US 20100144462A1

(19) **United States**

(12) **Patent Application Publication**

DAWSON et al.

(10) **Pub. No.: US 2010/0144462 A1**

(43) **Pub. Date: Jun. 10, 2010**

(54) **MULTIPLE MATERIAL FAIRWAY-TYPE GOLF CLUB HEAD**

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(21) Appl. No.: **12/621,378**

(22) Filed: **Nov. 18, 2009**

Related U.S. Application Data

(60) Provisional application No. 61/119,991, filed on Dec. 4, 2008.

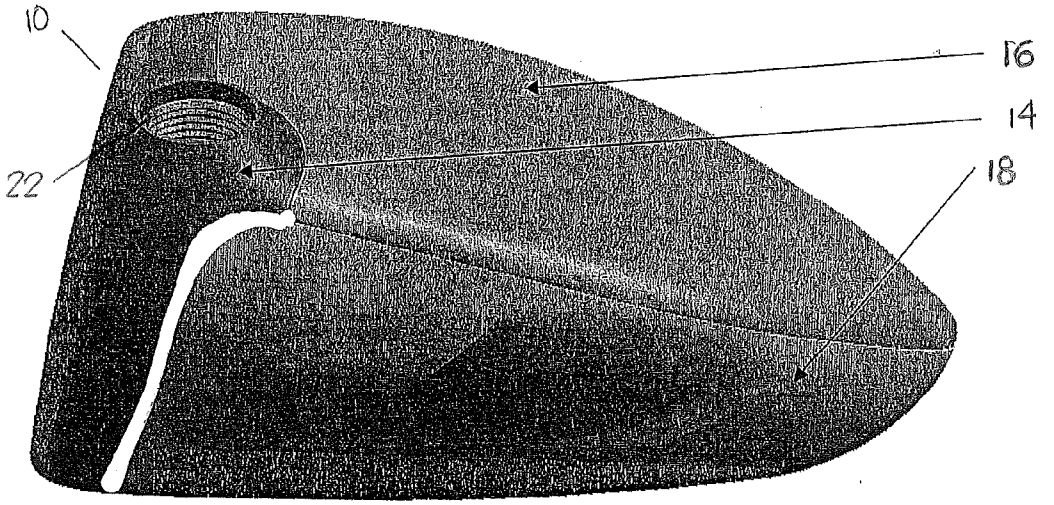
Publication Classification

(51) **Int. Cl.**
A63B 53/04 (2006.01)

(52) **U.S. Cl.** **473/345**; 473/349

(57) **ABSTRACT**

A fairway-wood type golf club head having a composite crown is disclosed herein. The fairway-wood type golf club head comprises a cast subassembly and a compression molded crown component which is bonded to the subassembly. Each of the subassembly and the crown component has a non-overlapping bonding flange that bonds with an interior surface.



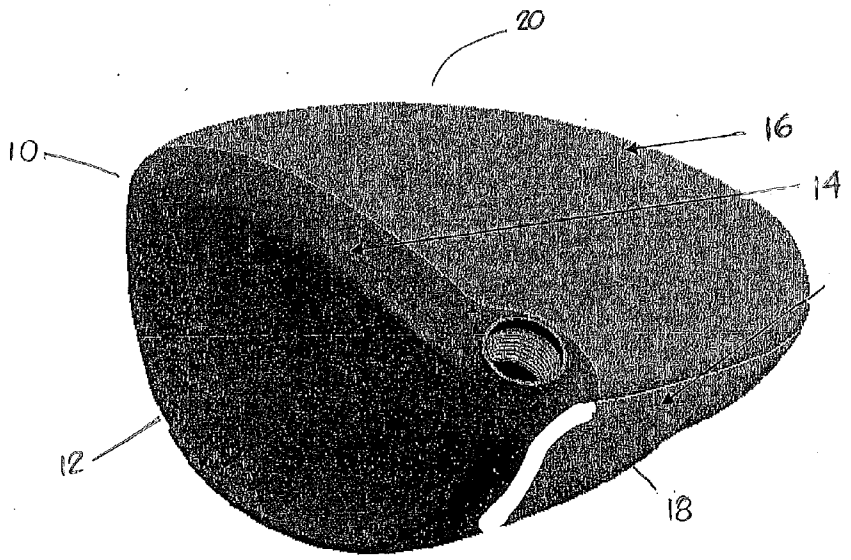


FIG. 1

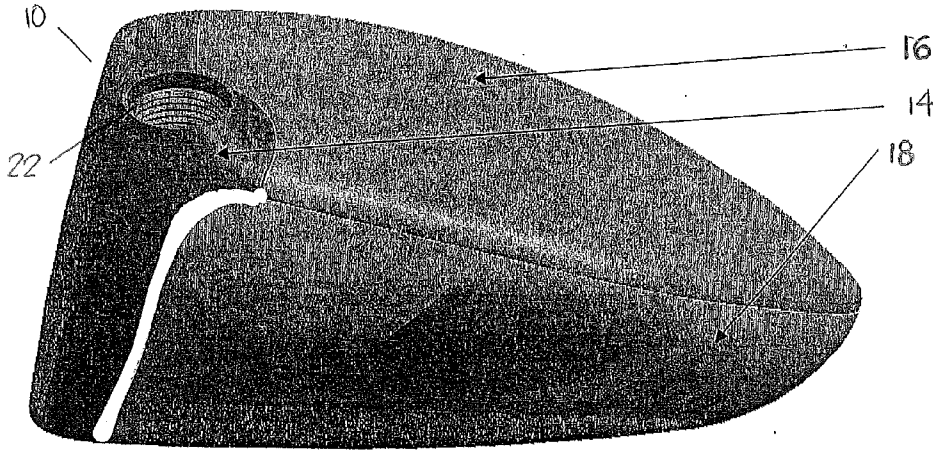


FIG. 2

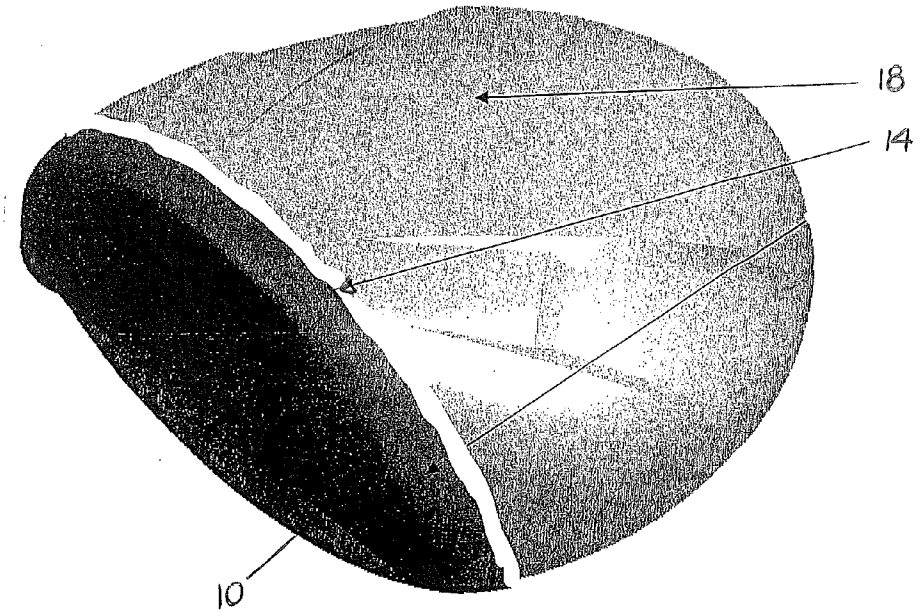


FIG. 3

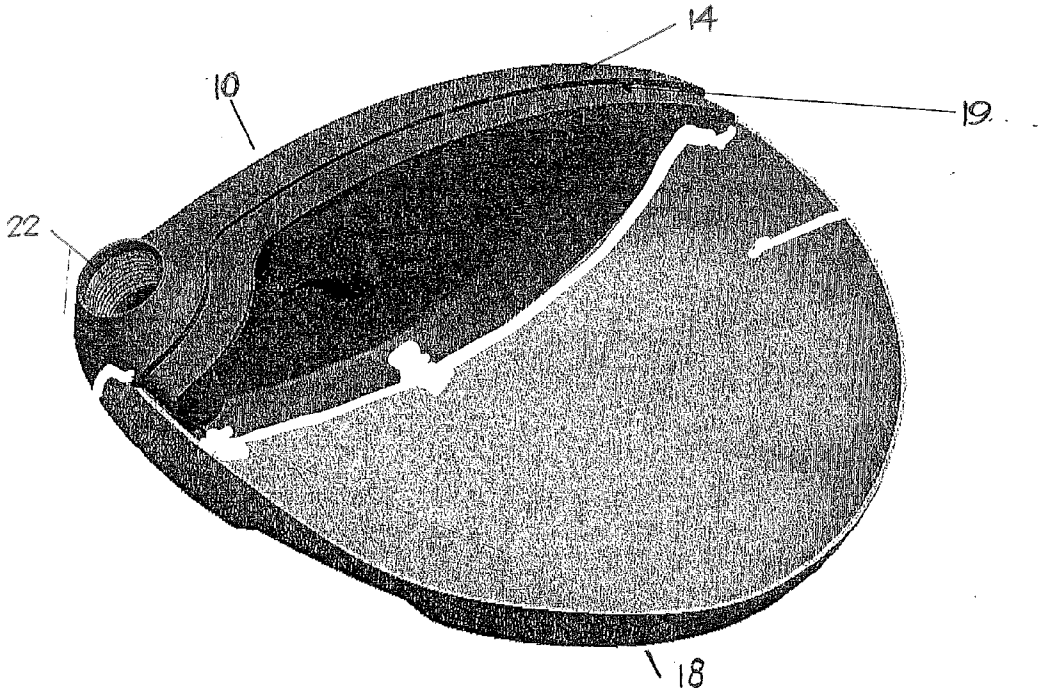


FIG. 4

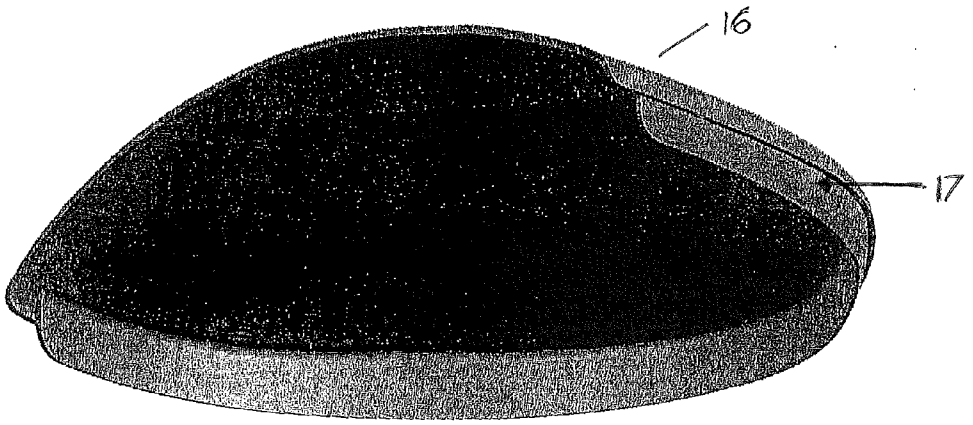


FIG. 5

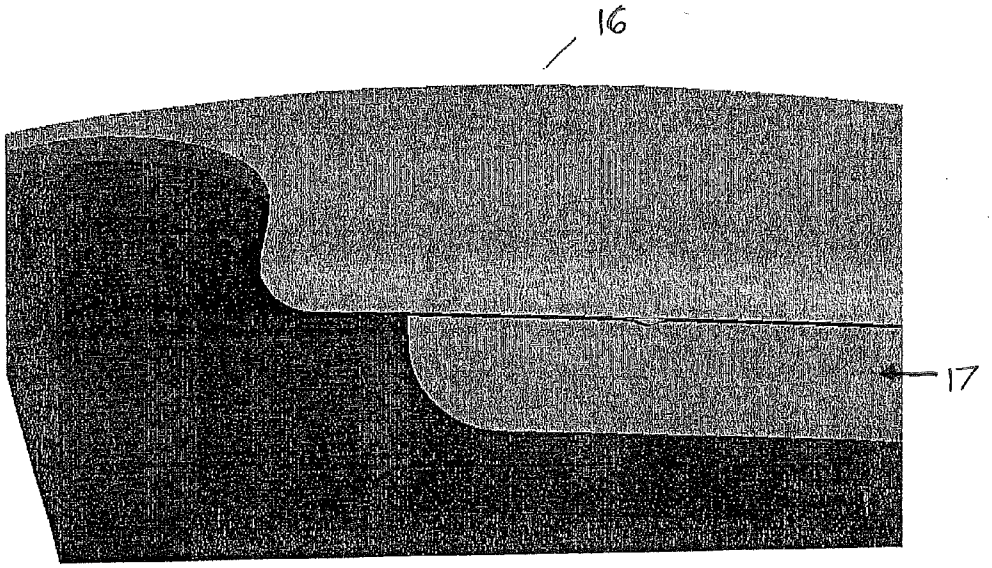


FIG. 6

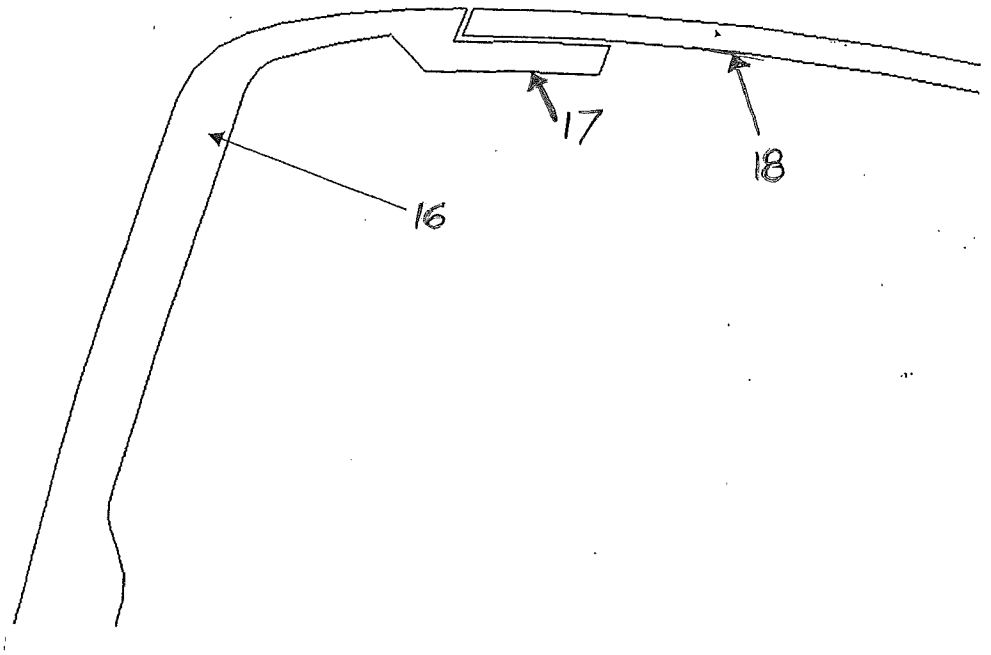


FIG. 7

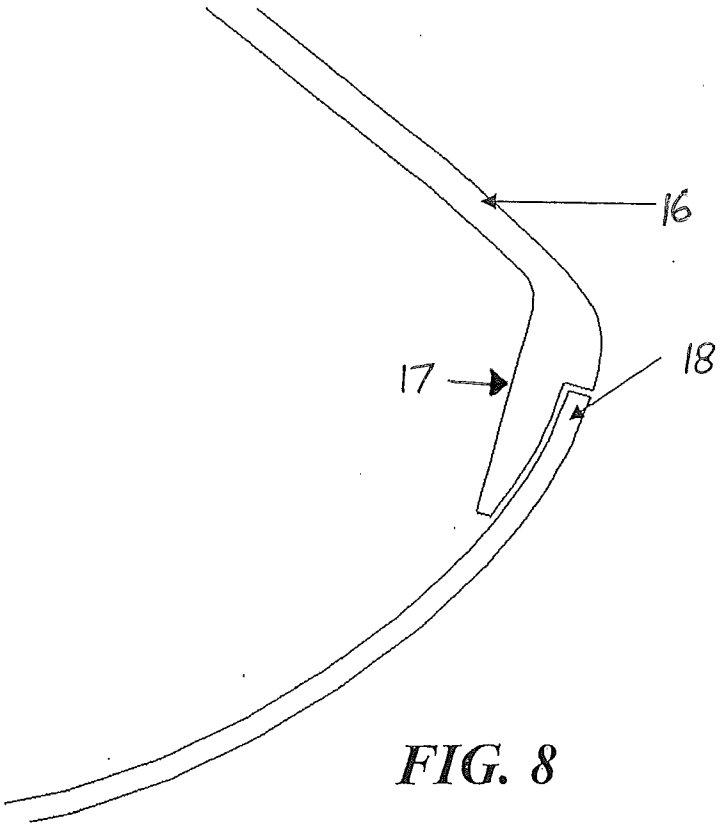


FIG. 8

MULTIPLE MATERIAL FAIRWAY-TYPE GOLF CLUB HEAD

CROSS REFERENCES TO RELATED APPLICATIONS

[0001] The present application claims priority to U.S. Provisional Patent Application No. 61/119,991, filed on Dec. 4, 2008.

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

[0002] Not Applicable

BACKGROUND OF THE INVENTION

[0003] 1. Field of the Invention

[0004] The present invention relates to a multiple material fairway-type golf club head.

[0005] 2. Description of the Related Art

[0006] The prior art discloses several methods for forming a golf club head.

[0007] One method is full casting which involves casting the entire golf club head, usually with a face pull tool. Duquette et al., U.S. Pat. No. 6,978,976 for a *Magnetized Core With Pneumatic Release System For Creating A Wax Mold For A Golf Club Head* describes certain aspects of the full casting method. Then a face insert is welded to the golf club head.

[0008] Another method is using a full casting method, using a face pull tool and then cutting a crown opening. A graphite crown is then bonded to cover the opening thereby forming a multiple material golf club head.

[0009] Yet another method is forming an entire golf club head from multiple pieces. In this method, several pieces (crown, sole, face and hosel) are welded together to form a precursor golf club head. Then, an opening is cut in the crown creating an opening. A graphite crown is then bonded to cover the opening thereby forming a multiple material golf club head.

[0010] Yet another method is a high performance multiple piece golf club head. This forming method involves making a multiple piece golf club head. The crown material needs to be of high quality expensive titanium so prior to welding the crown component to the sole component, the crown is chemically milled to the limits of drop tower durability. The chemical milling process is necessary to render the crown component to be competitive with graphite strength to weight ratio.

[0011] The current construction includes tacking a face component to sole (called face subassembly). Manually trim and tack crown to face subassembly. Fully weld face, crown, and sole (21 inches of weld). Grind weld and polish head.

[0012] Each of these prior art methods have drawbacks. Both multiple piece graphite crown and full casting require the manufacturer to produce a complete golf club head. The crown opening is then cut and replaced with a graphite crown. This is obviously wasteful because of the need to fabricate an entire golf club head and then removing a portion. The high performance multiple piece golf club head remedies this wastefulness by utilizing an expensive titanium material and which adds more cost to render the crown component weight competitive to graphite crowns.

[0013] Present day golf clubs are typically composed of titanium or steel, and either cast or forged. Various patents have disclosed the use of multiple material golf club heads, generally combining a metal with a non-metal. Various patents have disclosed the use of metal injection molding for golf clubs.

[0014] Sanford et al., U.S. Pat. No. 5,665,014, for a *Metal Golf Club Head And Method Of Manufacture,* discloses a golf club head with two components with at least one of the components composed of a metal injection molded material.

[0015] Gressel et al., U.S. Pat. No. 6,478,842, for a *Preparation Of Articles Using Metal Injection Molding,* discloses an entire golf club head composed of a metal injection molded material having a stainless steel and tungsten alloy composition.

[0016] Gressel et al., U.S. Pat. No. 6,669,898, for a *Preparation Of Articles Using Metal Injection Molding,* discloses forming an entire golf club head composed of a metal injection molded material having a stainless steel and tungsten alloy composition.

[0017] Zhang et al., U.S. Pat. No. 6,767,418, for a *TI-ZR Type Alloy And Medical Appliance Formed Thereof,* discloses a titanium-zirconium alloy that may be used for golf club components.

[0018] Sakata et al., U.S. Pat. No. 6,350,407, for a *Process For Producing Sintered Product,* discloses a process for metal injection molding.

[0019] LaSalle et al., U.S. Pat. No. 6,322,746, for a *Co-Sintering Of Similar Materials,* discloses a process of fusing two dissimilar material parts through use of co-sintering including a golf putter.

[0020] Takahashi et al., U.S. Pat. No. 6,027,686, for a *Method Of Manufacturing Sintered Compact,* discloses sintering a green body formed by metal injection molding.

[0021] LaSalle et al., U.S. Pat. No. 5,989,493, for a *Net Shape Hastelloy X Made By Metal Injection Molding Using An Aqueous Binder,* discloses metal injecting a Hastelloy X powder.

[0022] Zedalis et al., U.S. Pat. No. 5,985,208, for a *Process For Debinding And Sintering Metal Injection Molded Parts Made With An Aqueous Binder,* discloses metal injection molding a 17-4PH stainless steel alloy.

[0023] Takahashi et al., U.S. Pat. No. 5,911,102, for a *Method Of Manufacturing Sintered Compact,* discloses sintering a green body formed by metal injection molding.

[0024] Numerous techniques have been used for weighting golf club heads in order to gain better performance. In persimmon wood club heads, weights were attached to the sole in order to lower the center of gravity. The first metal woods had sufficient weight, however, the weight distribution deterred slightly from performance. The refinement of hollow metal woods with weighting on the sole improved upon the performance of these clubs. An example of such woods were the GREAT BIG BERTHA® HAWK EYE® drivers and fairway woods, developed by the Callaway Golf Company of Carlsbad, Calif., that used a tungsten screw in the sole of each titanium club head body to vary the weight of the golf club head.

[0025] Another example is set forth in Helmstetter et al., U.S. Pat. No. 6,364,788, for a *Weighting System For A Golf Club Head,* which discloses using a bismuth material within an internal cavity to add mass to a golf club head, particularly a fairway wood.

[0026] Yet a further example is set forth in Evans et al., U.S. Pat. No. 6,409,612, for a *Weighting Member For A Golf Club Head,* which discloses a weighting device composed of a

polymer body with ports to allow for placement of high density members such as tungsten spheres.

[0027] Another example of additional weighting of a golf club head is set forth in U.S. U.S. Pat. No. 5,447,309, which discloses the use of three weights fixedly disposed within the interior of a club head to provide a selected moment of inertia for the club head. Yet another example is set forth in British Patent Application Number 2332149 for a *Golf Club Head With Back Weighting Member,* which discloses a weight pocket in the exterior rear of a wood for placement of epoxy inserts that vary in density.

[0028] An example of positioning mass in a golf club head for performance is disclosed in Helmstetter et al., U.S. Pat. No. 6,739,983, for a *Golf Club Head With Customizable Center Of Gravity,* which discloses a method and golf club head which allows a golfer to select a preferred center of gravity location for better ball striking.

[0029] A further example of positioning mass for performance is set forth in Helmstetter, U.S. Pat. No. 5,785,605 for a *Hollow, Metallic Golf Club Head With Configured Medial Ridge,* which discloses a golf club head with a center of gravity located in vertical alignment with a local zone defined by ridge on a sole of the golf club head.

BRIEF SUMMARY OF THE INVENTION

[0030] The present invention provides a fairway-type golf club head that seeks to reduce the waste from current manufacturing methods while achieving similar or better performance than the high performance multiple piece golf club heads at a price point that is similar to conventional multiple piece golf club heads.

[0031] The fairway type golf club head comprises a subassembly having a bonding flange extending from a return section of a face component and a crown component having a bonding flange extending downward. The bonding flange of the crown component and the bonding flange of the subassembly do not overlap although both flanges are undercuts and are located to bond with an interior surface of either the crown component or the subassembly.

[0032] One aspect of the present invention is a fairway-wood-type golf club head comprising a subassembly and a crown component. The subassembly is preferably composed of a stainless steel material. The subassembly has a mass ranging from 150 grams to 250 grams. The crown component has a mass ranging from 10 grams to 30 grams. The golf club head has a mass ranging from 200 grams to 300 grams.

[0033] Having briefly described the present invention, the above and further objects, features and advantages thereof will be recognized by those skilled in the pertinent art from the following detailed description of the invention when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0034] FIG. **1** is a perspective view of an unfinished golf club head.

[0035] FIG. **2** is a side view of an unfinished golf club head.

[0036] FIG. **3** is a bottom perspective view of an unfinished golf club head.

[0037] FIG. **4** is an isolated top perspective view of an interior of a subassembly of a golf club head to illustrate the bonding flange of a face component.

[0038] FIG. **5** is an isolated front perspective view of a crown component of a golf club head illustrating the bonding flange of the crown component.

[0039] FIG. **6** is an enlarged isolated view of a crown component of FIG. **5** illustrating the bonding flange and joint for bonding with the subassembly.

[0040] FIG. **7** is a cross-sectional view of a bonding joint of a golf club head illustrating a bonding flange of the face component and the crown component.

[0041] FIG. **8** is a cross-sectional view of a bonding joint of a golf club head illustrating a bonding flange of a crown component and a sole component.

DETAILED DESCRIPTION OF THE INVENTION

[0042] In the present invention a crown component **16** is bonded into the golf club head subassembly, composed of a face component **10** and a sole component **18**. The face component **10** comprises a striking plate section **12** and a return section **14** extending rearward from a perimeter of the striking plate section.

[0043] As shown in FIGS. **1-8**, a fairway-type golf club head **20** is composed of a subassembly, which comprises the face component **10** and the sole component **18** with a bonding flange **19**, and a crown component **16** with a bonding flange **17** in order to construct the fairway-type golf club head **20** according to a method of the present invention.

[0044] The crown component **16** has a bonding flange **17** between itself and the sole **18**. The bonding flange **17** is substantially perpendicular to the top section of the crown component **16**. The bonding flange **17** is formed as an undercut relative to an edge of the top section of the crown component **16**.

[0045] The return section **14** comprises a bonding flange **19** formed as an undercut extending rearward approximately 0.200 inch from a top rearward edge of the return section **14**. The crown component **16** is adhesively bonded to the subassembly with an interior surface of a front portion of the top section of the crown component **16** bonded to an exterior surface of the bonding flange **19** of the return section **14** of the face component **10** of the subassembly. Additionally, the exterior surface of the bonding flange **17** of the crown component **16** is bonded to an interior surface of a portion of the sole component **18** of the subassembly. The subassembly is composed of a stainless steel material and comprises at least 70% of the mass of the golf club head. The crown component **16** is composed of a compression molded graphite material.

[0046] In one embodiment, the golf club head **20** has a loft angle of at least thirteen degrees. In a preferred embodiment, the fairway-type golf club head **20** comprises a hosel **22**, which may be either an interior hosel or an exterior hosel. In yet another embodiment, the golf club head **20** has a volume of less than 400 cubic centimeters

[0047] In yet another example, a subassembly comprised of a sole component **18** and a face component **10** have a bonding flange **19** formed as an undercut extending rearward. The crown component **16** has top section and a bonding flange **17** substantially perpendicular to the top section. The bonding is formed as an undercut relative to an edge of the top section.

[0048] The crown component **16** is bonded to the subassembly with an interior surface of a front portion of the top section of the crown component **16** bonded to an exterior surface of the bonding flange **19** of the face component **10** of the subassembly. Additionally, the exterior surface of the bonding flange **17** of the crown component **16** is bonded to an interior surface of a portion of the sole component **18** of the subassembly.

[0049] In one embodiment, the subassembly of the golf club head **20** is composed of a titanium alloy material. In another embodiment, the subassembly is composed of a stainless steel material. In yet another embodiment, the crown component **16** is composed of a non-metal material.

[0050] The resulting weight of the crown in carbon composite ranges from 5 grams to 30 grams, more preferably from 10 grams to 25 grams. The weight of the crown in the high performance multi-piece of the prior art is approximately 31 grams. By using the method of construction of the present invention, a manufacturer obtains at least an additional seven grams of discretionary weight that can be used in other sections of the golf club head to improve mass properties such as moment of inertias (Izz, Iyy and Izz) through the center of gravity of the golf club head, durability (thicker face regions or other regions open to stress during loading), and lower the positioning of the center of gravity by shifting the mass of the golf club head.

[0051] The golf club head **20** preferably has a volume from 100 cubic centimeters to 600 cubic centimeters, more preferably from 130 cubic centimeters to 475 cubic centimeters. When designed as a hybrid wood, the golf club head **20** preferably has a volume ranging from 130 cubic centimeters to 300 cubic centimeters, and more preferably from 150 cubic centimeters to 275 cubic centimeters. The volume of the golf club head **20** will also vary between lofts.

[0052] The golf club head **20** preferably has a mass ranging from 220 grams to 300 grams, more preferably from 225 grams to 260 grams. The golf club head **20** is preferably a hybrid wood, with a loft angle ranging from 18 degrees to 27 degrees, (18, 21, 24, 27 degrees hybrids) and a lie angle varying from 58.50 degrees to 60 degrees (58.50, 59, 59.50 and 60 degrees hybrids). The mass also varies depending on the loft angle with the higher lofted hybrid having more mass.

[0053] The golf club head **20** preferably has a length ranging from 2.0 inches to 3.0 inches, more preferably from 2.25 to 2.50 inches and most preferably 2.4 inches. The club head **20** preferably has a height ranging from 1.25 inches to 1.75 inches, more preferably from 1.35 inches to 1.50 inches and most preferably 1.42 inches.

[0054] In general, the moment of inertia, Izz, about the Z axis for the golf club head **20** of the present invention will range from 1900 g-cm^2 to 3000 g-cm^2, preferably from 1990 g-cm^2 to 2800 g-cm^2, and most preferably from 1990 g-cm^2 to 2600 g-cm^2. The moment of inertia, Iyy, about the Y axis for the golf club head **20** of the present invention will range from 900 g-cm^2 to 1700 g-cm^2, preferably from 950 g-cm^2 to 1500 g-cm^2, and most preferably from 965 g-cm^2 to 1300 g-cm^2.

[0055] From the foregoing it is believed that those skilled in the pertinent art will recognize the meritorious advancement of this invention and will readily understand that while the present invention has been described in association with a preferred embodiment thereof, and other embodiments illustrated in the accompanying drawings, numerous changes, modifications and substitutions of equivalents may be made therein without departing from the spirit and scope of this invention which is intended to be unlimited by the foregoing except as may appear in the following appended claims. Therefore, the embodiments of the invention in which an exclusive property or privilege is claimed are defined in the following appended claims.

We claim as our invention the following:

1. A fairway-wood type golf club head comprising:

a subassembly comprising a face component and a sole component, the face component section comprising a striking plate section and a return section extending rearward from a perimeter of the striking plate section, the return section having a bonding flange formed as an undercut extending rearward approximately 0.200 inch from a top rearward edge of the return section, the subassembly composed of a stainless steel material and comprising at least 70% of the mass of the golf club head;

a crown component composed of a compression molded graphite material, the crown component having top section and a bonding flanged substantially perpendicular to the top section, the bonding formed as an undercut relative to an edge of the top section;

wherein the crown component is adhesively bonded to the subassembly with an interior surface of a front portion of the top section of the crown component bonded to an exterior surface of the bonding flange of the return section of the face component of the subassembly and an exterior surface of the bonding flange of the crown component bonded to an interior surface of a portion of the sole component of the subassembly.

2. The fairway-wood type golf club head according to claim **1** wherein the golf club head has a loft angle of at least thirteen degrees.

3. The fairway-wood type golf club head according to claim **1** wherein the fairway-wood type golf club head has a volume of less than 400 cubic centimeters.

4. The fairway-wood type golf club head according to claim **1** wherein the subassembly further comprises a hosel.

5. The fairway-wood type golf club head according to claim **4** wherein the hosel is an exterior hosel.

6. The fairway-wood type golf club head according to claim **4** wherein the hosel is an interior hosel.

7. A fairway-wood type golf club head comprising:

a subassembly having a sole component and a face component with a bonding flange formed as an undercut extending rearward;

a crown component having top section and a bonding flange substantially perpendicular to the top section, the bonding formed as an undercut relative to an edge of the top section;

wherein the crown component is bonded to the subassembly with an interior surface of a front portion of the top section of the crown component bonded to an exterior surface of the bonding flange of the face component of

the subassembly and an exterior surface of the bonding flange of the crown component bonded to an interior surface of a portion of the sole component of the subassembly.

8. The fairway-wood type golf club head according to claim **7** wherein the subassembly is composed of a titanium alloy material.

9. The fairway-wood type golf club head according to claim **7** wherein the subassembly is composed of a stainless steel material.

10. The fairway-wood type golf club head according to claim **7** wherein the crown component is composed of a non-metal material.

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