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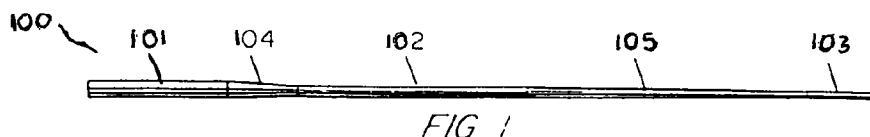
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(54) Improved golf club shaft with multiple kick points

(57) A golf club shaft fabricated of a carbon fiber pre-preg material. The shaft is comprised of a plurality of sheets of the material which are assembled and rolled to form the shaft. The shaft has at least two "kick points" for energy release during the golf swing. The shaft pro-

vides improved playing characteristics for the golf club. The shaft includes three parallel sections joined together by two intermediate tapered sections which are developed during the assembly of the club shaft.



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Description

BACKGROUND

1. Field of the Invention. This invention is directed to golf club shafts, in general, and to golf club shafts made of carbon fiber composite materials which are assembled with a unique configuration, in particular.

2. Prior Art. In recent years, the equipment used for the game of golf has evolved dramatically. For example, so-called "wood" clubs now include clubs referred to as "metal woods". The shafts in the clubs have evolved from hickory to rolled steel to aluminum to graphite to exotic materials such as titanium. Shafts are also made of carbon fiber type materials.

All of the shafts have been designed to provide substantial strength so that the shaft does not break. In addition, the shafts are designed to provide various amounts of flexure and/or stiffness. The golf club shafts have been designed to provide varying types of energy storage and release during the back swing and the forward swing in order to impart greater amounts of energy at the striking of a golf ball.

Wherever possible, manufacturers are continuing to experiment and develop new golf club shafts by introducing new types of materials and new types of assembly. The ultimate golf club shaft is always pursued.

SUMMARY OF THE INSTANT INVENTION

This invention is directed to a golf club shaft made of a composite material such as carbon prepreg or the like. The shaft incorporates three cylindrical (or parallel) sections integrally joined together by a pair of tapered sections. By utilizing appropriate materials, the shaft can attain a suitable amount of flexure and strength.

The shaft is assembled by a unique method of providing the composite materials, assembling the composite materials and finishing the shaft.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a schematic representation of a preferred embodiment of the golf club shaft made in accordance with the instant invention.

Figure 2 is a representation of the component pieces which are assembled to form the golf club shaft of the instant invention.

Figure 3 is a plan view of a partial assembly of the golf club shaft of the instant invention.

Figure 4 is a plan view of another partial assembly of the golf club shaft of the instant invention.

Figure 5 is a block diagram flow chart of the process by which the golf club shafts of the instant invention are assembled.

DESCRIPTION OF A PREFERRED EMBODIMENT

Referring now to Figure 1, there is shown a perspective view of a golf club shaft made in accordance of the instant invention. In this Figure, the golf club shaft 100 comprises three parallel chambers 101, 102 and 103. These chambers or sections are denoted as parallel in that they are, in effect, right cylinders.

The parallel sections 101 and 102 are joined by a tapered section 104. Similarly, parallel sections 102 and 103 are joined together by tapered section 105. As shown in Figure 1, the tapered sections 104 and 105 are quite exaggerated.

The same general construction is equally applicable to golf club shafts for so-called wood clubs and for iron clubs. The most significant difference in the structure of the wood or iron club shafts is in the overall length dimensions. For example, the shaft used with a wood club is typically on the order of 45 inches in length while the shaft for an iron club is on the order of 39 inches in length. The diameters of the shafts at the butt end are approximately 0.60 inches (wood) and 0.615 inches (iron) while the diameters at the tip end are approximately 0.335 inches (wood) and 0.370 inches (iron).

Referring now to TABLE 1, there is shown a listing of the approximate dimensions (in millimeters) for the respective sections of the wood club shafts and the iron club shafts.

TABLE 1 (mm)

CLUB	SECTION						TOTAL
		101	104	102	105	103	
WOOD	LENGTH	200	110	330	400	100	1140
	DIAM	15.24	15.24-11.5	11.5	11.5-8.5	8.5	
IRON	LENGTH	200	100	250	340	100	990
	DIAM	15.62	15.62-13.3	13.3	13.3-9.4	9.4	

Referring now to Figure 2, there is shown a plurality of components which are planar sheets of the appropriate carbon fiber material. As noted, one of the suitable types of material for a preferred embodiment of the invention is referred to as a 5218 prepreg systems which is manufactured by Cytec Structural Materials, Inc. of Anaheim, California. This material is obtained in rolls or sheets which can be cut into preferred configurations such as are shown in Figure 2.

The prepreg material includes carbon fibers and resins which are arranged in a particular orientation. By appropriately cutting the sheet, pieces of material having different carbon fiber orientations can be provided.

For example, as shown in Figure 2, the pieces 210 and 220 are planar cuts of the prepreg material. The pieces 210 and 220 are, in essence, mirror images of one another. These pieces are cut upon different biases in the prepreg material. For example, piece 210 is cut on a +45° line while piece 220 is cut on a -45° line. Thus, pieces 210 and 220 are comprised of elements which are disposed at a 90° relative bias overall.

In this embodiment, the pieces 210 and 220, referred to as the bias layers, have butt ends and tip ends which are identical in dimensions.

In addition, each of the pieces 210 and 220 is cut to eliminate certain triangular portions 211 and 212 thereof which are designed to assist in developing the parallel sections 101, 102 and 103 and the tapered sections 104 and 105 shown in Figure 1.

The other elongated components 250 and 260 have the same length as the pieces 210 and 220, in this case approximately 1010 mm. The tip end of piece 250 is slightly wider than the tip end of pieces 210 and 220. The tip end of piece 260 is slightly wider than the tip end of piece 250. The butt end of piece 260 is slightly wider than the width of the butt end of piece 250 which is slightly wider than the butt end of pieces 210 and 220.

The pieces 250 and 260 are referred to as layers 1 and 2 and are both cut with a 0° bias in the prepreg material. That is, in each piece the carbon fiber orientation is parallel to the long axis of the piece.

The reinforcing layers 230 and 240 are also cut with a 0° bias. The reinforcing layer 230 is, of course, a right triangular piece while the reinforcing piece 240 is right trapezoidal in configuration.

It should also be noted that the prepreg material, typically, has a thickness of approximately 0.15 mm. In addition, this material can be formed to have different tensile strength or tensile modulus. Typically, the pieces 210 and 220 are formed of the so-called 30 ton or high modulus carbon fiber (as defined by the manufacturer) which includes 31% resin content. Conversely, the layers 1 and 2 are fabricated of an intermediate modulus carbon fiber material with 34% resin. The reinforcing layers are fabricated of intermediate modulus carbon fiber material with 36% resin.

The specific dimensions and modulus for the pieces as shown and described, is not absolute. Modifications thereto can be incorporated into the invention. The modifications merely address the flexure and/or the strength of the shaft.

Referring now to Figure 3, there is shown a preliminary step in the assembly of the shaft. In particular, the reinforcing layer 240 is laid up or affixed to the surface of the piece 220. In the preferred arrangement, the right angle corner of the right trapezoidal reinforcing layer 240 is placed in the right angle corner of the tip end of bias layer 220. Typically, these layers are merely laid against each other. That is, the layers tend to adhere to each other sufficiently due to the tackiness of the material so that the layers can be worked on subsequently.

Referring now to Figure 4, there is shown another step in the preparation of the shaft. In this case, the bias layer 220 with the reinforcing layer 240 thereon is covered by the bias layer 210 and the triangular reinforcing layer 230. In particular, the bias layer 210 is aligned at the end thereof with the reinforcing layer 240. However, the lower straight edge of bias layer 210 is displaced from, but aligned in parallel with, the lower straight edge of the reinforcing layer 240. The offset between the two bias layers is, generally, equal to the diameter of the mandril 401 on which a rolling operation will take place.

After the bias layer 210 has been placed on top of the bias layer 220 with the reinforcing layer 240 in place, the triangular reinforcing piece 230 is placed on top thereof. The right angle corner of the triangular reinforcing layer 230 is

aligned with the right angle produced by the tip end of bias layers 210 and 220 and the bottom edge of the bias layer 210 which is disposed on top of bias layer 220.

Referring now to Figure 5, there is shown a schematic diagram or functional flow chart of the manufacturing process for producing the improved golf club shafts of the invention.

In the flow chart, the stage or phase is defined as the time when the individual pieces of composite material are operated upon. Thus, the pieces that are cut during step 501 are the layers 210, 220, 230, 240, 250 and 260 which are shown in Figure 2. In step 502, the layers are then assembled as shown in Figures 3 and 4 and placed on the mandril 401. In step 503, the assembled layers, together with the mandril 401, are then placed in a conventional rolling machine which is adapted to roll the layers of prepreg material around the mandril 401. The mandril is slightly tapered in accordance with the desires of the shaft manufacturer.

In this case, the reinforcing layer 240 is rolled into the tip end of the shaft as is the triangular reinforcing layer 230. These components add strength and rigidity to the shaft at the tip end and, together with the cut outs shown in pieces 210 and 220, establish the parallel portions 101, 102 and 103 of the shaft 100 (see Figure 1).

In step 504, a second rolling operation is performed in a conventional rolling machine. In this step, the first 0° layer comprising layer 250 is rolled around the mandril and the rolled up layers 210, 220, 230 and 240 as occurred during the first rolling operation.

In step 505, a third rolling operation is conducted wherein layer 260 is rolled around the apparatus which was produced during the second rolling operation in step 504.

In step 506, the unit, as produced by the third roll, is wrapped in a suitable wrapper such as, but not limited to, cellophane. This wrapper is fairly securely and snugly wrapped around the assembly produced in step 505. This wrap layer retains the other prepreg layers in a desired configuration.

In step 507, the apparatus is heat treated. In particular, the entire apparatus is placed in an oven where it is heated to 250° F for approximately two hours. Thus, the wrap layer retains the shape of the apparatus. After the heat treating is completed and the assembly has cooled to room temperature, the wrap that was applied in step 506 is removed in step 508.

The shaft is then run through a grinding operation in step 509 wherein the surface of the assembly is rendered quite smooth.

In step 510, the outer surface of the assembly is painted in a conventional fashion. Many appropriate paint applicators are known in the art. The type of paint used is also conventional.

In step 511, the assembly is run through a fine grind procedure in order to smooth any imperfections which may have been produced during the painting step.

In step 512, the assembly is submitted to a suitable process for applying logos, or other indicia to the surface of the assembly. Typically, this process can be done with a silk screening operation.

In step 513, the completed assembly is given a clear coat of lacquer, paint or the like to provide the ultimate finish which can be either glossy or matte, as desired.

The shaft is now fully completed and ready to be assembled to grips and heads to complete the manufacture of a golf club. The shafts are not limited to the particular configuration of wood or iron, except as noted above with regard to the dimensions thereof.

While the process shown in Figure 5 is typical, it is understood that modifications thereto can be made without departing from the sphere of this invention. For example, the third rolling step, i.e. step 505, can be omitted in some cases, in particular, in the manufacture of shafts for iron clubs.

Likewise, in step 506, material other than cellophane can be used to wrap the shafts in some instances.

The temperature and time profile recited in regard to step 507 can be altered, as desired, or as a function of the material used to form the shaft.

It is possible, in some instances, to combine steps 508 and 509 wherein the grinding operation could remove the wrapper.

While it is unlikely, the painting step 510 could be omitted to leave the shaft in a natural state.

The finalizing steps of fine grinding (step 511), applying a logo or similar indicia (step 512) and applying a clear coat (step 513) can be omitted or modified.

As described above, when the process shown in Figure 5 is completed, the shaft 100 shown in Figure 1 is produced. This shaft has a high standard of strength modulus, has flexibility suitable for most golfers and has two energy kick points such as shown in Figure 1 wherein the energy stored in the shaft during the backswing is released during the downswing by the golfer.

Thus, there is shown and described a unique design and concept of a golf club shaft and the method of making same. While this description is directed to a particular embodiment, it is understood that those skilled in the art may conceive modifications and/or variations to the specific embodiments shown and described herein. Any such modifications or variations which fall within the purview of this description are intended to be included therein as well. It is understood that the description herein is intended to be illustrative only and is not intended to be limitative. Rather, the scope of the invention described herein is limited only by the claims appended hereto.

It should be noted that the objects and advantages of the invention may be attained by means of any compatible combination(s) particularly pointed out in the items of the following summary of the invention and the appended claims.

SUMMARY OF INVENTION

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1. A golf club shaft comprising, at least three cylindrical sections, and at least two tapered sections,
each of said tapered sections integrally disposed intermediate two of said cylindrical sections to form a single
elongated shaft.

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2. The shaft wherein, each of the sections is fabricated of a carbon fiber composite.

3. The shaft wherein, each of said cylindrical sections has a different outside diameter.

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4. The shaft wherein, said cylindrical sections and said tapered sections are integrally formed.

5. The shaft wherein, said cylindrical sections of said shaft comprise approximately 55% of the total length of said
shaft.

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6. A golf club shaft comprising, a plurality of cylindrical sections having different diameters,
a tapered section interposed between adjacent cylindrical sections and integrally formed therewith to provide
dual kick points in said shaft.

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7. A golf club shaft formed by the process of assembling a plurality of precut planar layers of prepreg carbon fiber
composite along preferred carbon fiber orientations, and
rolling said layers on a tapered mandril whereby cylindrical and tapered portions of a shaft are produced.

8. The golf club shaft including, heat treating said shaft.

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9. The golf club shaft including, smoothing the surface of said shaft.

10. The golf club shaft including, finishing said shaft by applying a suitable coating to the surface thereof.

11. The golf club shaft wherein, said coating comprises a layer of paint.

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12. The golf club shaft wherein, at least two of said layers have bias orientations of said carbon fiber which are
arranged at 90° to each other.

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13. The golf club shaft wherein, at least one of said layers has a 0° bias orientation which is intermediate the bias
orientations of said two of said layers.

14. The golf club shaft wherein, at least one of said layers is a reinforcing layer having a 0° bias of said carbon fiber.

Claims

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1. A golf club shaft comprising, at least three cylindrical sections, and at least two tapered sections,
each of said tapered sections integrally disposed intermediate two of said cylindrical sections to form a single
elongated shaft.

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2. The shaft recited in claim 1 wherein, each of the sections is fabricated of a carbon fiber composite.

3. The shaft recited in claim 1 wherein, each of said cylindrical sections has a different outside diameter.

4. The shaft recited in claim 1 wherein, said cylindrical sections and said tapered sections are integrally formed.

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5. The shaft recited in claim 4 wherein, said cylindrical sections of said shaft comprise approximately 55% of the total
length of said shaft.

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6. A golf club shaft comprising, a plurality of cylindrical sections having different diameters,
a tapered section interposed between adjacent cylindrical sections and integrally formed therewith to provide
dual kick points in said shaft.

5 7. A golf club shaft formed by the process of assembling a plurality of precut planar layers of prepreg carbon fiber
composite along preferred carbon fiber orientations, and
rolling said layers on a tapered mandril whereby cylindrical and tapered portions of a shaft are produced.

10 8. The golf club shaft recited in claim 5 including, heat treating said shaft.

9. The golf club shaft recited in claim 6 including, smoothing the surface of said shaft.

15 10. The golf club shaft recited in claim 7 including, finishing said shaft by applying a suitable coating to the surface thereof,
wherein preferably said coating comprises a layer of paint,
wherein preferably at least two of said layers have bias orientations of said carbon fiber which are arranged
at 90° to each other,
wherein preferably at least one of said layers has a 0° bias orientation which is intermediate the bias orien-
tations of said two of said layers, and
wherein preferably at least one of said layers is a reinforcing layer having a 0° bias of said carbon fiber.

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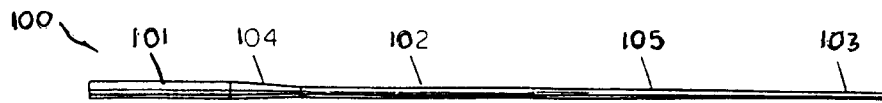


FIG 1

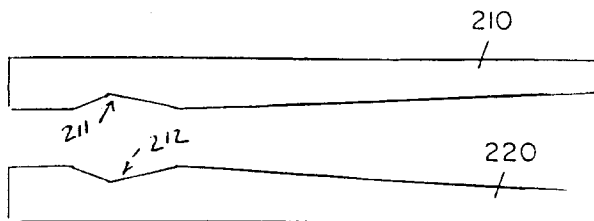


FIG 2

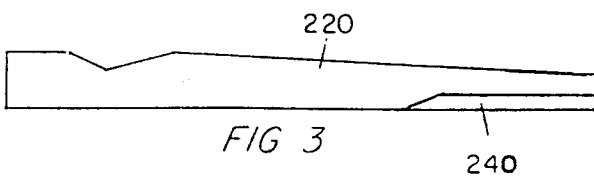
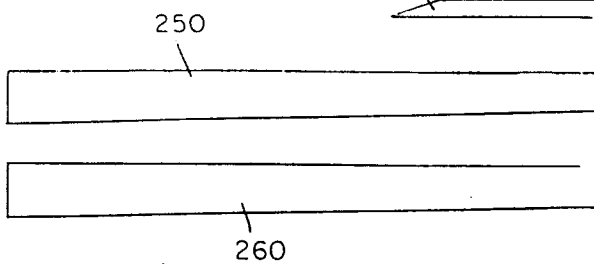


FIG 3

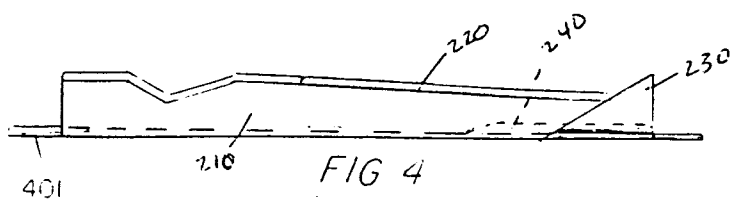
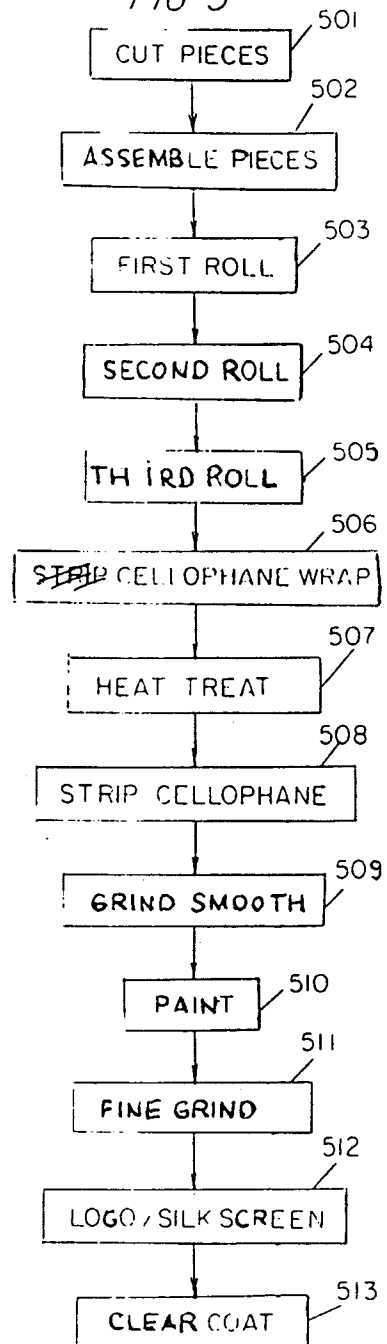


FIG 4

FIG 5





European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 95 11 4471

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X Y	GB-A-2 232 605 (SPALDING & EVENFLO) * the whole document *	1,3-6 2	A63B53/10
X Y A	US-A-5 265 872 (TENNENT ET AL.) * the whole document *	7-10 2 1,3-6	
A	US-A-4 319 750 (ROY) * column 7, line 57 - column 15, line 17; figures 8-24 *	1,2,7-10	
A	PATENT ABSTRACTS OF JAPAN vol. 18 no. 357 (C-1221) ,6 July 1994 & JP-A-06 091022 (NIKKO GOLF) * abstract *	6-8	
A	PATENT ABSTRACTS OF JAPAN vol. 18 no. 395 (C-1229) ,25 July 1994 & JP-A-06 114131 (FUJIKURA RUBBER) * abstract *	7,8,10	
TECHNICAL FIELDS SEARCHED (Int.Cl.6) A63B			
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 14 December 1995	Examiner Williams, M
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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