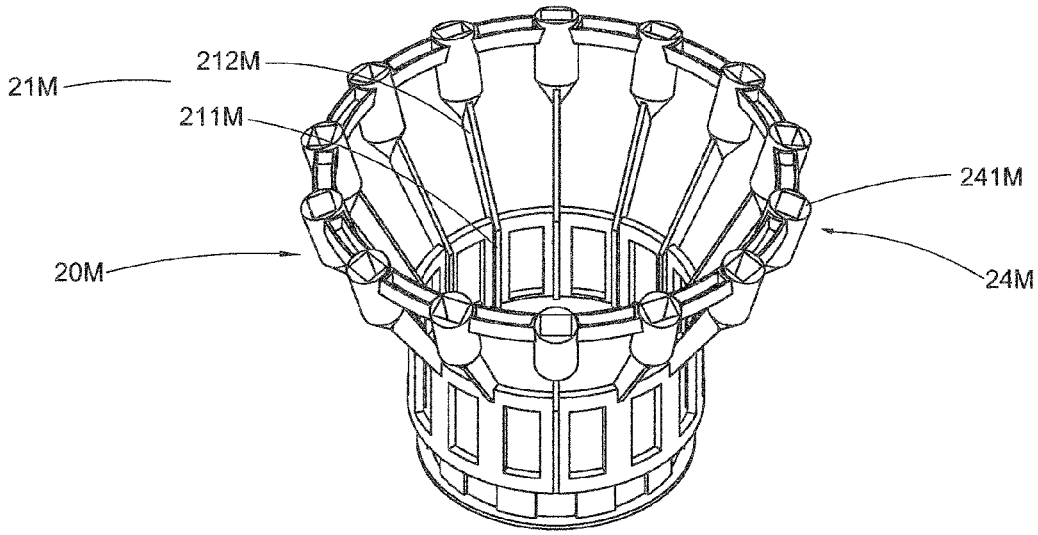


FIG. 19

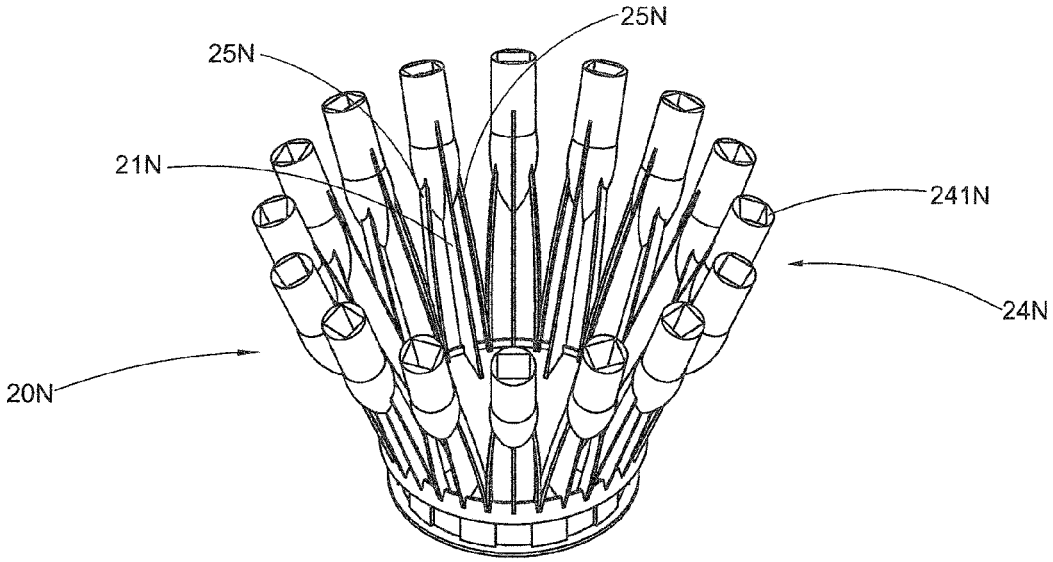


FIG. 20

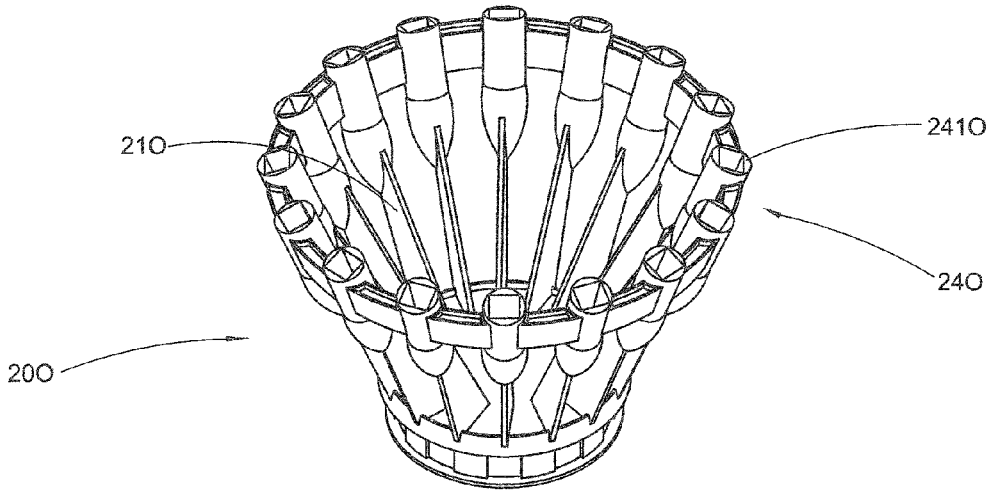


FIG. 21

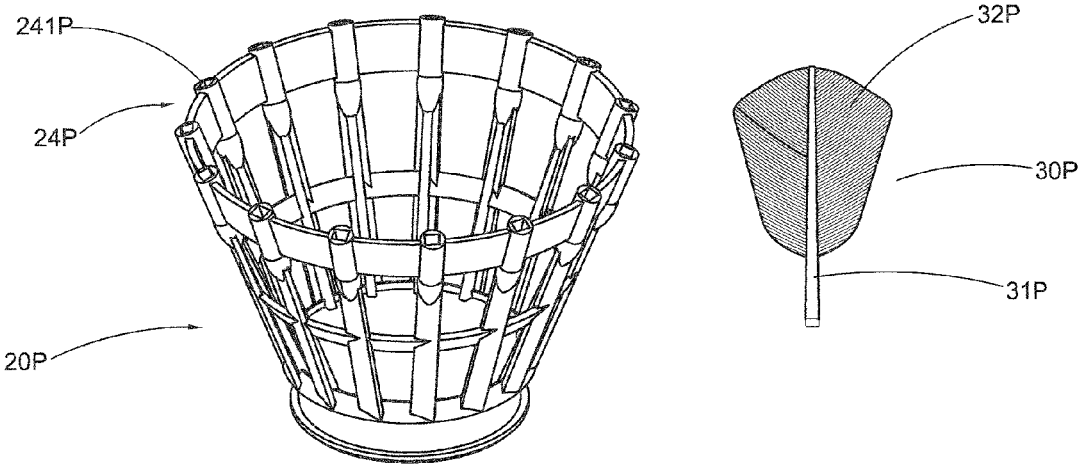


FIG. 22

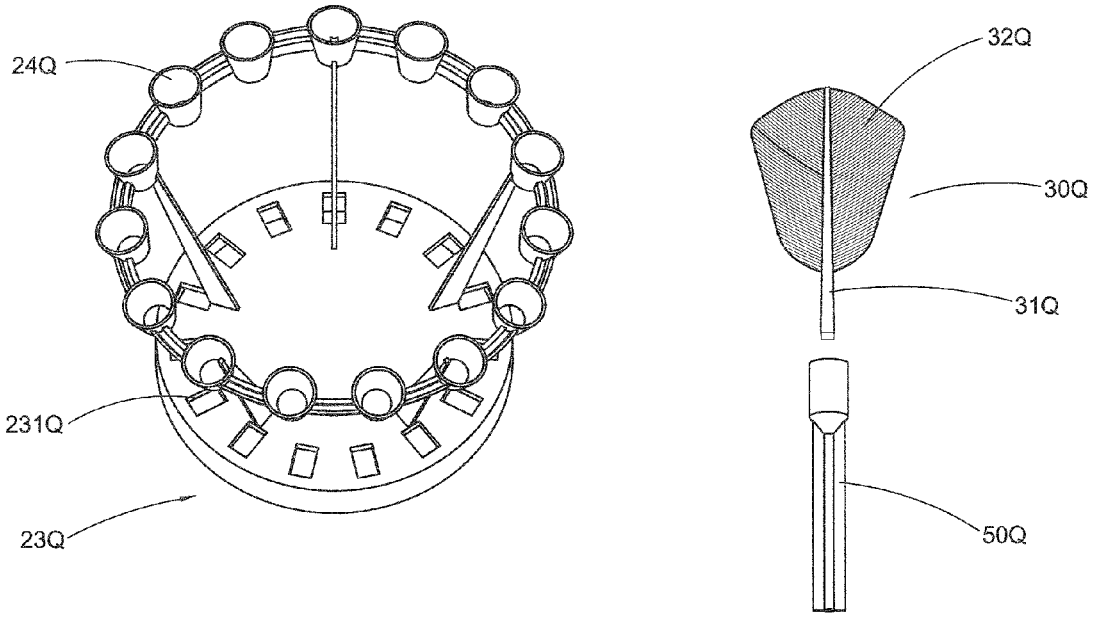


FIG. 23

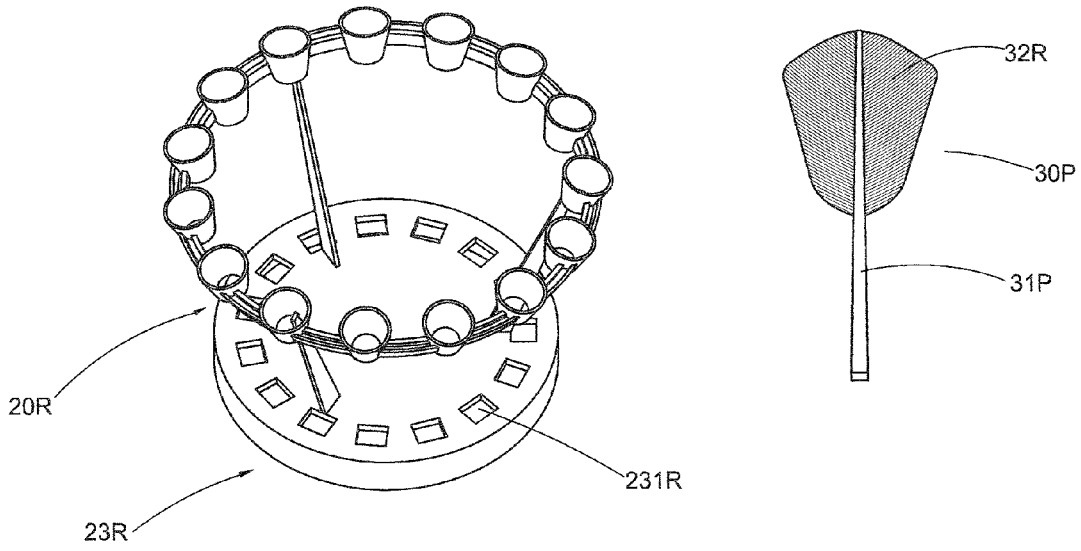


FIG. 24

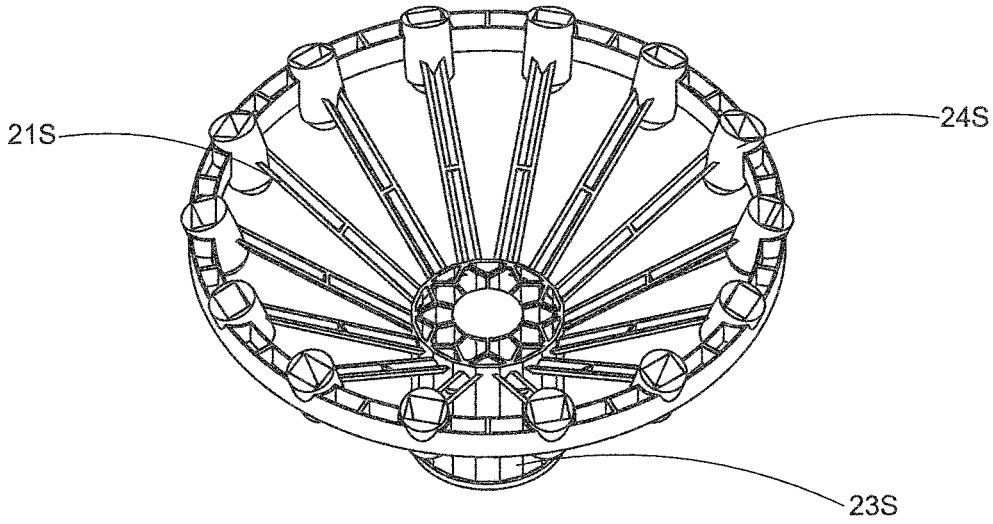


FIG. 25

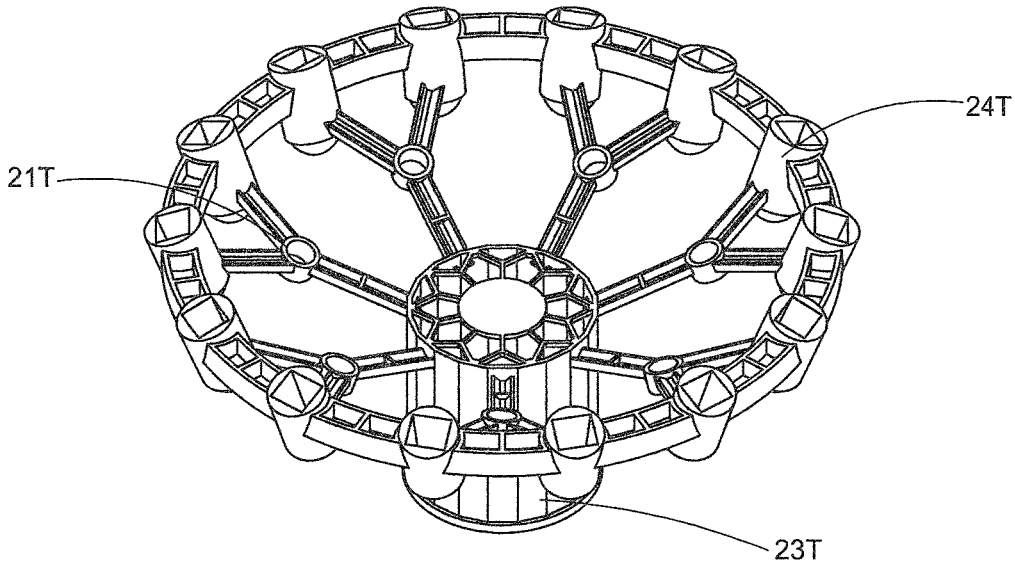


FIG. 26

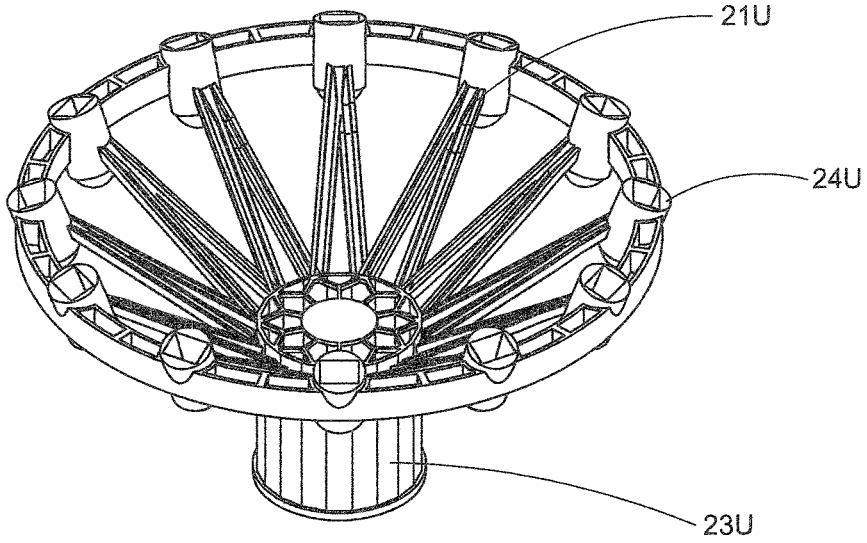


FIG. 27

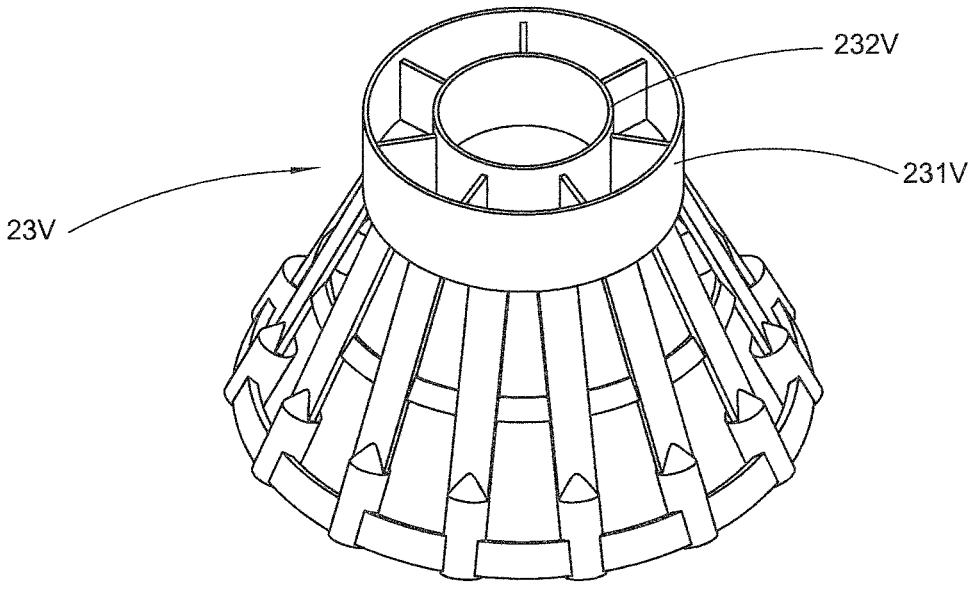


FIG. 28

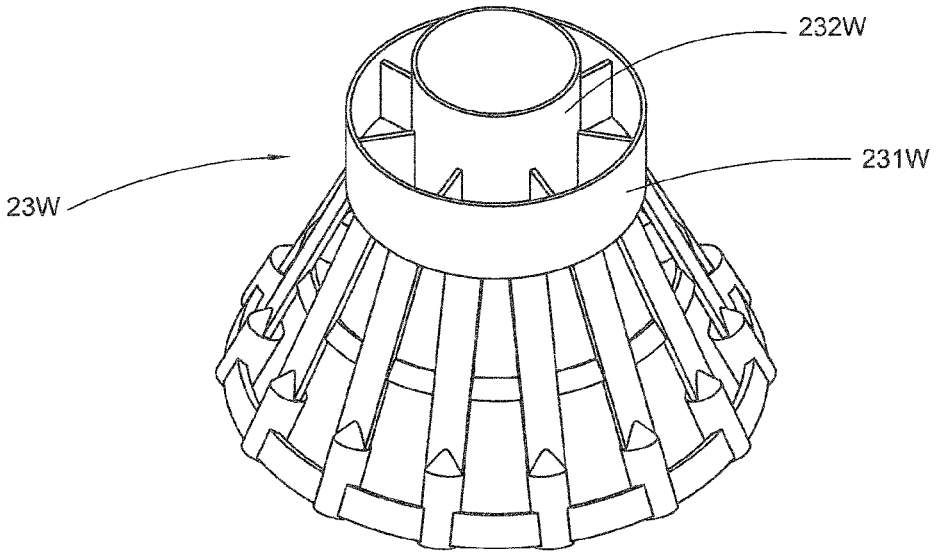


FIG. 29

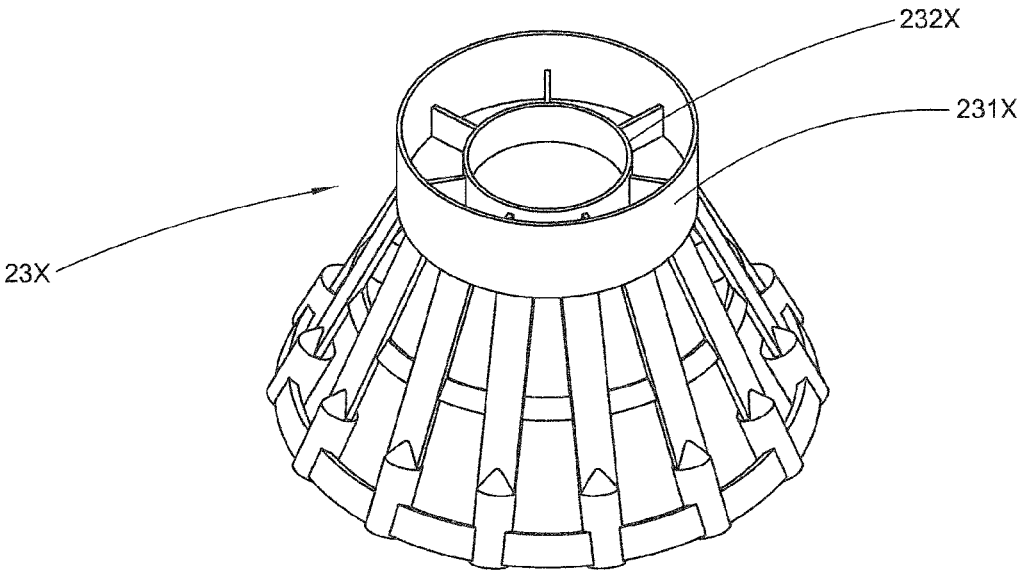


FIG. 30

SHUTTLECOCK AND MANUFACTURING METHOD THEREOF

NOTICE OF COPYRIGHT

BACKGROUND OF THE PRESENT INVENTION

1. Field of Invention

The present invention relates to a shuttlecock and a manufacturing method thereof, and more particularly to a shuttlecock comprising a connecting apparatus for coupling a shuttlecock head with a set of feather units, and its manufacturing method.

2. Description of Related Arts

Badminton is a beneficial racquet game for exercising, and since there is no intensive physical contact, it is suitable for people of all ages. However, the sports sites, the supporting facilities, and the manufacturing process of the shuttlecocks still restrict the development of the game, and thus result in a relatively low penetration rate of the game.

In addition, when manufacturing a shuttlecock in a conventional process, sixteen natural feathers are subject to a simple preparing process so that they substantially have a same length and a same shape, then these natural feathers are inserted into a shuttlecock head. In order to ensure the flying stability of the shuttlecock, all of the feathers of the shuttlecock are required to have a good consistence. As we all know, a feather comprises two parts which are the shaft portion and the feather portion. The so-called consistence of the feather requires the length, the degree of curvature, the degree of arch, the toughness, and the thickness of the shaft portions to be consistent, as well as requiring the shape, size, and color of the feather portions to be consistent. Through tailoring and selecting process, it is available to make the shape, size, and color of the feather portions be consistent. However, it is not likely to make the shaft portions of the feathers of the shuttlecock be consistent. That is because the feathers are natural feathers, so even the feathers are obtained from a same goose or duck, it is not likely to make the gradually decreasing rate of the length, the degree of curvature, the degree of arch, the toughness, and the thickness of all shaft portions be consistent, so that it is not possible to obtain consistent shaft portions of the feathers. Therefore, since the material for manufacturing a shuttlecock is not able to provide feathers with shaft portions of good consistence, there is an inevitable disadvantage for the conventional shuttlecock that that the flying stability is not good.

Because the quality of the goose feathers are better than the quality of the duck feathers, particularly, the shaft portions of goose feathers, which have relatively strong toughness, are not easy to fracture, while the shaft portions of duck feathers, which have relatively weak toughness, are easy to fracture, so that the durability of the shuttlecocks made of goose feathers is better than the durability of the shuttlecocks made of duck feathers. Furthermore, the period for raising ducks from eggs to be mature for harvesting feathers is about ninety days, but the period for a goose is about one hundred and twenty days, so that the costs for manufacturing shuttlecocks made of goose feathers and are of good quality are relatively high.

Additionally, in order to ensure that the shuttlecocks are able to fly in a spinning manner, all of the feathers are inserted into the shuttlecock head side by side in a staggered manner so that all of the feathers are constructed to be vortex-shaped. In other words, each of the feathers is arranged to have an eccentric angle, and each two adjacent feather portions of the feathers define a gap therebetween. In order to ensure that the shuttlecock is able to fly stably, all of the gaps are preferred to have a same size and distance. In a conventional shuttlecock, since the shaft portions of the natural feathers are directly inserted in the shuttle head, the insertion holes in the shuttlecock head are not easy to be constructed to have a shape matching the shape of the shaft portions of the feathers, the eccentric angles of the insertion holes are even harder to be arranged correctly, so that the eccentric angle of each of the feathers is hard to control, and thus the eccentric angles varied to a large extent, and result in a weak flying stability of the shuttlecocks.

Furthermore, as mentioned above, since it is impossible to keep the toughness, thickness, and curvature of the shaft portions of all feathers of a shuttlecock to be consistent, when the shuttlecock is applied with a strong impact force via a shuttlecock racket, the force is not distributed consistently along each shaft portion, so that not only the flying stability of the shuttlecock is influenced, but also the shaft portions are easy to fracture. Once the shaft portions are damaged, the whole shuttlecock cannot be used.

In addition, a quality test should be carried out when the shuttlecocks finish the manufacturing process. The test introduces a testing device to violently strike the shuttlecocks, and the impact force is larger than the force of a common user when striking the shuttlecocks, so that because the shaft portions are not able to be consistent, many shuttlecocks fracture after striking by the testing device, for the shaft portions of the feathers are not evenly applied with the impact force. Therefore, many shuttlecocks are abandoned before selling into the market for using. Thus, not only the production rate of the shuttlecocks is relatively low, but also it results in a large waste, and the manufacturing costs of the shuttlecocks are relatively high.

In a word, the output of the feathers is limited, and the natural feathers are not replaceable, so that the output of the conventional shuttlecocks is limited. And because the natural feathers have a bad consistence, especially it is hard to meet the requirement of the consistence of the thickness, curvature, and toughness of the shaft portions of the all feathers of the shuttlecock, the quality of the most conventional shuttlecocks is not good, and thus the price of the shuttlecocks of good quality is relatively high, so that the penetrate rate of badminton is influenced.

In order for better understanding the influence of the conventional shuttlecocks on badminton, the structure of the conventional shuttlecocks and manufacturing method thereof are illustrated in the following description. Referring to FIG. **1** of the drawings, a conventional shuttlecock is illustrated. The conventional shuttlecock comprises a shuttlecock head **10'**, a set of feather **30'** inserted into the shuttlecock head **10'**, and a connecting string **40'** for connecting and fixing the set of feather **30'**. The number of the feathers **30'** is sixteen, the length of the each feather **30'** is 62-77 mm. Each feather **30'** has a shaft portion **31'** and a feather portion **32'** which has a length about 35-40% of the total length of the entire feather. The lower portion of each feather **30'** is inserted into the outer circumference of the

shuttlecock head **10'**, and is further fixed and retained in position by glues, the upper portion of each feather **30'** is connected and fixed by the connecting string **40'**, so that all of the feathers **30'** are connected to form a one-piece structure, so as to ensure that the feathers **30'** can evenly withstand the impact force of the shuttlecock racket, so that the flying stability of the shuttlecock is improved. However, once one of the shaft portions **31'** fracture, since it is replaceable, the whole shuttlecock cannot be used.

Referring to FIG. **2** of the drawings, the connecting string **40'** connects the shaft portions **31'** of the sixteen feathers **30'** in series manually by human hands in a staggered and twisted manner, and then the binding positions between the connecting string **40'** and each shaft portion **31'** is provided with glues for enhancing the stability of the connection in series therebetween. As is well known in the art, there is a problem that it is difficult to ensure a same angle between each two adjacent shaft portions **31'** when connecting the shaft portions **31'** of the feathers **30'** in series manually by human hands in a staggered and twisted manner. Therefore, not only the flying stability of the shuttlecock is influenced, but also some of the shaft portions **31'** will fracture for the shaft portions **31'** are not able to evenly distribute impact force when the shuttlecock is under a strike.

The method for manufacturing the conventional shuttlecock comprises the following steps.

(1) Select and tailor sixteen feathers **30'** which fit predetermined requirements, each feather **30'** has a length of 62-77 mm and includes a shaft portion **31'** and a feather portion **32'**, wherein a length of the feather portion **32'** is 35-40% of the length of the entire feather, all of the feathers of the shuttlecock have a same length and each shaft portion **31'** has a same length. Most importantly, the shaft portions **31'** of the sixteen feathers of the shuttlecock should be consistent. Not only each shaft portion should have a same length, the toughness, curvature, and the thickness of each shaft portion should be substantially the same.

(2) Insert the shaft portions **31'** of the sixteen feathers **30'** into insertion grooves **11'** of the shuttlecock **10'** one by one.

(3) Connect the shaft portions **31'** of the sixteen feathers **30'** in series manually by human hands in a staggered and twisted manner by the connecting string **40'**. Generally, this step will be repeated twice. In other words, two connecting strings **40'** are required to connect the shaft portions **31'** on different sites.

(4) Apply glues to the binding positions between the shaft portions **31'** and the shuttlecock head **10'**, and the binding positions between the shaft portions **31'** and the connecting string **40'**, so that the shaft portions **31'** is engaged with the shuttlecock head **10'** and the connecting string **40'** more stably, so that the feathers **30'**, the shuttlecock head **10'**, and the connecting string **40'** form an integral structure.

The above mentioned manufacturing method of the conventional shuttlecocks is mainly carried out by manual operations, so that there are several disadvantages. First of all, in the above step (1) for selecting and tailoring sixteen feathers **30'** which fit predetermined requirements, the main object of this step is to ensure that the shaft portions of the sixteen feathers of the shuttlecock have a good consistence. In other words, the toughness, curvature, and thickness of the shaft portions of the sixteen feathers should be the same, but the whole selecting process is competed based on the experience and sensibility of the worker, so that it is difficult to ensure that the shaft portions of the sixteen feathers of the shuttlecock have a good consistence, and thus the quality of the shuttlecock cannot be guaranteed. Secondly, in the above step (3) for connecting the shaft portions **31'** in series via the connecting string **40'**, the angle between adjacent two shaft portions is hard to control, and the angle between each shaft portion **31'** and the shuttlecock head **10'** is also hard to control. In other words, the taper rate of the shuttlecock is hard to control. Thirdly, in the step (4), the amount of the glues cannot be controlled, usually resulting in an overweight of the shuttlecocks, so that the shuttlecocks cannot meet the standard requirements of the badminton matches. Fourthly, in the step (4), although the glues applied on the binding positions between the shaft portions **31'** and the shuttlecock **10'**, and the binding positions between the shaft portions **31'** and the connecting string **40'** is beneficial for enhancing the engagement therebetween. However, because of the introduction of the glues, the part of the shaft portion applied with glues have a stiffness larger than the rest part of the shaft portion without glues, particularly the binding positions between the shaft portion and the connecting string may result in a relatively large stiffness, so that when the shuttlecock is under a strike by a shuttlecock racket, the shaft portions may fracture from the binding positions at the connecting string **40'**. However, once one of the shaft portions fractures, the whole shuttlecock cannot be used. Fifthly, in order to keep the angle between two adjacent feathers to be the same, after using the connecting string **40'** to connect the shaft portions **31'** in series, not only the binding positions between the connecting string **40'** and each shaft portion **31'** are applied with glues, but also the whole connecting string **40'** is applied with glues, so that the connecting string **40'** is solidified to provide a support for the shaft portions **31'**, so as to prevent the angle between the two adjacent shaft portions **31'** to vary during the flying of the shuttlecock to influence the flying stability of the shuttlecock. However, the amount of the glues is hard to control, when excess amount of the glues is applied, the resulting shuttlecock may be overweight, when the amount of the glues is not enough, the solidifying performance of the connecting string **40'** is not good. In addition, evenly applying the glues is also a problem for the operations are carried out based on the experience of the workers, so that the quality of the shuttlecocks may vary depending on the experience of the workers.

In a word, the efficiency of conventional method for manufacturing a shuttlecock is relatively low, and the requirement for the experience of the workers is relatively high, so that the manufacturing process cannot be standardized, and thus the quality of the conventional shuttlecocks is far from satisfied. Once the shaft portions fracture, the whole shuttlecock cannot be repaired, so that it results in a large waste.

SUMMARY OF THE PRESENT INVENTION

A main object of the present invention is to provide a shuttlecock, wherein the shuttlecock is adapted for reducing the amount of natural feathers used for producing the shuttlecock, and increasing the utilization rate of the feathers.

Another object of the present invention is to provide a shuttlecock, wherein the flying stability of the shuttlecock is better than the flying stability of conventional shuttlecocks.

Another object of the present invention is to provide a shuttlecock, wherein the shuttlecock comprises a set of feather planting members for replacing the section of shaft portion at the lower side of the feather of the conventional shuttlecock. Since the roughness, curvature, and thickness of the feather planting members can be controlled via the manufacturing mold during the production process by the

manufacturers, the influence of the difference between the shaft members of the natural feathers on the flying stability of the shuttlecock can be reduced. In addition, the material of the feather planting members can be selected to be plastic material having a good roughness, so that the feather planting members can withstand a larger impact than the shaft portions of the natural feathers, so that the feather planting members are not easy to fracture when the shuttlecock is under a strike, and thus not only the quality of the shuttlecock is enhanced, the lifespan of the shuttlecock is prolonged.

Another object of the present invention is to provide a shuttlecock, wherein when the shaft members of the feathers fracture, it is convenient to replace with a new feather, so that the lifespan of the shuttlecock is prolonged, and the waste is prevented.

Another object of the present invention is to provide a shuttlecock, wherein the connecting members of the feather planting arrangement is inserted into the shuttlecock head, so as to prevent the feather being directly inserted into the shuttlecock similar to the prior art and result in a hollow core of the shuttlecock head, and thus the risk of the shuttlecock being smashed is reduced, and the lifespan of the shuttlecock is prolonged.

Another object of the present invention is to provide a shuttlecock, wherein when the length of the feather member of the feather is the same as the length of the feather portion of the feather of a natural shuttlecock, the length of the shaft member of the feather of the shuttlecock of the present invention is only 15-25% of the total length of the feather. In other words, the feather used for manufacturing the shuttlecock of the present invention is shorter than the feather used for manufacturing the conventional shuttlecock. More specifically, the shaft member of the feather of the present invention is shorten than the shaft portion of the feather of the conventional shuttlecock, so that the risk of the difference between shaft members of the natural feathers resulting in the low quality of the shuttlecock is reduced. In addition, the utilization rate of the feathers is significantly increased, and the manufacturing costs are reduced.

Another object of the present invention is to provide a method for manufacturing a shuttlecock, wherein the method for manufacturing the shuttlecock is greatly simplified in comparison with the conventional manufacturing methods, so that the manufacturing costs are reduced.

Another object of the present invention is to provide a method for manufacturing a shuttlecock, wherein the quality of the shuttlecock manufactured by the present invention is better than the conventional shuttlecock.

Another object of the present invention is to provide a method for manufacturing a shuttlecock, wherein the shuttlecock manufactured by the present invention has a lower reject rate than the conventional shuttlecock.

Another object of the present invention is to provide a method for manufacturing a shuttlecock, the requirement for experience and capability of the manufacturer of the present invention is lower than the requirement for the manufacturer of the conventional shuttlecock, while the quality of the shuttlecock is still guaranteed.

Additional advantages and features of the invention will become apparent from the description which follows, and may be realized by means of the instrumentalities and combinations particular pointed out in the appended claims.

According to the present invention, the foregoing and other objects and advantages are attained by a shuttlecock, comprising: a set of feather units each comprising a feather member and a shaft member extended from the feather member, a shuttlecock head having at least one insertion groove, and a connecting arrangement, wherein the shaft member of each feather unit is planted at the connecting arrangement, and the connecting arrangement is planted in the insertion groove of the shuttlecock head.

In addition, the present invention further provides a method for manufacturing a shuttlecock, wherein the method comprises the following steps.

(a) Provide a set of feather units.

(b) Plant the set of feather units at the connecting arrangement.

(c) Connect the connecting arrangement with a shuttlecock head.

In the above method, the order of the steps (b) and (c) can be reversed.

Still further objects and advantages will become apparent from a consideration of the ensuing description and drawings.

These and other objectives, features, and advantages of the present invention will become apparent from the following detailed description, the accompanying drawings, and the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of a conventional shuttlecock according to a prior art.

FIG. **2** is a schematic view illustrating the shaft portions of the feathers of a conventional shuttlecock being connected in series using connecting strings.

FIG. **3** is an exploded view of a shuttlecock according to a first preferred embodiment of the present invention.

FIG. **4**A is a partial enlarged view of FIG. **3** illustrating the partial structure of the feather planting member.

FIG. **4**B is a partial sectional view of line A-A of FIG. **4**A.

FIG. **5** is an exploded view of a shuttlecock according to a second preferred embodiment of the present invention.

FIG. **6** is an exploded view of a shuttlecock according to a third preferred embodiment of the present invention.

FIG. **7** is a longitudinal sectional view of the feather planting arrangement of FIG. **6**.

FIG. **8** is a longitudinal sectional view of the shuttlecock head of FIG. **6**.

FIGS. **9** to **17** are schematic views illustrating a shuttlecock according to a fourth preferred embodiment of the present invention.

FIGS. **18** to **21** are schematic views illustrating a shuttlecock according to a fifth preferred embodiment of the present invention.

FIGS. **22** to **24** are schematic views illustrating a shuttlecock according to a sixth preferred embodiment of the present invention.

FIGS. **25** to **30** are schematic views illustrating a shuttlecock according to a seventh preferred embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The following description is disclosed to enable any person skilled in the art to make and use the present invention. Preferred embodiments are provided in the following description only as examples and modifications will be apparent to those skilled in the art. The general principles defined in the following description would be applied to

other embodiments, alternatives, modifications, equivalents, and applications without departing from the spirit and scope of the present invention.

Embodiment 1

Referring to FIGS. **3** and **4** of the drawings, a shuttlecock according to a first preferred embodiment of the present invention is illustrated. As shown in FIG. **3** of the drawings, the shuttlecock comprises a shuttlecock head **10**, a set of feather units **30**, and a connecting arrangement **2** for connecting with the shuttlecock head **10** and the feather units **30** to form a one-piece structure.

Referring to FIG. **3** of the drawings, the connecting arrangement **2** further comprises a feather planting arrangement **20** for connecting with the shuttlecock head **10** and the feather units **30** to form an integral structure. The feather planting arrangement **20** further comprises a set of feather planting members **21** of the same number as the number of the feather units, each feather planting member **21** is coupled with a feather unit **30** and connect with the shuttlecock head **10**. For example, when the number of the feather units of a shuttlecock is generally sixteen, correspondingly, the number of the planting members **21** is also sixteen. Of course, the number of the planting members **21** can be increased or decreased in response to the increasing or decreasing of the number of the feather units in practical use. Each feather planting member **21** comprises a feather planting end portion **211** and an insertion end portion **212**. The feather planting end portion **211** is arranged for planting the feather unit **30** while the insertion end portion is arranged for inserting in the shuttlecock head **10**.

As shown in FIG. **3** of the drawings, the shuttlecock **10**, which is constructed to be crown-shaped and is made of wooden or plastic material, is provided with a set of insertion grooves **11** of the same number as the number of the feather planting members for the feather planting members **21** to be inserted therein.

Referring to FIG. **3** of the drawings, each feather unit **30** comprises a shaft member **31** and a feather member **32**. A length of the feather member **32** is the same length as the length of the feather portion of a conventional shuttlecock. A length of the shaft member **31** is 15-25% of a total length of the feather unit, so that the shaft member **32** is shorter than the shaft portion of the conventional shuttlecock. Therefore, the lower end of the shaft member **31** of the feather unit **30** is planted at the feather planting end portion **211** of the feather planting member **21** to form a semi-artificial feather similar of the feather of a conventional shuttlecock. In other words, the feather planting member **21** replaces the lower section of the shaft portion of the conventional shuttlecock, so that the feather used for manufacturing the shuttlecock of the present invention can be tailored to provide two or more feather units. In addition, some feathers cannot meet the requirement of the conventional shuttlecocks, for example, the shaft portion having a relatively small length, a large curvature, or a small thickness, also can be used in the present invention for planting at the feather planting member **21** to provide a semi-artificial feather, so that the utilization rate of the natural feathers can be increased. Manufacturing a conventional shuttlecock may require using feathers of two gooses or a duck, but manufacturing the shuttlecock of the present invention only need to use feathers of one goose or half duck. It is worth mentioning that the feather units **30** also can be artificial feathers.

Since the feather planting members **21** can be manufactured though a molding and pressing process, good consistence of the feather planting members **21** is ensured. In other words, all of the feather planting members **21** of a shuttlecock can be provided with same thickness, curvature, and roughness, so as to overcome the disadvantage of low consistence of the shaft portions of the feathers of the conventional shuttlecocks. The introduction of the feather planting members **21** reduces the requirement for the natural feathers, particularly reduces the requirement for the shaft members of the feathers, so that the length of the feather used in the present invention does not have to be as long as the length of the feather of the conventional shuttlecock. Therefore, more goose feathers or duck feathers can be used for manufacturing shuttlecocks, and one piece of feather may be tailored to provide two or more feather units **30**, so that the utilization rate of the feather material is significantly increased.

FIG. **4** is a partial enlarged view of the feather planting member **21** of the present invention. As shown in FIG. **4** of the drawings, each feather planting end portion **211** further has a feather planting groove **2111** for insertion of the shaft member **31**. Preferably, the feather planting groove **2111** is constructed to be rectangular-shaped, a width of the feather planting groove **2111** is slightly smaller than a diameter of the shaft member **31**. Therefore, when each shaft member **31** of the feather is inserted in the corresponding feather planting groove **2111**, the inner surface around the feather planting groove **2111** applies pressure to the shaft member **31**, so that the shaft member **31** of the feather unit can be firmly secured in the feather planting groove **2111**. It is worth mentioning that the feather planting groove **2111** can be shaped to match with the shape of the shaft member **31** of the feather unit. It is also worth mentioning that in order to firmly plant the shaft member **31** in the feather planting groove **2111**, glues are introduced to bond the binding position between the shaft member **31** and the feather planting groove **2111**.

Referring to FIGS. **4**A and **4**B of the drawings, the feather planting end portion **211** further comprises an insertion core **2112** which is extended in the feather planting groove **2111**. When the shaft member **31** of the feather unit **30** is inserted into the feather planting groove **2111**, the insertion core **2112** is simultaneously inserted into the center of the shaft member **31**, so that the insertion core **2112** not only enables the firm engagement between the shaft member **31** and the feather planting end portion **211** of the feather planting member **21**, but also enhances the roughness of the shaft member **31**, so as to prevent the shaft member **31** from fracturing.

It is worth mentioning that the connecting arrangement **2** further comprises a connecting string **40** for connecting the feather planting members **21** in series to for a hollow taper body. As shown in FIG. **6** of the drawings, each feather planting member **21** comprises a series connecting portion **213** for connecting all of the feather planting members **21** of the shuttlecock with the connecting string **40**, so that when the shuttlecock head of the shuttlecock is under a strike, all of the feather planting members **21** of the shuttlecock can integrally and evenly distribute the impact force, so that the whole shuttlecock flies stably.

It is worth mentioning that each series connection portion **213** can be embodied as a groove in the feather planting member **21**, or a penetrating hole in the feather planting member **21**. The positions of the series connecting portion **213** can be provided at a same level of the feather planting members **21**, so as to not only ensure that the connecting

string **40** can be provided at a same position at the feather planting members **21**, but also firmly connect the feather planting members **21** with the connecting string **40** without use of glues, so that the shuttlecock will not be overweight, and when one of the feather units is broken, it is easy to replace with a new feather unit for repairing.

It is worth mentioning that a same angle, such as 10-15°, is defined between center lines of two adjacent feather planting members **21**. Each feather planting member **21** define a same tapering angle, such as 16-20°, with respect to the bottom plane of the feather plating arrangement.

The manufacturing method of the shuttlecock of the present invention comprises the following steps.

(a) Provide a set of feather units **30**, the number of the feather units **30** is sixteen.

(b) Plant the set of feather units **30** at the connecting arrangement **2**. The connecting arrangement **2** comprises a feather planting arrangement **20** comprising sixteen feather planting members **21**, each shaft member **31** of the feather unit **30** is planted at the corresponding feather planting member **21**, so as to form a semi-artificial feather unit which has a same length as the length of the natural feather of the conventional shuttlecock, and comprises a feather member of the same shape and size as the shape and sized of the feather portion of the conventional shuttlecock.

(c) Connect the connecting arrangement with a shuttlecock head. The shuttlecock head **10** is provided with a set of insertion grooves **11** of the same number as the number of the feather planting members **21**, and the opening of each insertion groove **11** is shaped and sized to couple with the shape and size of the corresponding feather planting member **21**.

In the above method, the order of the steps (b) and (c) can be reversed. In other words, we can plant the feather units **30** at the connecting arrangement **21** first, and then couple the connecting arrangement **2** with the shuttlecock head **10**. Alternatively, we can couple the connecting arrangement **2** with the shuttlecock head **10** first, and then plant the feather units **30** at the connecting arrangement **21**.

It is worth mentioning that the method for manufacturing the shuttlecock of the present invention further comprises a step (d): connecting the feather planting members **21** in series via a connecting string **40** so as to form a hollow taper body, so that the good flying stability of the shuttlecock is ensured.

It is worth mentioning that in order to firmly couple the connecting arrangement **2** with the shuttlecock head **10**, the method for manufacturing the shuttlecock of the present invention further comprises a step (e): applying glues at the binding positions between the feather planting members **21** and the insertion grooves **11**.

Embodiment 2

FIG. **5** is a perspective view of a shuttlecock according to a second preferred embodiment of the present invention, wherein the shuttlecock comprises a shuttlecock head **10**A, a set of feather units **30**A, and a connecting arrangement **2**A for connecting with the shuttlecock head **10**A and the feather units **30**A to form an integral shuttlecock. The feather units of the shuttlecock of this preferred embodiment is the same as the feather units of the above first preferred embodiment. The connecting arrangement **2**A is provided with some modifications.

Referring to FIG. **5** of the drawings, the connecting arrangement **2**A comprises a feather planting arrangement **20**A for connecting with the shuttlecock head **10**A and the feather units **30**A to form an integral structure. The feather planting arrangement **20**A comprises a set of feather planting members **21**A of the same number as the number of the feather units **30**A, and a connecting rib **22**A for connecting the feather planting members **21**A in series. It is worth mentioning that the number of the connecting rib **22**A can be increased or decreased depending on the practical use, the shape of the connecting rib **22**A also can be changed. In other words, the connecting rib **22**A is introduced to replace the connecting string **40** of the above first preferred embodiment. The feather planting members **21**A and the connecting rib **22**A can be previously prepared in a manufacturing mold, and then undergo a mold injection process to form a one-piece structure. Thus, the distance between the two adjacent feather planting members **21**A can be the same, the insertion grooves **11** provided in the shuttlecock head **10** enable the angle between the two adjacent feather planting members **21**A to be the same, so that the taper angle of the shuttlecock is under control, and thus good flying stability of the shuttlecock is ensured.

It is worth mentioning that the feather planting members **21**A and the connecting rib **22**A are molded to form an integral structure. In other words, the connecting rib **22**A is introduced to replace the connecting string **40** of the above first preferred embodiment, so that the manufacturing method omits a step which is to wind and connect the feather planting members **21**A via the connecting string **40**.

It is still worth mentioning that since the feather planting members **21**A and the connecting rib **22**A are molded to form an integral structure, the manufacturing mold can be configured to ensure a same angle between the two adjacent feather planting members **21**A, so that the connecting rib **22**A can be connected at any position at each feather planting member **21**A, the length of the connecting rib **22**A between two adjacent feather planting members **21**A can be varied, so as to enhance the aesthetic appearance of the shuttlecock without influencing the flying stability of the shuttlecock.

It is worth mentioning that since the feather planting members **21**A and the connecting rib **22**A are molded to form an integral structure, all feather planting members **21**A define a same angle with respect to the center axial line of the shuttlecock, so that a good taper angle of the shuttlecock is ensured, and thus the shuttlecock can fly stably.

It is worth mentioning that the shape of the feather planting groove **2111**A of each feather planting member **21**A can be varied depending on the shape of the shaft member **31**A of the corresponding feather unit **30**A. Although the shapes of the shaft members **31**A of the natural feathers vary largely, the shape of the shaft member **31**A of each natural feather is generally rectangular-shaped. Therefore, each feather planting groove **2111**A is configurated to have a substantially rectangular shape via the manufacturing mold, and the diameter of the opening there of is slightly smaller than the diameter of the shaft member of the feather unit. When each shaft member **31**A is inserted into the corresponding feather planting groove **2111**A, the inner surface around the feather planting groove **2111**A and the shaft member **31**A contact and press with each other, so that the shaft member **31**A is secured at the feather planting end portion **211**A of the feather planting member **3**A, thus the shaft member **31**A is not easy to slip off.

It is worth mentioning that each feather planting groove **2111**A of the feather planting member **21**A defines an eccentric angle with respect to the center of the feather planting arrangement **20**A, and the values of any two eccentric angles of all the eccentric angles are the same, so

that when each feather unit **30**A is planted in corresponding feather planting groove **2111**A, an eccentric angle is formed, and the values of the any two eccentric angles are the same, while the distance of the gap between feather members **32**A of two adjacent feather units **30**A is the same, so that the shuttlecock can spin during flying, so as to enhance the flying stability.

It is worth mentioning that since the connecting rib **22**A is introduced to replace the connecting string of conventional shuttlecock, there is no need for applying glues to the binding positions between the connecting string and the shaft members of the feather units. In addition, since the feather planting members **21**A and the connecting rib **22**A are molded to form an integral structure, the weight of the whole feather planting arrangement is under control, and thus use of the feather planting arrangement of the present invention to produce the shuttlecock can effectively avoid the excess use of glues which results in an overweight of the shuttlecock.

The method for manufacturing the shuttlecock of the present invention comprises the following steps.

(a) Provide a set of feather units **30**A, the number of the feather units **30**A is sixteen.

(b) Plant the set of feather units **30**A at the connecting arrangement **2**A. The connecting arrangement **2**A comprises a feather planting arrangement **20**A comprising sixteen feather planting members **21**A and a connecting rib **22**A for connecting the feather planting members **21**A in series, each shaft member **31**A of the feather unit **30**A is planted at the corresponding feather planting member **21**A, so as to form a semi-artificial feather unit which has a same length as the length of the natural feather of the conventional shuttlecock, and comprises a feather member of the same shape and size as the shape and sized of the feather portion of the conventional shuttlecock.

(c) Connect the connecting arrangement with a shuttlecock head. The shuttlecock head **10**A is provided with a set of insertion grooves **11**A of the same number as the number of the feather planting members **21**A, and the opening of each insertion groove **11**A is shaped and sized to couple with the shape and size of the corresponding feather planing member **21**A.

In the above method, the order of the steps (b) and (c) can be reversed. In other words, we can plant the feather units **30**A at the connecting arrangement **21**A first, and then couple the connecting arrangement **2**A with the shuttlecock head **10**A. Alternatively, we can couple the connecting arrangement **2**A with the shuttlecock head **10**A first, and then plant the feather units **30**A at the connecting arrangement **21**A.

Embodiment 3

Referring to FIGS. **6** to **8** of the drawings, a shuttlecock according to a third preferred embodiment of the present invention is illustrated, wherein the shuttlecock comprises a shuttlecock head **10**B, a set of feather units **30**B, and a connecting arrangement **2**B for connecting with the shuttlecock head **10**B and the feather units **30**B to form an integral shuttlecock. The shuttlecock of this preferred embodiment is similar to the shuttlecock of the above first and second preferred embodiment, except that the connecting arrangement **2**B and the shuttlecock head **10**B are provided with some modifications.

Referring to FIG. **6** of the drawings, the connecting arrangement **2**B comprises a feather planting arrangement **20**B for connecting with the shuttlecock head **10**B and the feather units **30**B to form an integral structure. The feather planting arrangement **20**B comprises a connecting element **23**B, and a set of feather planting members **21**B of the same number as the number of the feather units **30**B. The set of feather planting members **21**B is radially extended from the connecting element **23**B to form a taper body, and the connecting element **23**B is integrally formed with the feather planting members **31**B to form a one-piece structure.

FIG. **7** is a longitudinal sectional view of the feather planting arrangement **20**B, as shown in FIG. **7** of the drawings, the connecting element **23**B of the feather planting arrangement **20**B comprises an insertion wall **231**B and an insertion cavity **232**B defined by the insertion wall **231**B, the insertion wall **231**B of the connecting element **23**B is inserted into the shuttlecock head **10**B so as to connect the connecting element **23**B with shuttlecock head **10**B.

FIG. **8** is a longitudinal sectional view of the shuttlecock head **10**B, as shown in FIG. **8** of the drawings, the shuttlecock head has an insertion groove **11**B and an insertion pin **12**B provided at a center of the insertion groove **11**B. When the feather planting arrangement **20**B is connected with the shuttlecock head **10**B, the insertion wall **231**B of the connecting element **23**B is inserted into the shuttlecock head **10**B, the insertion groove **11**B is shaped and sized to couple with the shape and size of the insertion wall **231**B, the insertion cavity **232**B is positioned around the insertion pin **12**B at the center of the insertion groove **11**B. In other words, the shuttlecock head **10**B is coupled with the connecting element **23**B in an insertion and retention coupling manner, the insertion pin **12**B of the shuttlecock head **10**B is inserted in the insertion cavity **232**B, simultaneously, the insertion wall **231**B of the connecting element **23**B is inserted into the insertion groove **11**B, so that the issue of the hollow core of the shuttlecock head **10**B is solved, and when the shuttlecock is under a strike by the shuttlecock racket, the shuttlecock head **10**B will not easy to fracture.

It is worth mentioning that the insertion wall **231**B of the connecting element **23**B may have a regular shape such as a cylinder shape and a triangular prism shape. Preferably, the outer appearance of the insertion wall **231**B is embodied as cylinder-shaped. Correspondingly, the insertion pin **12**B of the shuttlecock head **10**B is also constructed to be cylinder-shaped. The insertion groove **11**B is ring-shaped. The diameter of the insertion cavity **232**B is slightly larger than the diameter of the insertion pin **12**B, while the thickness of the insertion wall **231**B is equal or slightly smaller than the width of the insertion groove **12**B. When the insertion wall **231**B is inserted into the insertion groove **11**B, the connecting element **23**B is capable of firmly coupling with the shuttlecock head **10**B, so that the feather planting arrangement is able to firmly secured with the shuttlecock head.

The method for manufacturing the shuttlecock of the present invention comprises the following steps.

(a) Provide a set of feather units **30**B, the number of the feather units **30**B is sixteen.

(b) Plant the set of feather units **30**B at a connecting arrangement **2**B. The connecting arrangement **2**B comprises a feather planting arrangement **20**B comprising a connecting element **23**B and a set of feather planting members **21**B of a same number as the number of feather units **30**B, wherein the feather planting members **21**B are radially extended from the connecting element to form a taper body, and the connection element **23**B and the feather planting members **21**B are manufactured in a mold injection process to form a one-piece structure, each shaft member **31**B of the feather unit **30**B is planted at the corresponding feather planting member **21**B, so as to form a semi-artificial feather unit

which has a same length as the length of the natural feather of the conventional shuttlecock, and comprises a feather member of the same shape and size as the shape and sized of the feather portion of the conventional shuttlecock.

(c) Connect the connecting arrangement **2**B with a shuttlecock head **10**B. The shuttlecock head **10**B is provided with an insertion groove **11**B and an insertion pin **12**B at the center of insertion groove **11**B, and the opening of each insertion groove **11**B is shaped and sized to couple with the shape and size of the corresponding feather planing member **21**B. The connecting element **23**B is inserted in the insertion groove **11**B of the shuttlecock head **10**B and is simultaneously housing around the insertion pin **12**B.

In the above method, the order of the steps (b) and (c) can be reversed. In other words, we can plant the feather units **30**B at the connecting arrangement **21**B first, and then couple the connecting arrangement **2**B with the shuttlecock head **10**B. Alternatively, we can couple the connecting arrangement **2**B with the shuttlecock head **10**B first, and then plant the feather units **30**B at the connecting arrangement **21**B.

It is worth mentioning that in order for firmly coupling the connecting arrangement **2**B and the shuttlecock head **10**B, the method for manufacturing the shuttlecock further comprises a step (f): applying glues to the binding positions between the connecting arrangement **2**B and the shuttlecock head. Preferably, glues are applied on the connecting element **23**B and the insertion pin **12**B.

Embodiment 4

Referring to FIGS. **9** to **17** of the drawings, a shuttlecock according to a fourth preferred embodiment of the present invention is illustrated, wherein several alternative modes of the connecting arrangement of the shuttlecock are illustrated. The connecting arrangement comprises a feather planting arrangement which comprises a set of feather planting members and a set of feather planting tubes. In other words, a portion of each feather planing member of the first preferred embodiment is embodied as a feather planting tube of this preferred embodiment. The feather planting groove **2111** is formed in the feather planting tube of this preferred embodiment. In other words, each feather planting tube of this preferred embodiment is used for the insertion of the shaft member of the feather unit. It is worth mentioning that the center line of the feather planting tube is the same center line of the feather planting member. In other words, each feather planting tube is coaxial with the corresponding feather planting member.

Referring to FIG. **9** of the drawings, the feather planting arrangement **20**C comprises a set of feather planting members **21**C and a set of feather planting tubes **24**C which are respectively provided at end portions of the corresponding feather planting members **21**C. According to this preferred embodiment, the number of the feather planting members **21**C is the same as the number of the feather planting tubes **24**C and each feather planting member **21**C is linearly arranged with the corresponding feather planting tube **24**C.

Referring to FIG. **10** of the drawings, the feather planting arrangement **20**D comprises a set of feather planting members **21**D and a set of feather planting tubes **24**D which are respectively provided at end portions of the corresponding feather planting members **21**D. Each feather planting tube **24**D is provided with a feather planting groove **241**D for the insertion of the shaft member of the feather unit. According to this preferred embodiment, the number of the feather planting members **21**C is the same as the number of the feather planting tubes **24**C, and each feather planting member **21**C is arranged with the corresponding feather planting tube **24**C in a spirally extending manner.

Referring to FIG. **11** of the drawings, the feather planting arrangement **20**E comprises a set of feather planting members **21**E and a set of feather planting tubes **24**E which are respectively provided at end portions of the corresponding feather planting members **21**E. Each feather planting tube **24**E is provided with a feather planting groove **241**E for the insertion of the shaft member of the feather unit. According to this preferred embodiment, each feather planting member **21**E is constructed to be Y-shaped, so that each feather planting member **21**E is provided with a number of the feather planting tubes **24**E. More specifically, each feather planting member **21**E comprises a main portion **211**E and two branch portions **212**E extended from the main portions **211**E respectively, the branch portions **211**E at the adjacent feather planting members are connected to each other. Each feather planting tube **24**E is provided at an end portion of the main portion **211**E or provided at an end portion of one of the two branch portions **212**E.

Referring to FIG. **12** of the drawings, the feather planting arrangement **20**F comprises a set of feather planting members **21**F and a set of feather planting tubes **24**F which are respectively provided at end portions of the corresponding feather planting members **21**F. Each feather planting tube **24**F is provided with a feather planting groove **241**F for the insertion of the shaft member of the feather unit. According to this preferred embodiment, the number of the feather planting members **21**F is the same as the number of the feather planting tubes **24**F and each feather planting member **21**F is linearly arranged with the corresponding feather planting tube **24**F. It is worth mentioning that the connecting arrangement **2**F is not provided with connecting string **40** of the first preferred embodiment, nor the connecting rib **22**A of the second preferred embodiment.

Referring to FIG. **13** of the drawings, the structure of the feather planting arrangement **20**G is similar to the structure of the feather planting arrangement **20**F shown in FIG. **12** of the drawings. The difference is that the feather planting arrangement **20**G is further provided with a connecting rib **22**G for connecting the set of feather planting members **21**G or connecting the set of feather planting tubes **24**G. According to this preferred embodiment, the connecting rib **22**G connects the set of feather planting tubes **24**G.

Referring to FIG. **14** of the drawings, the structure of the feather planting arrangement **20**H is similar to the structure of the feather planting arrangement **20**F shown in FIG. **12** of the drawings. The difference is that the feather planting arrangement **20**H is further provided with two connecting ribs **22**H for connecting the set of feather planting members **21**H and connecting the set of feather planting tubes **24**H respectively.

Referring to FIG. **15** of the drawings, the structure of the feather planting arrangement **20**I is similar to the structure of the feather planting arrangement **20**F shown in FIG. **12** of the drawings. The difference is that the feather planting arrangement **20**I is further provided with three connecting ribs **22**I, and two connecting ribs **22**I are arranged for connecting the set of feather planting members **21**I and the rest one connecting rib **22**I connecting the set of feather planting tubes **24**H respectively.

Referring to FIG. **16** of the drawings, the structure of the feather planting arrangement **20**J is similar to the structure of the feather planting arrangement **20**G shown in FIG. **13** of the drawings. The difference is that the connecting rib **22**J of feather planting arrangement **20**J is provided with a

plurality of connecting rib sections **221**J which are provided between the adjacent feather planting members **21**J/feather planting tubes **24**J in a staggered manner.

Referring to FIG. **17** of the drawings, according to an alternative mode of the preferred embodiment, the main part of the connecting element **23**K is embodied to have a net like structure.

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Referring to FIGS. **18** to **21** of the drawings, a number of alternative modes of the connecting arrangement of the shuttlecock of the present invention are illustrated. The connecting arrangement comprises a feather planting arrangement which comprises a set of feather planting members and a set of feather planting tubes. The feather planting arrangement of this preferred embodiment is similar to the feather planting arrangement of the fourth preferred embodiment, the difference is that the center line of each feather planting tube does not the same center line of the corresponding feather planting member. In other words, each feather planting tube is not coaxially arranged with the corresponding feather planting member.

Referring to FIG. **18** of the drawings, the feather planting arrangement **20**L comprises a set of feather planting members **21**L and a set of feather planting tubes **24**L which are respectively provided at end portions of the corresponding feather planting members **21**L. Each feather planting tube **24**L is provided with a feather planting groove **241**L for the insertion of the shaft member of the feather unit. According to this preferred embodiment, the feather planting arrangement **20**L further comprises a set of side enhancing rib **25**L. In other words, each feather planting tube **24**L is supported by a corresponding feather planting member **21**L and a side enhancing rib **25**L.

Referring to FIG. **19** of the drawings, the feather planting arrangement **20**M comprises a set of feather planting members **21**M and a set of feather planting tubes **24**M which are respectively provided at end portions of the corresponding feather planting members **21**M. Each feather planting tube **24**M is provided with a feather planting groove **241**M for the insertion of the shaft member of the feather unit. According to this preferred embodiment, each of the feather planting member **21**M is bended into several sections to provide the supporting performance. More specifically, each of the feather planting member **21**M comprises a base portion **211**M and a supporting portion **212**M which is inclinedly extended from the base portion **211**M. Each feather planting tube **24**M is provided at the corresponding supporting portion **212**M.

Referring to FIG. **20** of the drawings, the feather planting arrangement **20**N comprises a set of feather planting members **21**N and a set of feather planting tubes **24**N which are respectively provided at end portions of the corresponding feather planting members **21**N. Each feather planting tube **24**N is provided with a feather planting groove **241**N for the insertion of the shaft member of the feather unit. According to this preferred embodiment, the feather planting arrangement **20**N further comprises a set of double-side enhancing ribs **25**N. In other words, each feather planting tube **24**M is supported by a corresponding feather planting member **21**N and two enhancing ribs **25**N.

Referring to FIG. **21** of the drawings, the feather planting arrangement **20**O comprises a set of feather planting members **21**O and a set of feather planting tubes **24**O which are respectively provided at end portions of the corresponding feather planting members **21**O. Each feather planting tube **24**O is provided with a feather planting groove **241**O for the insertion of the shaft member of the feather unit. According to this preferred embodiment, each feather planting tube **24**O is inclinedly provided at an end portion of the corresponding feather planting member **21**O, so as to inclinedly support each feather planting member **21**O.

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FIGS. **22** to **24** are schematic views illustrating the connection between the feather units an the feather planting arrangement of the connecting arrangement.

Referring to FIG. **22** of the drawings, an end portion of the shaft member **31**P of each feather unit **30**P is planted into the corresponding feather planting groove **241**P of the feather planting tube **24**P of the feather planting arrangement **20**P. It is worth mentioning that the feather units **30**P can be made of natural feathers. The feather planting members **21** are introduced to replace the shaft portions of conventional shuttlecocks, so that the prosperity of the feather members **32** of natural feathers is utilized, such as achieving a quick head reversing action through the opening and closing of the feather members after the shuttlecock is under a strike, while disadvantages resulting from the inconsistence of the thickness, curvature, the degree of arch of the natural feathers can be avoided.

Referring to FIG. **23** of the drawings, according to this alternative mode, each feather unit **30**Q is installed at an artificial rod **50**Q. The connecting member **23**Q of the feather planting arrangement **20**Q is provided with feather planting grooves **231**Q, each artificial rod **50**Q which is planted with the feather unit **30**Q is inserted in the corresponding feather planting groove **231**Q of the connecting member **23**Q. It is worth mentioning that the feather planting arrangement **20**Q further comprises a cluster of feather planting tubes **24**Q. Each artificial rod **50**Q penetrates the corresponding feather planting tube **24**Q, so that each feather planting tube **24**A retains the corresponding artificial rod **50**Q in position.

Referring to FIG. **24** of the drawings, the structure of the feather planting arrangement **20**R of this alternative mode is similar to the structure of the feather planting arrangement **20**Q shown in FIG. **23**. According to this alternative mode, the artificial rods **50**Q are omitted, the shaft member of each feather unit **30**R is directly planted in the feather planting groove **231**R of the connecting member **23**R of the feather planting arrangement **20**R.

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FIGS. **25** to **30** are schematic views illustrating the alternative modes of the connecting element of the feather planting arrangement. As shown in FIGS. **25** to **27** of the drawings, each connecting member **23**S, **23**T and **23**U is embodied as a ring body for connecting with the shuttlecock head. Each feather planting tube **24**S, **24**T and **24**U can be connected with the corresponding connecting member **23**S, **23**T and **23**U via a various structures. It is worth mentioning that Each feather planting tube **24**S, **24**T and **24**U can be connected with the corresponding connecting member **23**S, **23**T and **23**U via the feather planting member **21**S, **21**T and **21**U in a connecting manner which is not the same manner as the end-to-end manner of the above preferred embodiment. In other words, each feather planting member **21**S, **21**T and **21**U is sidewardly extended from the corresponding feather planting tube **24**S, **24**T and **24**U. Referring to FIGS. **28** to **30** of the drawings, each of the connecting member

23V, 23W and 23X comprises an outer cylindrical wall 231V, 231W and 231X, and an inner cylindrical wall 232V, 232W and 232X for connecting with the shuttlecock head.

It is worth mentioning that the number of the feather planting tubes is 10-20. Correspondingly, the number of the feather units is 10-20.

One skilled in the art will understand that the embodiment of the present invention as shown in the drawings and described above is exemplary only and not intended to be limiting.

It will thus be seen that the objects of the present invention have been fully and effectively accomplished. The embodiments have been shown and described for the purposes of illustrating the functional and structural principles of the present invention and is subject to change without departure from such principles. Therefore, this invention includes all modifications encompassed within the spirit and scope of the following claims.

What is claimed is:

1. A shuttlecock, comprising:

a set of feather units each comprising a feather member and a shaft member extended from said feather member;

a shuttlecock head having at least one insertion groove; and

a connecting arrangement, wherein each of said shaft member of said feather unit is planted at said connecting arrangement, wherein said connecting arrangement is inserted in said insertion groove of said shuttlecock head, wherein said connecting arrangement comprises a feather planting arrangement which comprises a set of feather planting members of a same number as a number of said feather units, wherein each of said feather planting members comprises a feather planting end portion and an insertion end portion, wherein an end portion of said shaft member of said feather unit is planted in said feather planting end portion of said feather planting member, wherein said insertion end portion of each of said feather planting members is inserted in said insertion groove of said shuttlecock head, wherein each of said feather planting end portions is provided with a feather planting groove for said shaft member to insert therein.

2. A shuttlecock, comprising:

a set of feather units each comprising a feather member and a shaft member extended from said feather member;

a shuttlecock head having at least one insertion groove; and

a connecting arrangement, wherein each of said shaft member of said feather unit is planted at said connecting arrangement, wherein said connecting arrangement is inserted in said insertion groove of said shuttlecock head, wherein said connecting arrangement comprises a feather planting arrangement which comprises a set of feather planting members and a set of feather planting tubes each provided at an end portion of said feather planting member, wherein each of said feather planting tube is provided with a feather planting groove for insertion of said shaft member of said feather unit.

3. The shuttlecock, as recited in claim 2, wherein each of said feather planting member is coupled with said corresponding feather planting tube in an end-to-end manner.

4. The shuttlecock, as recited in claim 2, wherein said feather planting arrangement further comprises a set of side enhancing rib for supporting each of said corresponding feather planting tube.

5. The shuttlecock, as recited in claim 2, wherein said feather planting arrangement further comprises a set of double-side enhancing ribs for supporting each of said corresponding feather planting tube.

6. A shuttlecock, comprising:

a set of feather units each comprising a feather member and a shaft member extended from said feather member;

a shuttlecock head having at least one insertion groove; and

a connecting arrangement, wherein each of said shaft member of said feather unit is planted at said connecting arrangement, wherein said connecting arrangement is inserted in said insertion groove of said shuttlecock head, wherein said connecting arrangement comprises a feather planting arrangement which comprises a set of feather planting members, wherein the number of said feather planting members is 10-20, the number of said corresponding feather units is 10-20.

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