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(54) **GOLF CLUB HEAD**

(75) Inventors: **Bing-Ling Chao**, San Diego, CA (US); **Brian Weed**, Gloucester, MA (US); **Peter Larsen**, San Marcos, CA (US); **Gery Zimmerman**, Fallbrook, CA (US); **Benoit Vincent**, Encinitas, CA (US)

(73) Assignee: **Taylor Made Golf Company, Inc.**, Carlsbad, CA (US)

(*) Notice: This patent is subject to a terminal disclaimer.

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Filed: **Apr. 22, 2004**

U.S. Applications:

(63) Continuation of application No. 11/998,435, filed on Nov. 28, 2007, now Pat. No. Re. 42,544.

(51) **Int. Cl.**
A63B 53/04 (2006.01)
A63B 53/08 (2006.01)

(52) **U.S. Cl.** **473/329**; 473/342; 473/345; 473/346

(58) **Field of Classification Search** 473/324–350, 473/287–292

See application file for complete search history.

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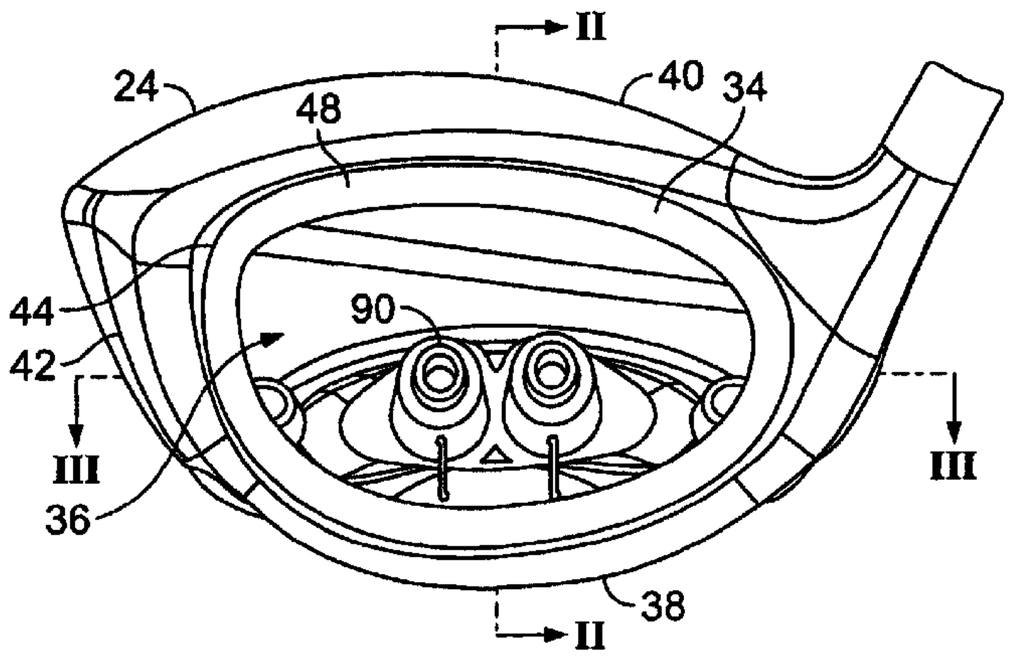
Primary Examiner — Sebastiano Passaniti

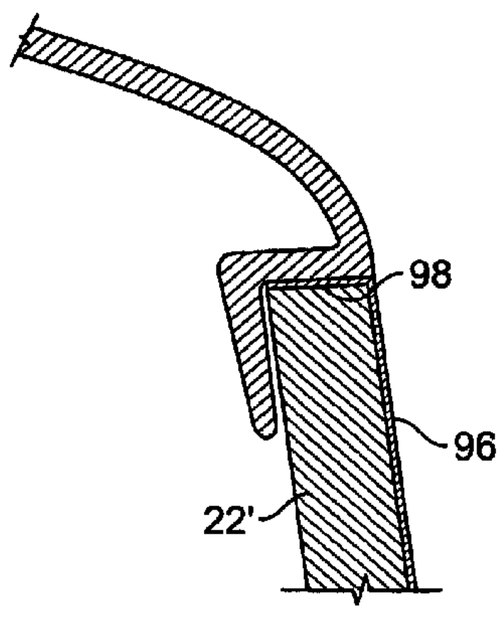
(74) *Attorney, Agent, or Firm* — Klarquist Sparkman, LLP

(57) **ABSTRACT**

A golf club head has a body having a top, a sole, a toe end, a heel end, and a forward wall. The forward wall defines a front opening about which a face support is disposed. The face support receives a face plate, thereby enclosing the front opening of the body. The face support includes portions proximate to the top, the toe end, and the heel end, each portion having a peripheral member extending rearward from the forward wall and a rear member extending inward from the peripheral member, with respect to the front opening. The face support can be combined with a preferred face construction and weight elements to optimize club head performance to help a golfer achieve greater distance and control.

16 Claims, 8 Drawing Sheets





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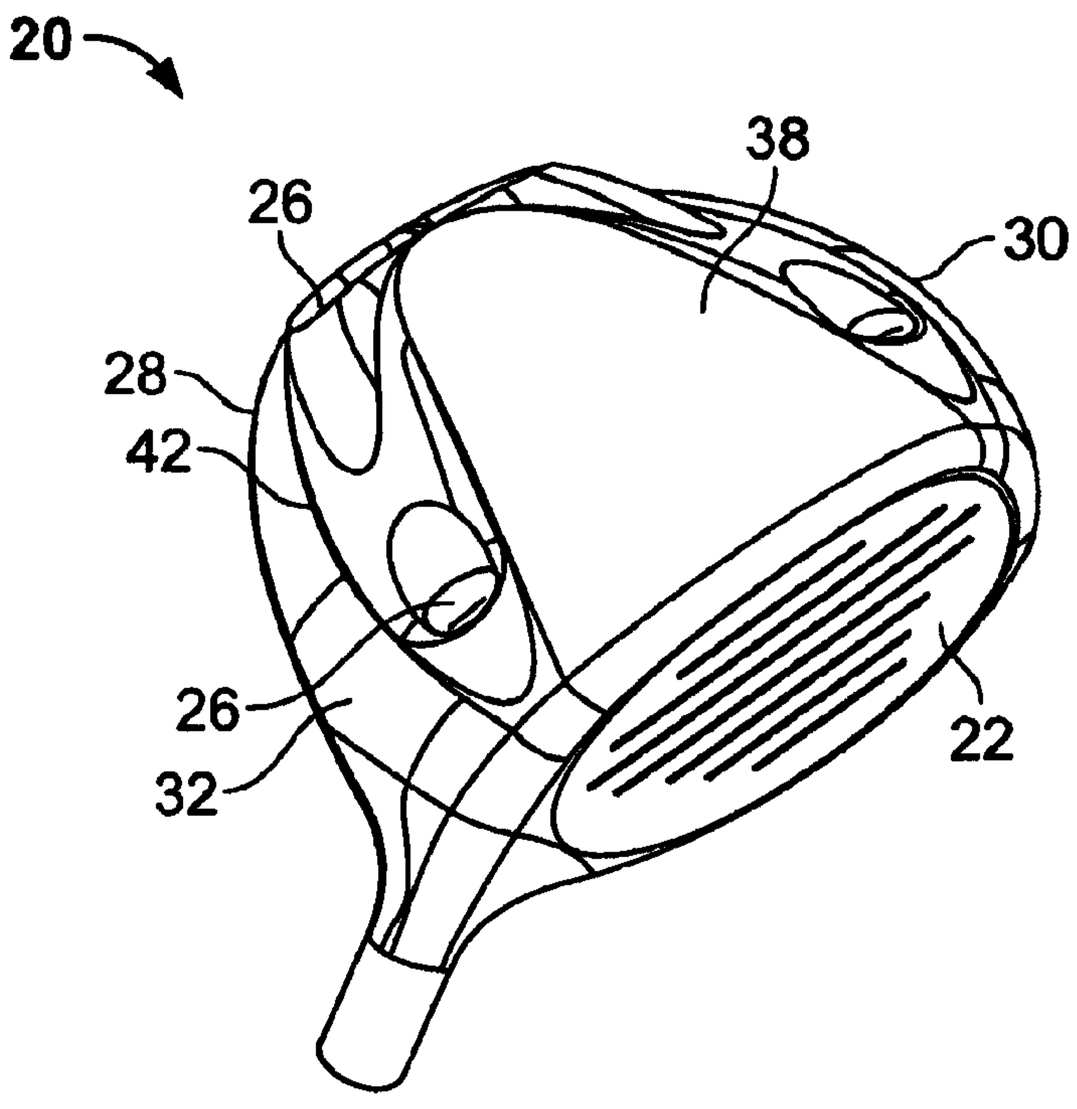


FIG. 1

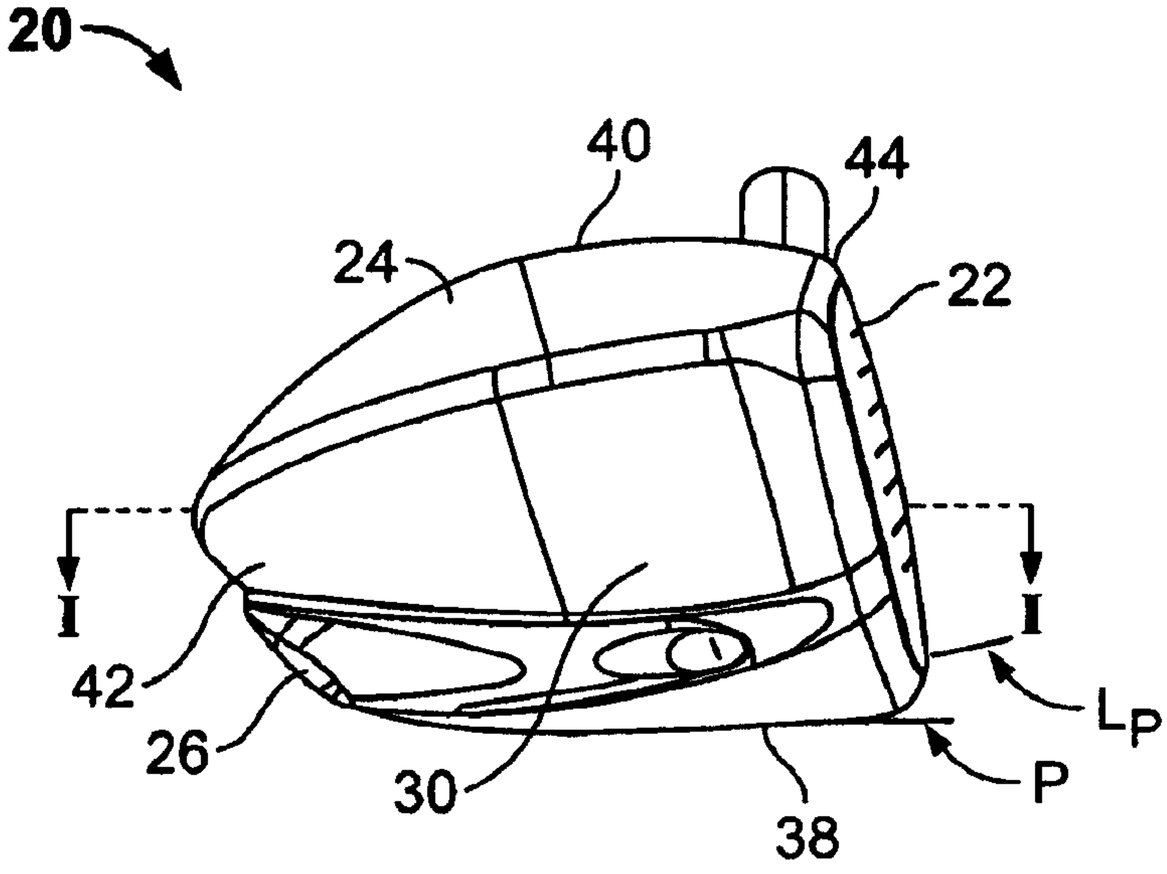
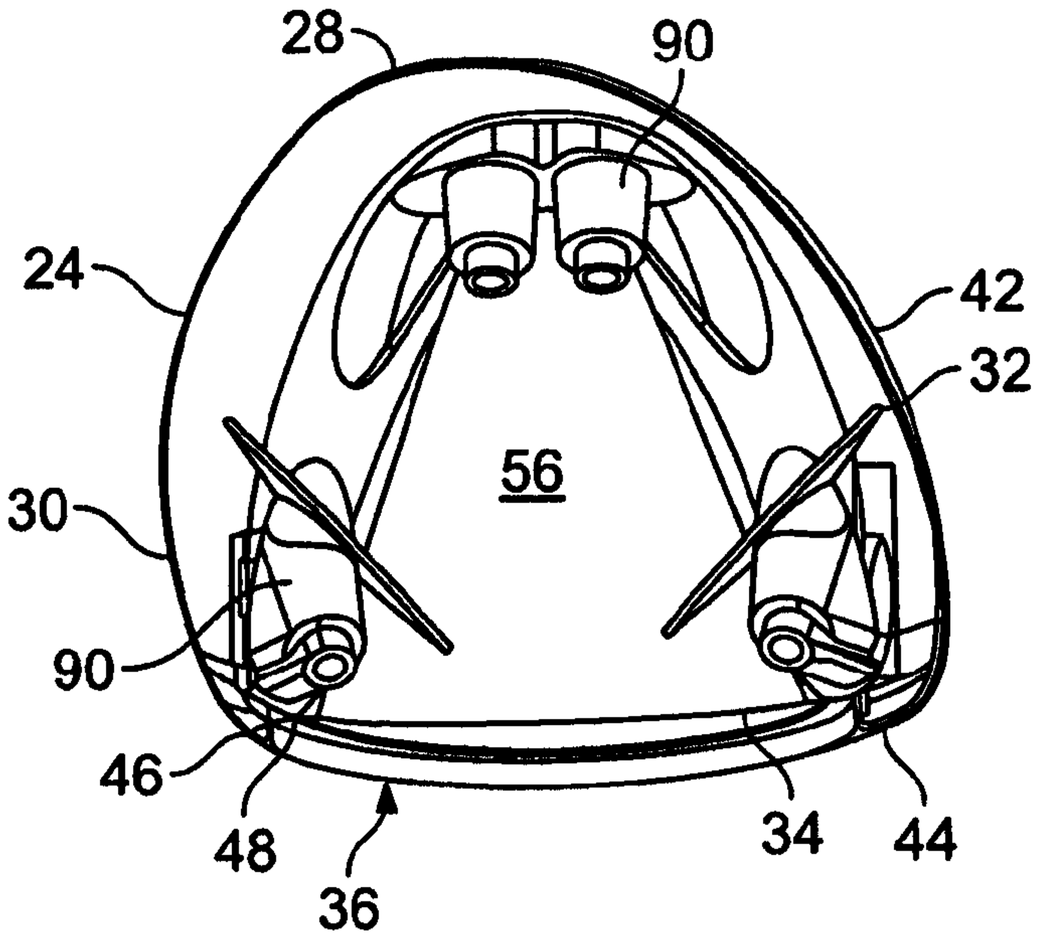


FIG. 2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90
24
42
32
56
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46
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36
34
44

FIG. 3

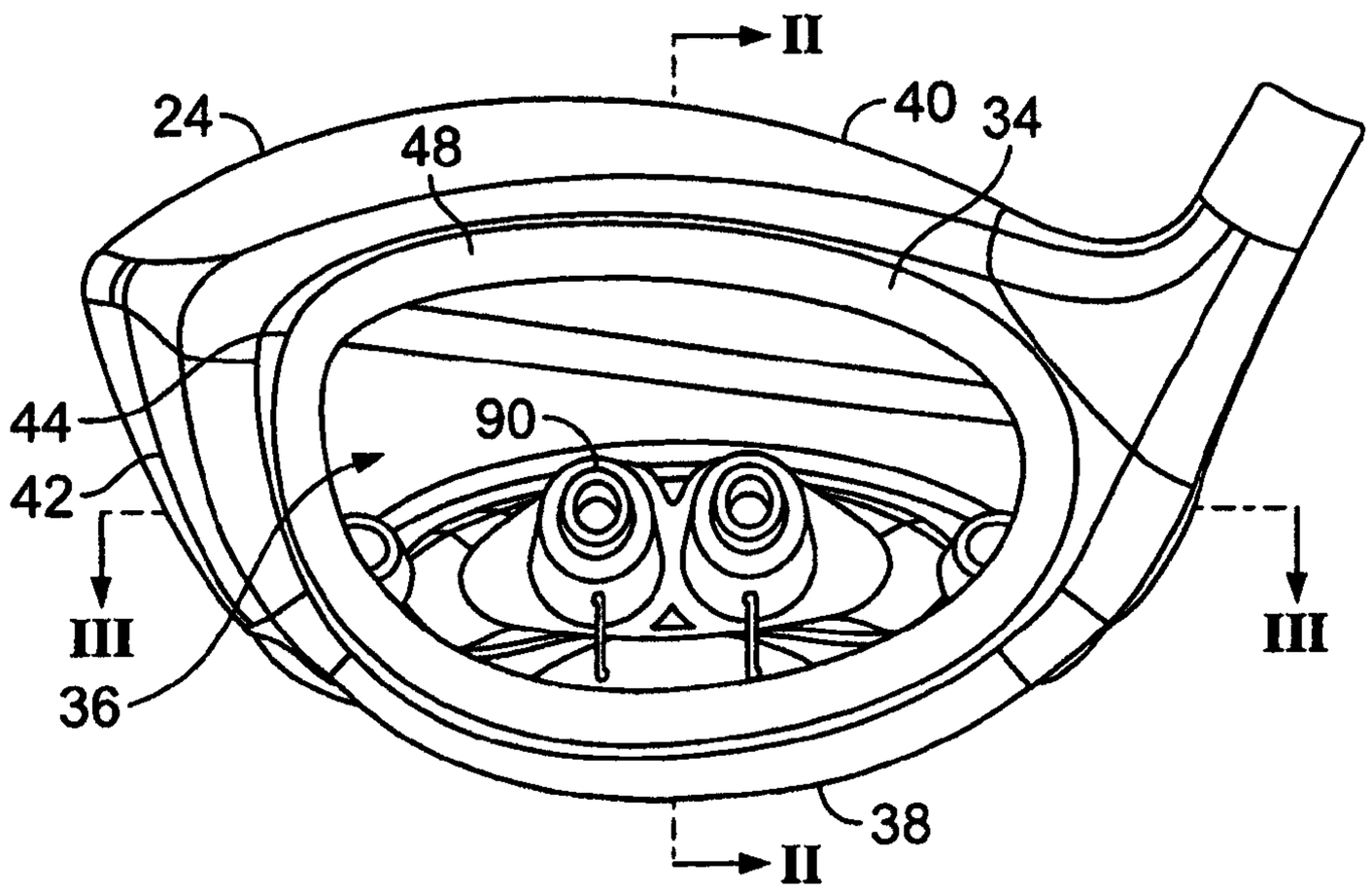
II
24
48
40
34
44
42
90
III
36
III
38
II

FIG. 4

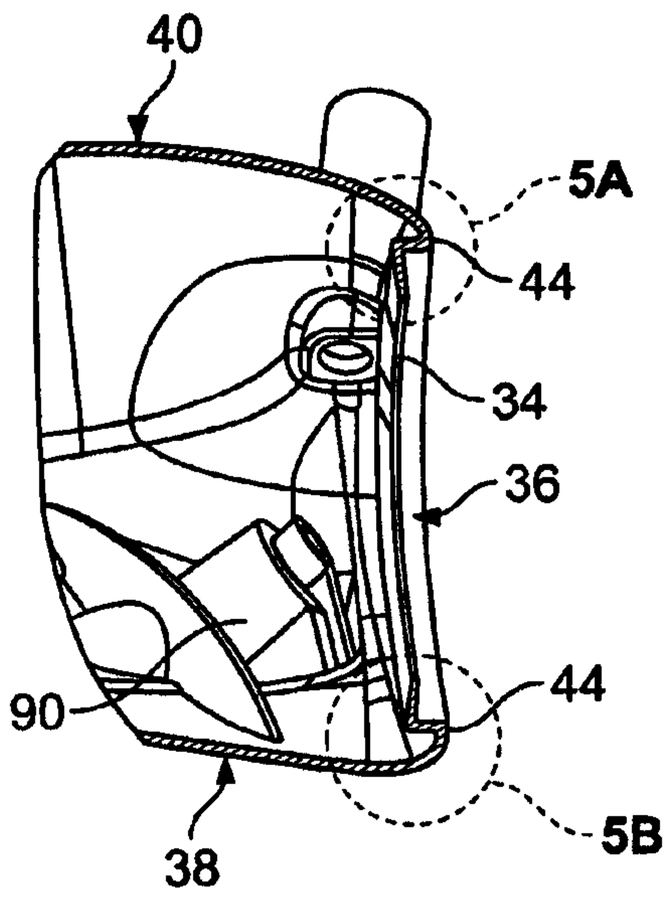

FIG. 5

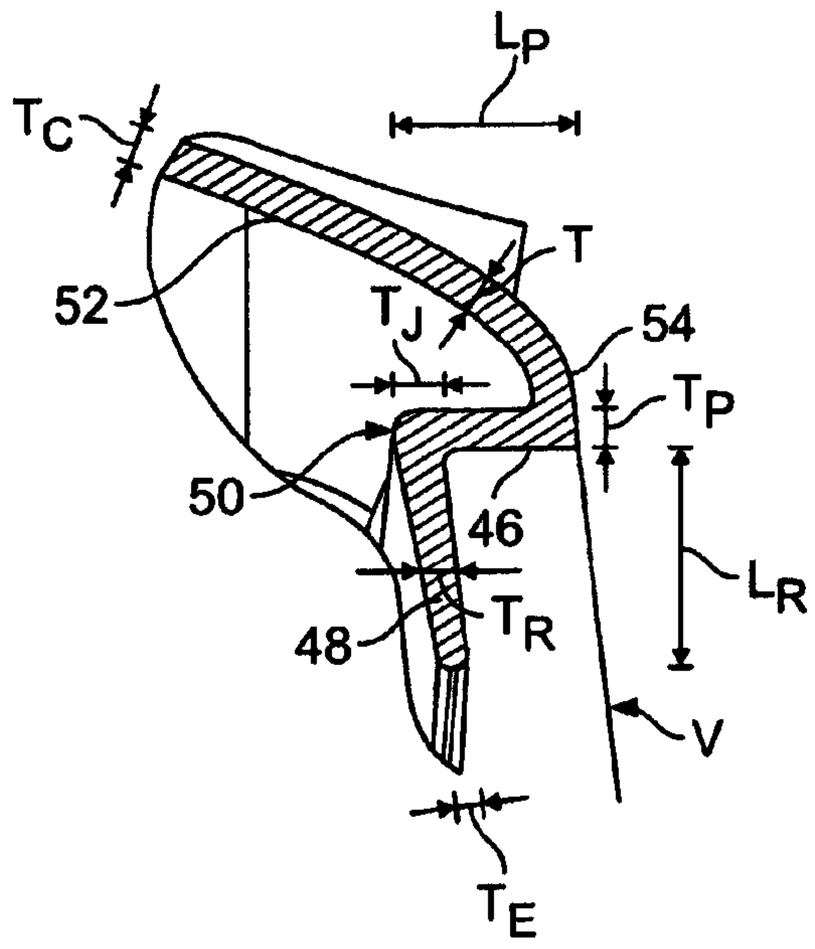

FIG. 5A

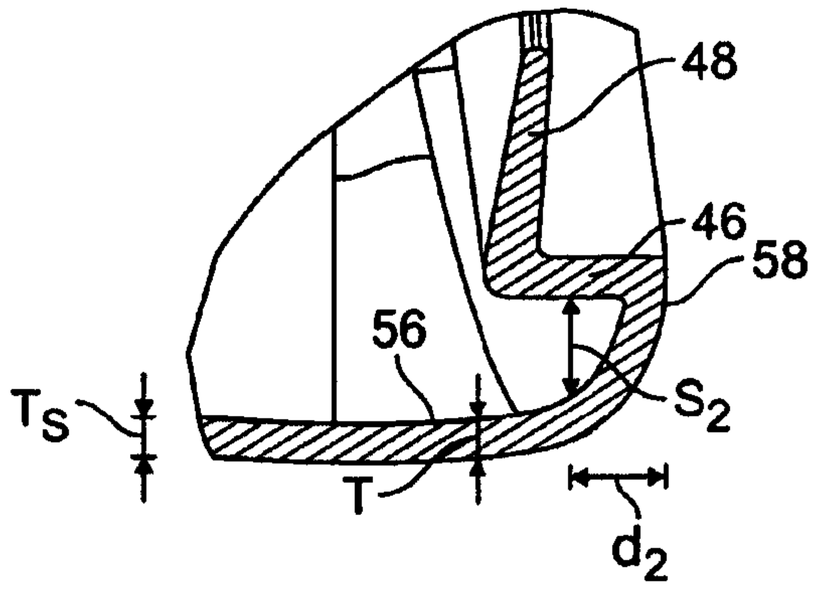

FIG. 5B

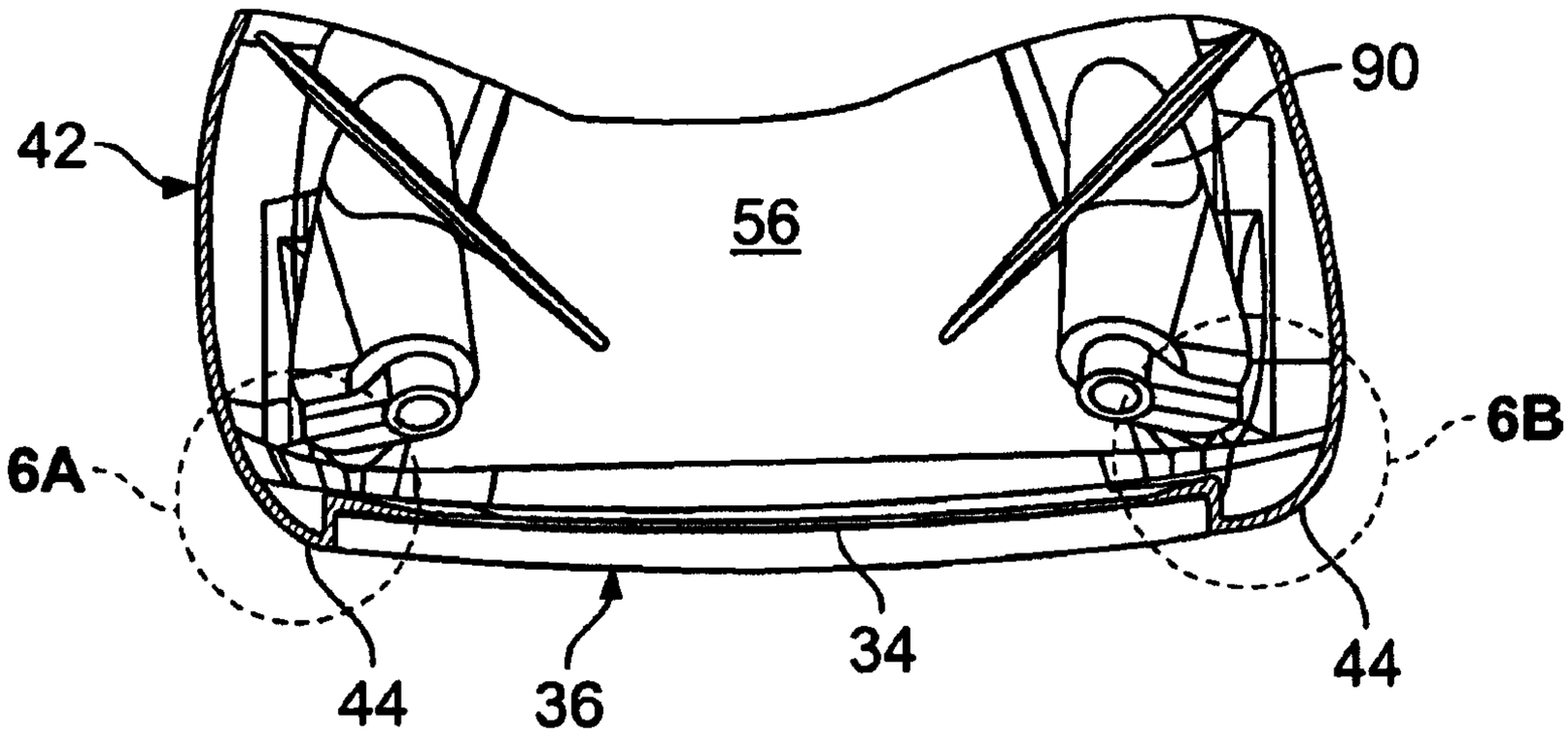

FIG. 6

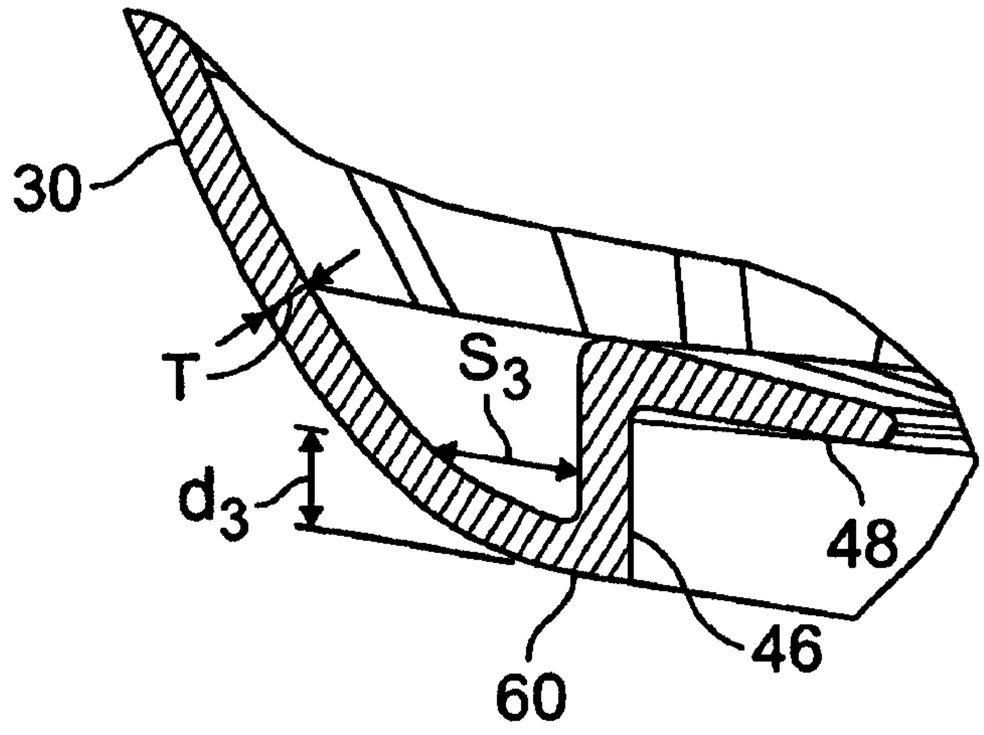

FIG. 6A

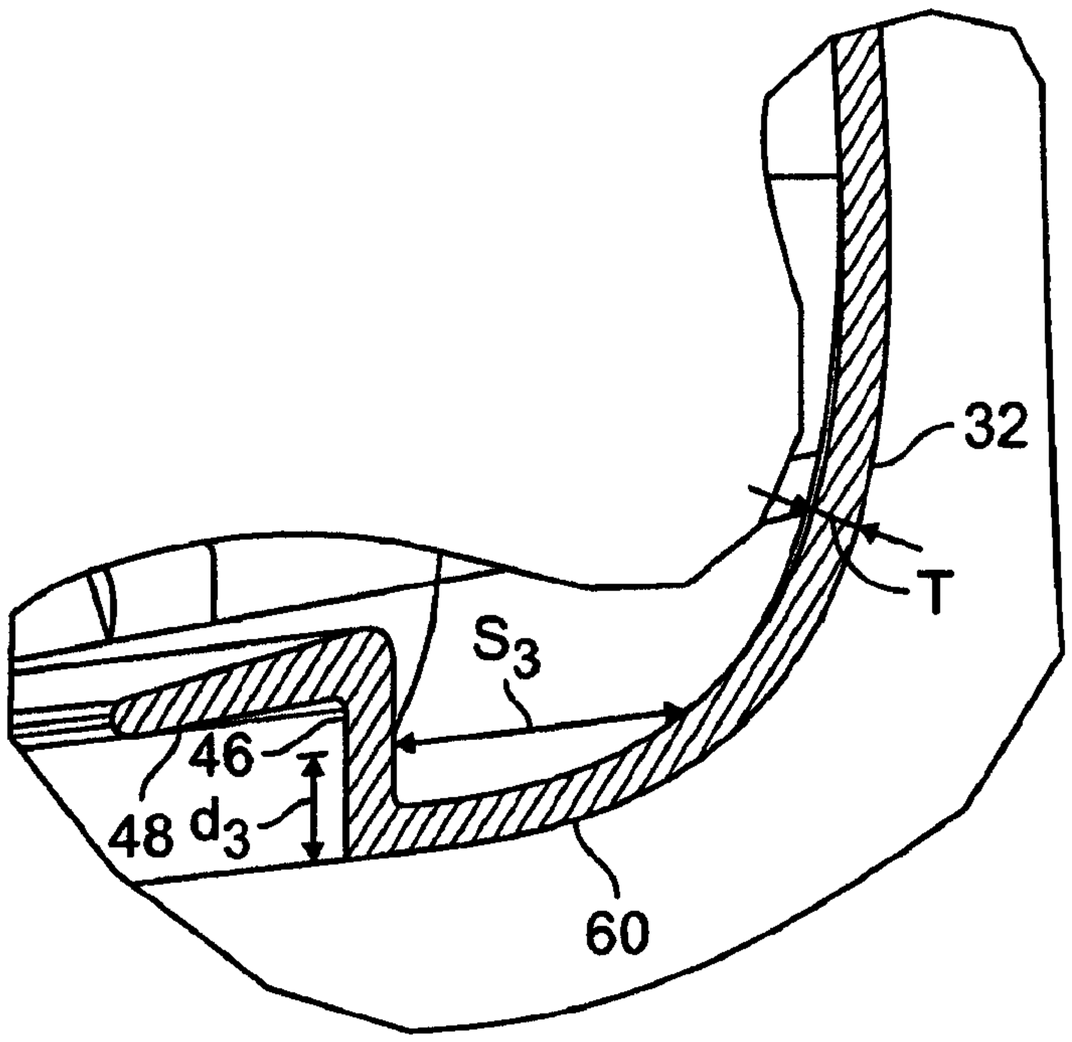

FIG. 6B

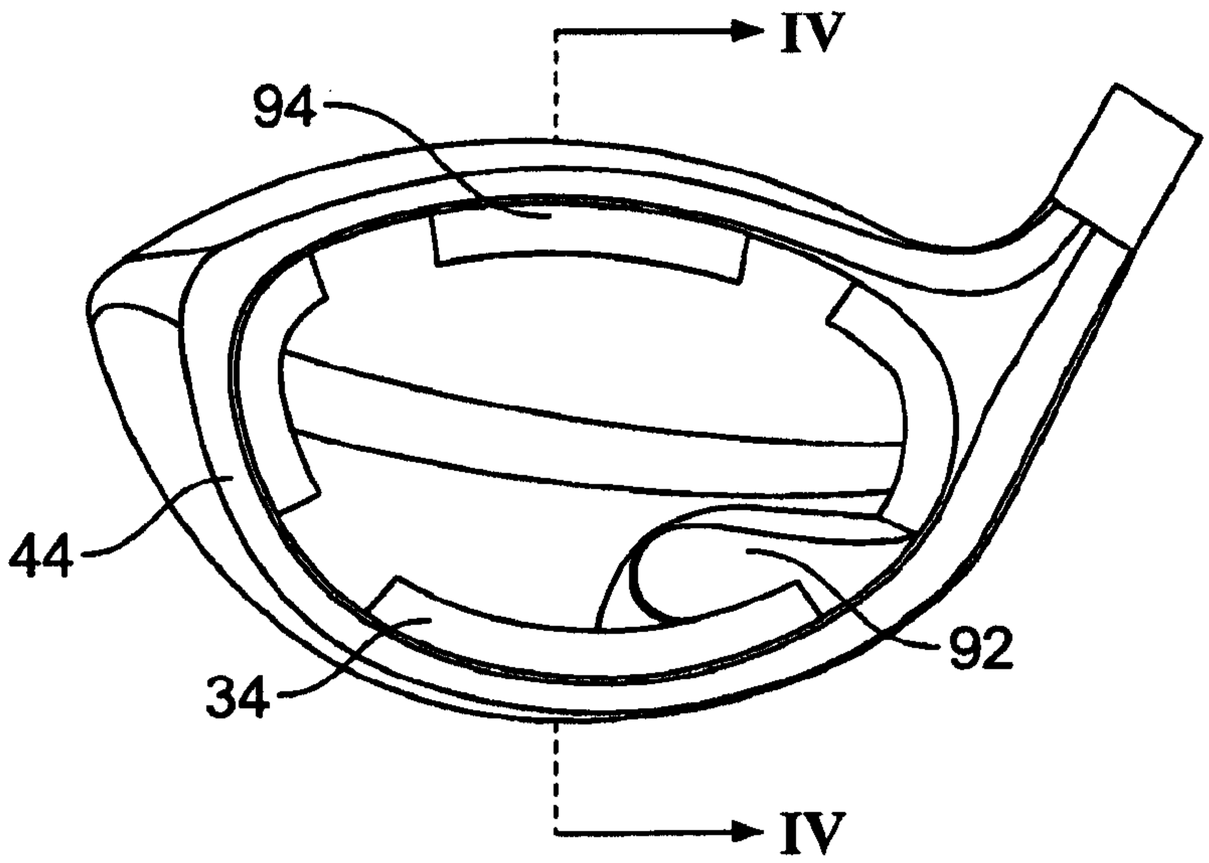

FIG. 7

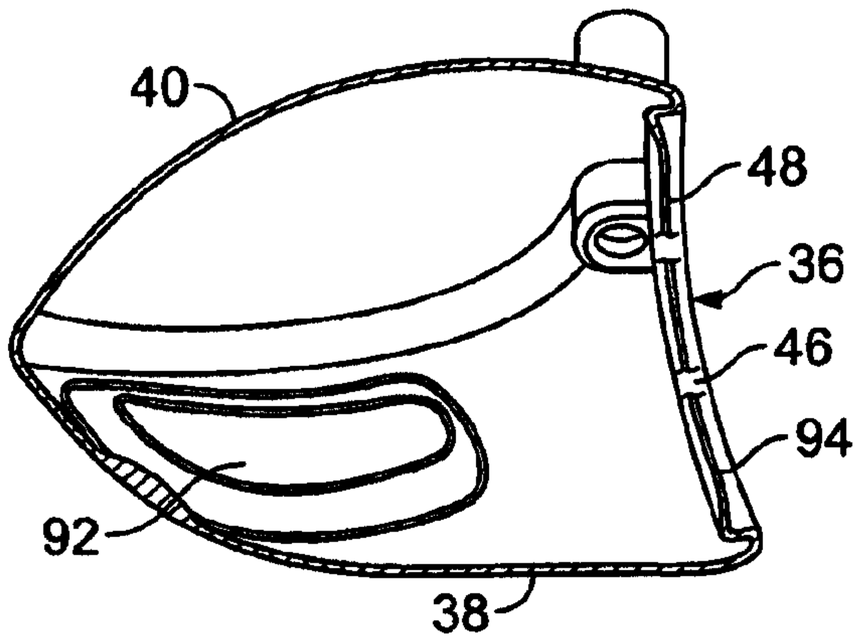

FIG. 8

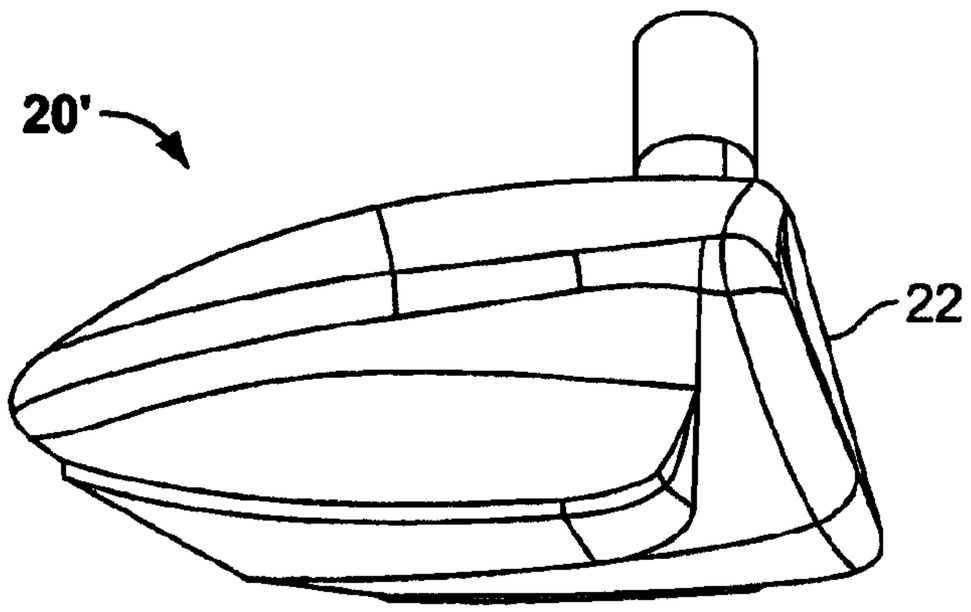

FIG. 9

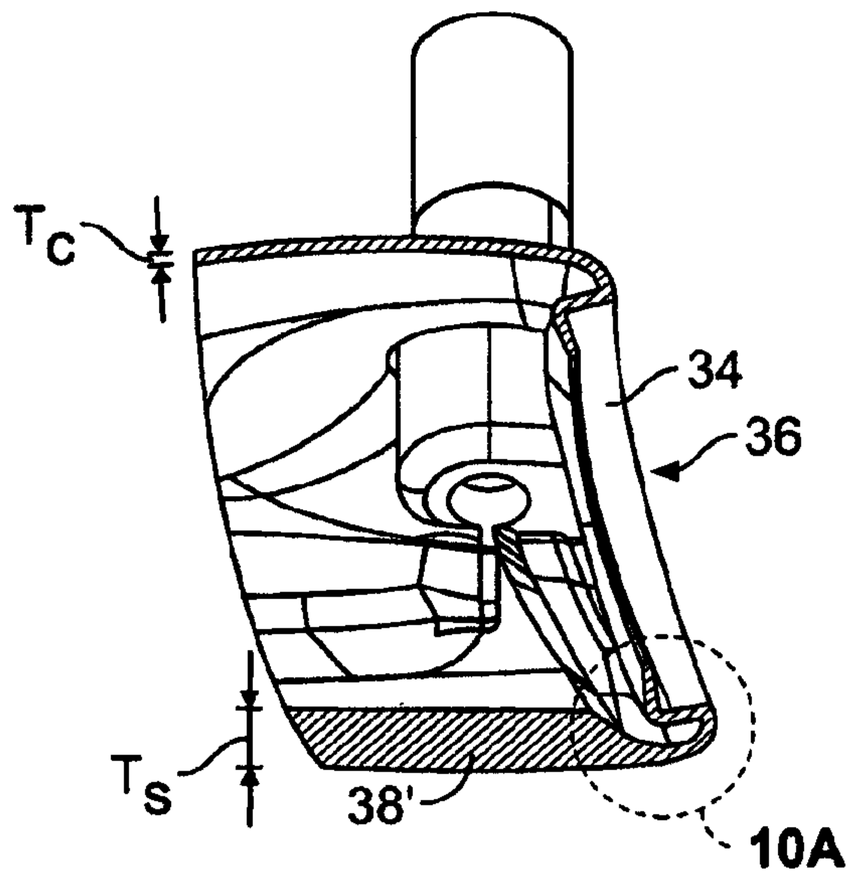

FIG. 10

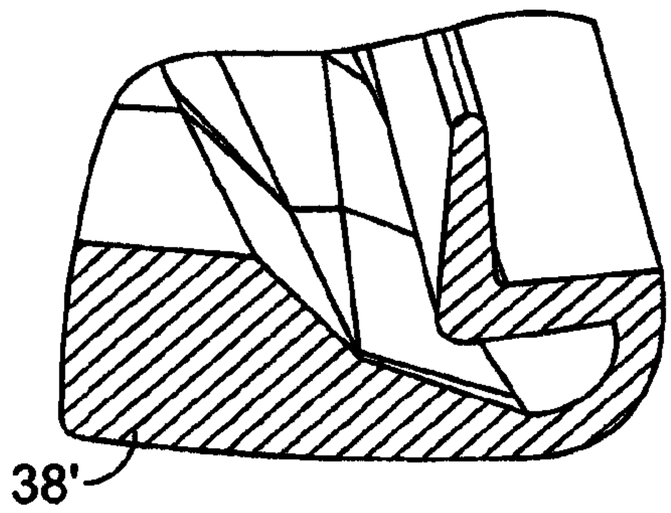

FIG. 10A

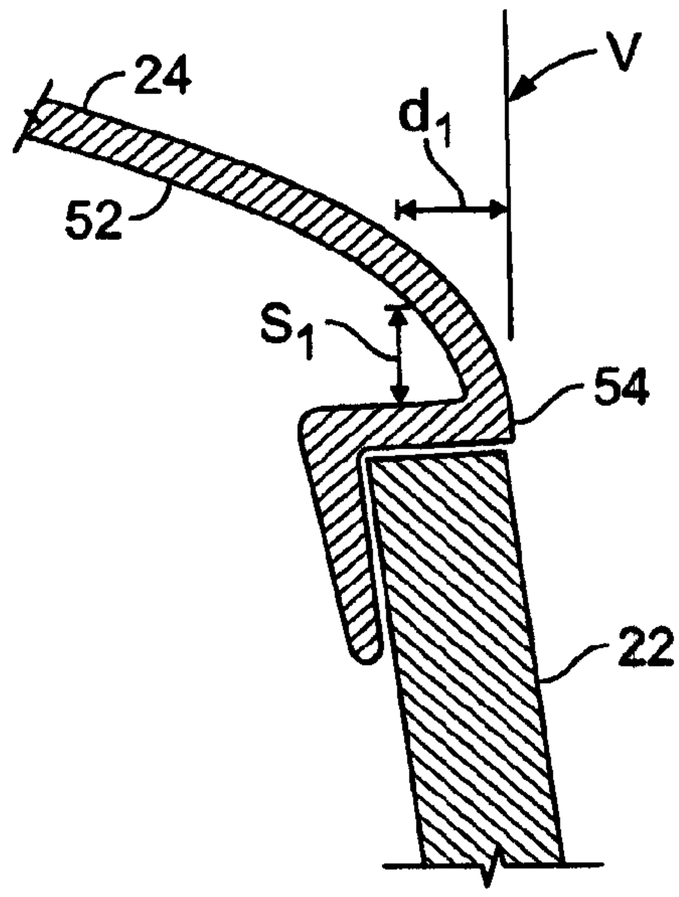

FIG. 11

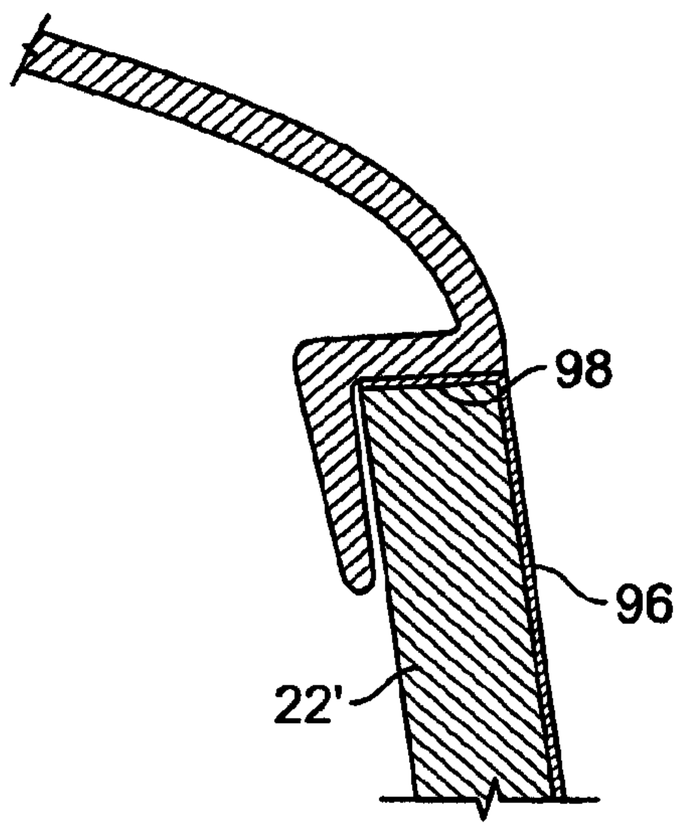

FIG. 12

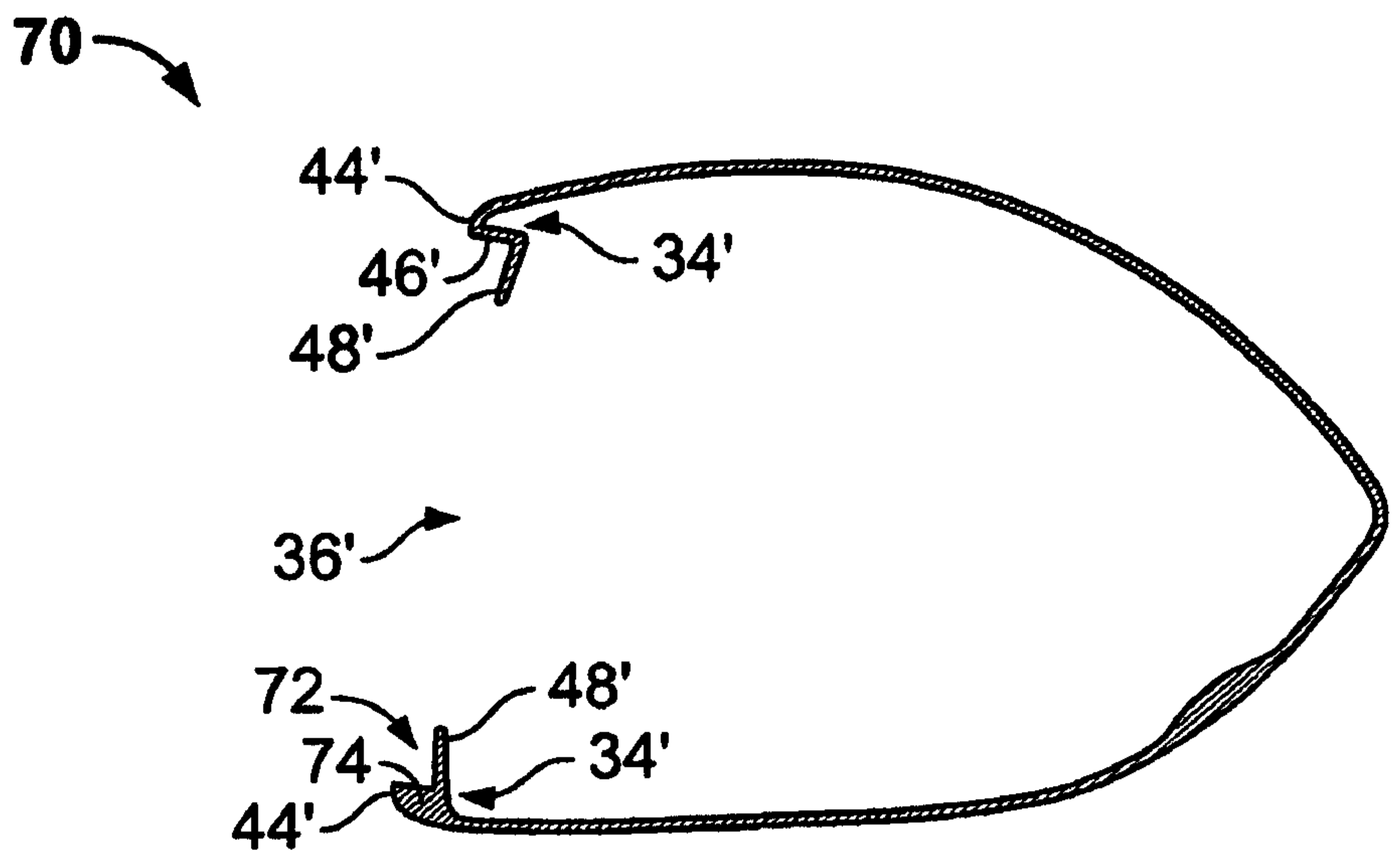

FIG. 13

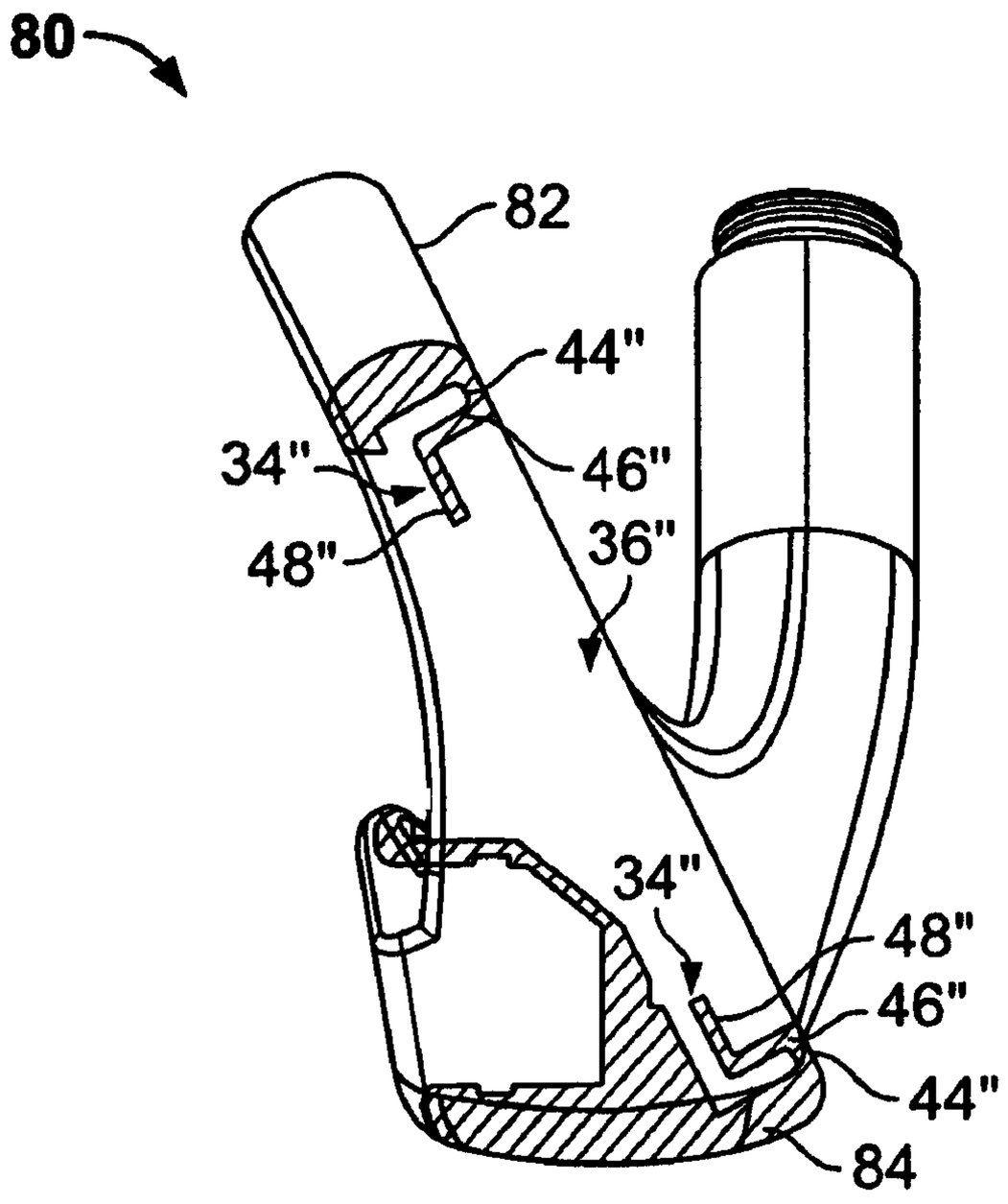

FIG. 14

GOLF CLUB HEAD

Matter enclosed in heavy brackets [ ] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue.

Notice: More than one reissue application has been filed for the reissue of U.S. Pat. No. 7,140,974. The application numbers are: (1) reissue application Ser. No. 11/998,435, filed Nov. 28, 2007, now Pat. No. Re. 42,544 and (2) the present application Ser. No. 13/149,485, which is a continuation reissue application of 11/998,435.

BACKGROUND OF THE INVENTION

The present invention relates generally to golf clubs and, more particularly, to an golf club head having an improved face plate support.

Many factors must be considered when designing a golf club head. One factor is the distribution of mass about the club head, which is typically quantified by parameters such as moments of inertia (MOI) magnitude and center of gravity (CG) location. Rotational moments of inertia of a club head about the club head CG are measures of a club head's resistance to rotation about the CG and are related to the distribution of mass within the club head about the CG. It is desirable for a club head to have high moments of inertia about the CG, particularly to promote forgiveness for off-center hits. To achieve high moments of inertia about the CG, designers typically position mass to the periphery of the golf club head and backwards from the face plate. In addition, a club head's CG is spaced from the face plate at a prescribed location to achieve a desired launch angle upon impact with a golf ball. As a result, for wood-type club heads (i.e., fairway woods and drivers), large internal volumes are typically desirable.

Another factor in club head design is the face plate of the club head. Upon impact with a golf ball, the face plate of a club head deflects and rebounds, thereby imparting energy to the struck golf ball. The club head's coefficient of restitution (COR) is the ratio of the difference between the ball speed after impact and the club speed after impact and the club speed before impact. A thin face plate generally will deflect more than a thick face plate. Thus, a properly constructed club with a thin, flexible face plate can impart a higher initial velocity to a golf ball than a club with a thick, rigid face plate. In order to maximize the MOI about the CG and achieve a high COR, it typically is desirable to incorporate thin walls and a thin face plate into the design of the club head. Thin walls afford the designers additional leeway in distributing club head mass to achieve desired mass distribution, and a thin face plate may provide for a high COR.

Thus, thin walls are important to a club's performance. However, overly thin walls can adversely affect the club head's durability. Problems also arise from stresses distributed across the club head upon impact with the golf ball, particularly at junctions of club head components, such as the junction of the face plate with other club head components (e.g., the sole, skirt, and crown). One prior solution has been to provide a reinforced periphery about the face plate, such as welding, in order to withstand the repeated impacts. Another approach to combat stresses at impact is to use one or more ribs extending substantially from the crown to the sole vertically, and in some instances extending from the toe to the heel horizontally, across an inner surface of the face plate. These

approaches tend to adversely affect club performance characteristics, e.g., diminishing the size of the sweet sport, and/or inhibiting design flexibility in both mass distribution and the face structure of the club head. Thus, these club heads fail to provide optimal MOI, CG, and/or COR parameters, and as a result, fail to provide much forgiveness for off-center hits for all but the most expert golfers.

It should, therefore, be appreciated that there exists a need for a golf club head having a face plate support that facilitates performance and durability. The present invention fulfills this need and others.

SUMMARY OF THE INVENTION

Briefly, and in general terms, the present invention provides a golf club head having enhanced durability and performance characteristics. The club head includes a face plate and a body having a face plate support for receiving the face plate. The body includes a top, a toe end and a heel end, a sole, and a forward wall. The forward wall defines a front opening about which the face plate support is disposed. The face plate support receives the face plate, thereby enclosing the front opening of the body.

More specifically, and by way of example, the face plate support is configured to enhance the durability and performance of the club head. The face plate support includes portions proximate to the crown, the toe end, and the heel end. Each of these face plate support portions includes a peripheral member extending rearward from the forward wall and a rear member extending inward from the peripheral member, with respect to the front opening. The face plate support can also include a portion proximate to the sole of the body. The face plate support contributes to increased COR even about the periphery of the face plate while providing durable support. Thus, the face plate can be designed with an emphasis or performance. For example, the face plate can be configured with a face thickness variation that provides a maximum COR over a larger face area than otherwise possible. Preferably, the face plate is formed from composite material; however, a lightweight metal face plate may alternatively be attached to a metal body of the club head. In addition, in an exemplary embodiment, a junction of the peripheral and rear members of the face plate support has a maximum thickness of between about 1.5 and 2 mm.

For purposes of summarizing the invention and the advantages achieved over the prior art, certain advantages of the invention have been described herein above. Of course, it is to be understood that not necessarily all such advantages may be achieved in accordance with any particular embodiment of the invention. Thus, for example, those skilled in the art will recognize that the invention may be embodied or carried out in a manner that achieves or optimizes one advantage or group of advantages as taught herein without necessarily achieving other advantages as may be taught or suggested herein.

All of these embodiments are intended to be within the scope of the invention herein disclosed. These and other embodiments of the present invention will become readily apparent to those skilled in the art from the following detailed description of the preferred embodiments having reference to the attached figures, the invention not being limited to any particular preferred embodiment disclosed.

BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments of the present invention will now be described, by way of example only, with reference to the following drawings in which:

FIG. **1** is a bottom perspective view of a first embodiment of a golf club head in accordance with the present invention, depicting a body and a face plate.

FIG. **2** is a toe-side elevational view of the golf club head of FIG. **1**.

FIG. **3** is a cross-sectional view, taken along line I—I of FIG. **2**, depicting the club head with the face plate removed.

FIG. **4** is a front elevational view of the body of the club head of FIG. **1**, depicting a recessed face plate support about a front opening of the body.

FIG. **5** is a partial cross-sectional view, taken along line II—II of FIG. **4**.

FIG. **5**A is a detailed view at section A of FIG. **5**, depicting a portion of the face plate support adjacent to the crown of the club head.

FIG. **5**B is a detailed view at section B of FIG. **5**, depicting a portion of the face plate support adjacent to the sole of the club head.

FIG. **6** is a partial cross-sectional view, taken viewed along line III—III of FIG. **4**.

FIG. **6**A is a detailed view at section A of FIG. **6**, depicting a portion of the face plate support adjacent to the toe end of the club head.

FIG. **6**B is a cross-sectional view at section B of FIG. **6**, depicting a portion of the face plate support adjacent to the heel end of the club head.

FIG. **7** is a front elevational view of a second embodiment of a body for a golf club head in accordance with the present invention, depicting a face plate support having a plurality of tabs about a front opening of the body.

FIG. **8** is a cross-sectional view taken along line IV—IV of FIG. **7**.

FIG. **9** is a toe-side elevational view of a third embodiment of a club head in accordance with the present invention.

FIG. **10** is a partial cross-sectional view of the body of the club head of FIG. **9**, depicting a recessed face plate support about a front opening of the body.

FIG. **10**A is a cross-sectional view at section A of FIG. **10**, depicting a portion of the face plate support adjacent to the sole of the club head.

FIG. **11** is a cross-sectional view similar to FIG. **5**A, depicting a composite face plate secured to the face plate support of the body.

FIG. **12** is a cross-sectional view similar to FIG. **11**, depicting a composite face plate having a metal cap at an outer surface.

FIG **13** is a cross-sectional view of a fourth embodiment of a body for a wood-type golf club head in accordance with the present invention, depicting a face plate support of the body having a portion, including a rear member, adjacent to the sole.

FIG. **14** is a cross-sectional view of a fifth embodiment of a body for an iron golf club head in accordance with the present invention, depicting a face plate support of the body disposed about a front opening.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The drawings include preferred embodiments of golf club heads in accordance with the present invention. With reference to FIGS. **1-4**, a wood-type club head **20** is shown having a separate face plate **22** and a body **24**. The body **24** and the face plate **22** are relatively light, thereby facilitating the use of four removable weights **26** disposed about the periphery of the club head **20**, including two weights in a rear region **28** of the body **24**, one weight in a toe region **30** of the body, and one weight in a heel region **32** of the body. The body **24** includes a face plate support **34** disposed about a front opening **36** of the body for receiving the face plate **22**. The face plate support **34** provides durable support for the face plate **22** while contributing to enhanced club performance, such as a high COR even about the periphery of the face plate. More particularly, upon impact with a golf ball, the face plate support **34** promotes accommodates deflection of the face plate **22** even about the periphery thereof.

The body **24** includes a sole **38**, a top (i.e., crown **40**), a skirt **42**, and a forward wall **44**. The face plate support **34** includes a peripheral member **46** extending rearward from the forward wall **44** and a rear member **48** extending inward with reference to the front opening **36**. The face plate support **34** includes portions proximate to the crown **40**, the toe **30**, the heel **32** and the sole **38**. More particularly, in the exemplary embodiment, the face plate support **34** is continuous about the front opening **36**. In other embodiments, portions of the face plate support **34** can be configured as a plurality of tabs spaced apart about the front opening **36**. One such example is depicted in FIGS. **7** and **8** and is discussed in further detail below. Also, in other embodiments (e.g., FIGS. **13** and **14**), the portion of the face plate support **34** proximate to the sole **38** may not include a thin peripheral member **46**.

With reference to FIGS. **1-4**, the face plate support **34** is recessed relative to the forward wall **44** allowing the face plate **22** to sit flush with the forward wall **44** of the body **24**. In the portions of the face plate support **34** proximate to the crown **40** and sole **38**, the peripheral member **46** is generally perpendicular to a face plane (V) (i.e., a plane tangent to a point at the geometric center of the face plate striking surface), and the rear member **48** is generally parallel to the face plane (V). As best seen in FIG. **2**, a loft plane (LP) of the club head is normal to the face plane (V) and forms an acute angle with a horizontal ground plane (P) when the club head **20** is at address position. Adjacent the toe and heel ends **30**, **32**, of the skirt **42** the peripheral member **46** is generally parallel to the face plane (V).

With reference now to FIG. **5** through FIG. **6**B, the face plate support **34** is configured to provide durable support while facilitating club performance. More particularly, the face plate support **34** is sufficiently thin to promote a high COR, even about the periphery of the face plate **22**, and is structured to provide ample surface area for receiving the face plate, thereby enhancing club head durability. The rear member **48** of the face plate support **34** has a thickness T_R between about 0.5 mm and 2.5 mm and a length L_R between about 2 mm and 25 mm. The dimensions of the face plate support **34** can vary in other embodiments of the invention. For example, the dimensions of the face plate support **34** can vary depending upon the materials used to form the club head **20**, head volume, and face plate dimensions. Preferably, the thickness T_R is between about 0.6 mm and 1.5 mm and the length L_R is between about 2 mm and 15 mm, and most preferably the length L_R is between about 2 mm and 7 mm. The peripheral member **46** of the face plate support **34** has a thickness T_P between about 0.5 mm and 2.5 mm and a length L_P between about 3 mm and 30 mm. Preferably, the thickness T_P is between about 0.8 mm and 1.2 mm, and more preferably, the thickness T_P is about 1 mm. The peripheral member **46** preferably has a length L_P between about 4 mm and 6 mm. While the peripheral member **46** most preferably is substantially constant in thickness, the rear member **48** preferably tapers inwardly toward a center of the front opening **36**. At an inner end of the rear member **48**, the thickness T_E is between about 0.6 mm and 0.9 mm.

At a junction **50** of the peripheral and rear members **46**, **48** of the face plate support **34**, there is preferably a maximum thickness T_J between about 1.5 mm and 2 mm. In the preferred embodiment of FIGS. **1**–**6**, the peripheral member **46** is spaced from an inner surface **52** of the crown **40** by a distance S_1 measured in a vertical direction at a distance d_1 rearward from an upper forward wall **54** of the body **24** proximal the front opening **36**; this is more clearly shown in FIG. **11**. Distance S_1 is at least 1 mm and distance d_1 is about 2 mm. Similarly, the peripheral member **46** is spaced from an inner surface **56** of the sole **38** a vertical distance S_2 measured at a distance d_2 rearward from a lower forward wall **58** of the body **24** proximal the front opening **36**. Distance S_2 is at least 1 mm and distance d_2 is about 2 mm. Preferably, the peripheral member **46** is spaced from the crown **40** and sole **38** at least 1.5 mm measured in a vertical direction.

Referencing FIG. **6**, at the toe and heel ends **30**, **32** the skirt **42**, the peripheral member **46** is spaced from an inner surface of the body **24** by a distance S_3 measured in a horizontal direction at a distance d_3 rearward from a side forward wall **60** of the body **24** proximal the front opening **36**. Distance S_3 is at least 1.5 mm and distance d_3 is about 2 mm. Preferably, distance S_3 is at least 2 mm.

Preferred dimensions for the body **24** of the golf club head **20** of FIG. **1** are in the range of 0.7 mm to 1 mm for the crown thickness T_C and in the range of 0.8 mm to 1.2 mm for the sole and the skirt thickness T_S. Referencing FIG. **5**B, the wall thickness T of the wall that transitions from the crown **40**, sole **38**, toe **30**, and heel **32** to the forward wall **44** and the front opening **36** is preferably about 1 mm. This results in a smoother transition to the thickness T_P of the peripheral member **46** of the face plate support **34**. Of course, for golf club heads having smaller volumes the desirable dimensions for the club head may vary. For example, fairway wood club heads **10'** having a club head volume in the range of about 130 cc to 190 cc may have substantially thicker soles **38'**, as shown in FIGS. **9**, **10** and **10**A.

With reference now to FIG. **13**, a body **70** is depicted for use in a wood-type golf club head. For convenience of reference, like components are given like reference numerals. The body **70** includes a face plate support **34'** continuous about a front opening **36'**. In the present embodiment, the face plate support **34'** includes a lower portion **72** adjacent to a sole **38** of the body **70**. The lower portion **72** includes a rear member **48'** extending from a lower lip **74** of the body **70** and having dimensions similar to those discussed above. The rear member **48'** extends inward with respect to the front opening **36'** and is recessed to allow a face plate (not shown) to sit flush with the body **70**. In the present embodiment, the entirety of the lower portion **72** of the face plate support **34'** excludes a thin peripheral member. However, in other embodiments, the lower portion **72** can include a thin peripheral member only at prescribed locations along the lower portion. Although the present embodiment is for use in a wood-type club head, similar face plate support configurations in which the face plate support does not include a thin peripheral member at prescribed locations, can also be used for other club heads, such as in iron-type club heads(e.g., one-irons through wedges). Moreover, other embodiments of club heads can incorporate a face plate support comprising a plurality of tabs in which selected tabs adjacent to the sole **38** do not include a thin peripheral member, as discussed above.

With reference now to FIG. **14**, a body **80** is depicted for use in an iron-type golf club head. The body **80** includes a top **82**, sole **84**, a toe end, a heel end, and a face plate support **34"** similar to face plate supports **34** and **34'** described in the previous exemplary embodiments. The face plate support **34"** includes a peripheral member **46"** extending rearward from a forward wall **44"** and a rear member **48"** extending inward with reference to the front opening **36"**. The face plate support **34** is sufficiently thin to promote performance (i.e., higher COR about a peripheral portion of the face plate), and is structured to facilitate club durability. The dimensions for the peripheral and rear members **46"**, **48"** (e.g., thickness and length) are similar to those discussed above. In the exemplary embodiment, the face plate support **34** is continuous about the front opening **36**. In other embodiments, the face plate support **34** can be configured as a plurality of tabs spaced apart about the front opening **36**.

With reference again to FIGS. **1-4**, the club head **20** has four removable weights **26**. Two weights are located in the rear region **28** of the club head **20**. A third weight is located in the toe region **30** of the club head **20**, and a fourth weight is located in the heel region **32** of the club head. The weights **26** are accessible from the exterior of the club head **20** and securely received into recesses **90**. In the exemplary embodiment, each weight **26** is oriented such that a longitudinal axis defined by each weight is directed toward the face plate **22**. Fewer, such as two or three weights, or more than four weights may be provided as desired.

Various weight configurations may be used, such as those disclosed in co-pending U.S. patent applications Ser. Nos. 10/290,817 and 10/785,692, which are incorporated herein by reference. In the exemplary embodiment, the weights **26** are attached by screws, such as those available from Textron, Inc., under the brand names TORX® or TORX PLUS®. Screws, such as those available from Textron, Inc., under the brand name CAMCAR®, can be used as one or more of the weights. In the exemplary embodiment, four weights **26** having a combined mass of about 23 g are provided as shown in FIG. **3**, wherein the volume of the club head is about 460 cc. A total mass of the club head **20**, including a face plate mass of about 24 g, is about 199 g. With this arrangement, the magnitude of a moment of inertia about a vertical axis at a center of gravity of the club head, I_{ZZ}, is about 405 kg-mm^2.

With continued reference to FIGS. **1-4**, the body **24** for the club head **20** comprises cast titanium alloy. In other embodiments, other metal or non-metallic materials may be used, for example, the body can be formed of materials such as squeeze-cast magnesium alloy, steel, and combination of magnesium and titanium alloys. Also, a multi-piece body may be used including one or more different materials. For example, a body may be provided with a sole, skirt, partial crown and face opening formed by metal casting methods known to those skilled in the art. A stamped metal or composite crown may be included to complete the crown of the body and a forged metal or composite face plate may be attached to form the club head **20**. Alternatively, a composite body may be provided.

A hollow club head having features of the present invention can range in volume from about 130 cc to about 460 cc. Preferably, the head has a volume of at least 360 cc and more preferably at least 400 cc. The removable weights preferably comprise a mass of between about 20 g and 30 g., for a total head weight between about 180 g to 205 g. The moment of inertia I_{ZZ} is preferably at least 300 kg-mm^2 for the present invention and more preferably is at least 350 kg-mm^2.

The club head may be formed by casting techniques known to those skilled in the art, preferably by investment casting a titanium alloy such as Ti-6Al-4V. Alternatively, a soluble wax core may be used to create the specific internal structures (e.g., face plate support, weight recess) to achieve the desired club head MOI and CG location parameters. In particular, a separate wax mold may be created for the recesses for the

weights **26** that is then attached to a main wax mold for the club head body **24**, such as by gluing the two wax molds. In the exemplary embodiment, the forward, heel and toe recesses **90** are formed as part of a unitary head body **24**. Alternatively, the weight recesses **90** may separately formed and welded to an internal location of the club head body **24**. Of course, alternative embodiments of the present invention may include integral, thickened wall portions **92**, such as shown in FIGS. **7** and **8**, in lieu of removable weights **26**. Alternative embodiments may omit distinct weight elements completely.

In several exemplary embodiments, the face plate **22** is formed of composite material; nonetheless, a lightweight metal face plate **22** can also be used. Referring now to FIG. **11**, the plies (layers) of composite material (prepreg) comprising the composite face plate **22** can be defined according to the combination of fiber, resin system, fiber area weight (FAW) and resin content (R/C) used. One example of a preferred prepreg is 70 g FAW 34/700 material which comprises 34/700 fiber, Newport 301 resin, 70 g/m^2 FAW and 40% R/C. Various embodiments of suitable composite face plates, and methods of manufacture, are disclosed in co-pending U.S. patent application Ser. No. 10/442,348 filed May 21, 2003 and titled GOLF CLUB HEAD AND METHOD OF MANUFACTURE, which is incorporated herein by reference.

The composite face plate **22** can be manufactured by stacking and cutting the plies in predetermined orientations. This may be done in smaller groups of plies that are eventually stacked to form the final thickness of the face plate **22**. More particularly, the plies of prepreg can be arranged in specific groups in which each ply has a predetermined orientation with reference to a horizontal axis. For example, a first or outermost ply may comprise 1080 glass fabric oriented at 0 degrees, followed by 48 plies of 34/700 prepreg oriented such that 12 plies each are at 0, +45, 90 and −45 degrees. Another ply of 34/700 at 90 degrees precedes the final or innermost ply of 1080 glass fabric oriented at 0 degrees.

The face plate **22** preferably achieves its final desired shape or dimensions by die cutting. The final desired bulge and roll of the face plate **22** may be achieved during the last of two or more "debulking" or compaction steps of two minutes each to reduce air trapped between plies. Preferably a third debulking step includes forming a panel having the final desired bulge and roll, and more preferably an additional fourth debulking step is provided to form the panel to a final face thickness, where the duration of the fourth debulking step is about three minutes. The weight and thickness of the resulting panel are preferably measured prior to the curing step.

Preferably, the composite golf club face comprises low fiber area weight (FAW) materials, and has a thickness less than about 4 mm. The weight savings from the use of the composite face is about 20 g to 25 g compared to a 2.7 mm thick face plate formed from a titanium alloy such as Ti-6Al-4V, for example. For fairway wood golf club heads, the face plate is preferably at least 60 mm wide and 25 mm high. For driver-type golf club heads, the face plate is preferably at least 80 mm wide and 50 mm high.

Attaching a composite material face plate **22** to a metallic club head body **24** may be accomplished with adhesives. In order to prevent peel and delamination failure at the face-body junction, the composite face plate **22** should be recessed from or substantially flush with the plane of the forward surface of the metal body **24** at the junction, as shown in FIG. **11**. Preferably, the composite face plate **22** is sufficiently recessed so that the ends of the fibers are not exposed. The junction of the composite face plate **22** and the metal body **24** preferably includes an annular ledge as the face support **34**. Alternatively, the face plate support **34** may comprise two or more sections **94** (FIGS. **7**–**8**) or a plurality of tabs, to support and attach the face plate.

In a preferred embodiment shown in FIG. **12**, the face plate comprises a titanium cap **96** placed over a composite portion **22'** to form the striking surface of the face plate. Preferably, the titanium cap includes a peripheral rim **98** to cover the periphery of the composite portion **22'**, wherein the rim may be continuous or comprise a plurality of segments. The titanium cap thickness is less than about 1 mm, and preferably, the titanium cap thickness is less than 0.2 mm. The cap in one test sample was formed from Ti-6Al-4V titanium alloy; however, other materials or titanium alloys may be employed as desired. The thickness of the composite portion **22'** of the face plate is about 3.65 mm and the titanium cap thickness is about 0.3 mm. Also preferably, a bond gap of about 0.05 mm to 0.2 mm, and more preferably about 0.1 mm, is provided between the titanium cap **96** and the composite portion **22'** for adhesive attachment of the titanium cap over the composite portion. In other embodiments, a composite portion **22'** can be provided without a titanium cap, in which case a front surface of the composite portion **22'** may comprise the striking surface of the face plate.

A surface roughness can be provided to the composite face plate **22** to facilitate adhesive bonding. In a first approach, a layer of textured film may be placed on the composite material before curing, thereby forming a given surface roughness on the cured composite material. An example of such a textured film is ordinary nylon fabric. Curing conditions do not degrade the fabric, and an imprint of the fabric texture is transferred to a surface of the composite material. Tests have shown that adhesion of urethane and epoxy, such as 3M® DP460, to the textured composite surface was greatly improved and superior to adhesion to a metallic surface, such as cast titanium alloy. In a second approach, the texture can be incorporated into a mold surface, allowing the textured area to be controlled precisely. For example, in an embodiment having a composite face plate joined to a cast body, the texture can be located on surfaces of the composite face plate where shear and peel are dominant failure modes.

It should be appreciated from the foregoing that the present invention provides a golf club head that includes a face plate and a body having a top, a sole, a toe end, a heel end, and a forward wall. The forward wall defines a front opening about which a face support is disposed. The face support receives the face plate, thereby enclosing the front opening of the body. A face plate is received in a face support provided at the front opening. The face support includes portions proximate to the top, the toe end, and the heel end. Each portion of the face support includes a peripheral member extending rearward from the forward wall and a rear member extending inward from the peripheral member, with respect to the front opening. The face support can be combined with a preferred face construction and weight elements to optimize club head performance to help a golfer achieve greater distance and control.

Although the invention has been disclosed in detail with reference only to the preferred embodiments, those skilled in the art will appreciate that additional golf club heads can be included without departing from the scope of the invention. Accordingly, the invention is defined only by the claims set forth below.

We claim:

[1. A golf club head, comprising:

a body having a top, a sole, a toe end, a heel end, and a forward wall, the forward wall defining a front opening, the body further having a face support disposed about

the front opening, the face support having portions proximate to the top, the toe end, and the heel end, the face support including

a peripheral member extending rearward from the forward wall for a length between about 3 mm and 30 mm, measured from a forward surface of the forward wall, the peripheral member having a thickness between about 0.5 mm and 2.5 mm, and

a rear member extending inward from the peripheral member, with respect to the front opening, for a length of at least about 2 mm and no more than about 25 mm, the rear member having a thickness between about 0.5 mm and 2.5 mm; and

a face plate received by the face support.]

[**2**. A golf club head as defined in claim **1**, wherein the face support further includes a portion proximate to the sole of the body, the portion proximate to the sole having a rear member extending inward with respect to the front opening and configured to support a lower edge of the face plate.]

[**3**. A golf club head as defined in claim **1**, wherein the face support further includes a portion proximate to the sole of the body, the portion proximate to the sole having

a peripheral member extending rearward from the forward wall for a length between about 3 mm and 30 mm, measured from a forward surface of the forward wall, the peripheral member having a thickness between about 0.5 mm and 2.5 mm, and

a rear member extending inward from the peripheral member, with respect to the front opening, for a length of at least about 2 mm and no more than about 25 mm, the rear member having a thickness between about 0.5 mm and 2.5 mm.]

[**4**. A golf club head as defined in claim **1**, wherein the rear member of the face support is continuous about the front opening, the rear member extending inward from the peripheral member of each of the portions of the face support.]

[**5**. A golf club head as defined in claim **1**, wherein the peripheral member has a thickness of about 1 mm and a length between about 4 mm and 6 mm, and the rear member has a thickness between about 0.6 mm and 1.5 mm and a length between about 2 mm and 7 mm.]

[**6**. A golf club head as defined in claim **1**, wherein a junction of the peripheral and rear members of the face support has a maximum thickness of between about 1.5 and 2 mm.]

[**7**. A golf club head as defined in claim **1**, wherein the rear member tapers from a junction of the peripheral and rear members to an inward end, the inward end having a thickness of between about 0.6 and 0.9 mm.]

[**8**. A golf club head as defined in claim **1**, wherein the peripheral member is spaced from a skirt of the body at one or both of the toe and heel ends a horizontal distance of at least 1.5 mm measured about 2 mm inward from a side forward surface of the body at the front opening.]

[**9**. A golf club head as defined in claim **1**, wherein the face support further includes a portion proximate to the sole, the portion proximate to sole having a rear member extending inward with respect to the front opening the portion proximate to sole face disposed such that the front surface of the face plate is substantially flush with the forward wall of the body.]

[**10**. A golf club head as defined in claim **9**, wherein the portion proximate to the sole further having a peripheral member, the peripheral member extending rearward from the forward wall proximate to the sole for a length between about 3 mm and 30 mm, the peripheral member having a thickness between about 0.5 mm and 2.5 mm, the rear member extending inward from the peripheral member, with respect to the front opening, for a length of at least about 2 mm and no more than about 25 mm, the rear member having a thickness between about 0.5 mm and 2.5 mm.]

[**11**. A golf club head as defined in claim **1**, wherein the peripheral member is spaced from the top a vertical distance of at least 1 mm measured about 2 mm rearward of an upper forward surface of the body at the front opening.]

[**12**. A golf club head as defined in claim **11**, wherein the peripheral member is spaced from the sole a vertical distance of at least 1 mm measured about 2 mm rearward of a lower forward surface of the body at the front opening.]

13. A golf club head comprising:

[a crown;]

a sole;

[a skirt disposed between the crown and the sole, the skirt having a toe end and a heel end;]

a body having a top, a sole, a toe end, a heel end and a forward wall;

[a] the forward wall coupled [to the crown, the sole, and the skirt, the forward wall] defining a front opening;

a peripheral member coupled to at least a portion of a periphery of the front opening and extending rearwardly therefrom, *the peripheral member being spaced from the body*;

a rear member directly coupled to the peripheral member and extending inwardly therefrom, partially towards a center of the front opening; and

a face plate coupled to the rear member.

14. The golf club head of claim **13**, wherein at least a portion of each of the peripheral member and the rear member is disposed proximate to [the] *a* crown, [the] *a* sole, [the] *a* toe end, or [the] *a* heel end, or combinations thereof.

15. The golf club head of claim **13**, wherein the peripheral member extends between about 3 mm and 30 mm from a forward surface of the forward wall.

16. The golf club head of claim **15**, wherein the peripheral member extends between about 4 mm and 6 mm from a forward surface of the forward wall.

17. The golf club head of claim **13**, wherein the peripheral member has a thickness between about 0.5 mm and 2.5 mm.

18. The golf club head of claim **13**, wherein the peripheral member is spaced a first distance of at least 1.5 mm measured in a horizontal direction from [the] *a* skirt, and wherein the first distance is measured about 2 mm rearward from a side forward surface proximate the front opening.

19. The golf club head of claim **13**, wherein the peripheral member is spaced a first distance of at least 1 mm measured in a vertical direction from [the] *a* crown, and wherein the first distance is measured about 2 mm rearward from an upper forward surface proximate the front opening.

20. The golf club head of claim **13**, wherein the peripheral member is spaced a first distance of at least 1 mm measured in a vertical direction from [the] *a* sole, and wherein the first distance is measured about 2 mm rearward of a lower forward surface proximate the front opening.

21. The golf club head of claim **13**, wherein the rear member is continuous about the periphery of the front opening.

22. The golf club head of claim **13**, wherein the rear member extends between about 2 mm and 25 mm from an inner surface of the peripheral member, relative to the center of the front opening.

23. The golf club head of claim **22**, wherein the rear member extends between about 2 mm and 7 mm from an inner surface of the peripheral member, relative to the center of the front opening.

24. The golf club head of claim **13**, wherein the rear member has a thickness between about 0.5 mm and 2.5 mm.

25. The golf club head of claim **24**, wherein the rear member has a thickness between about 0.6 mm and 1.5 mm.

26. The golf club head of claim 13, further comprising a junction defined by an intersection of the peripheral member and the rear member, wherein the junction has a maximum thickness between about 1.5 mm and 2 mm.

27. The golf club head of claim 17, wherein the peripheral member has a thickness between about 0.8 mm and 1.2 mm.

28. The golf club head of claim 22, wherein the rear member extends between about 2 mm and 15 mm from an inner surface of the peripheral member, relative to the center of the front opening.

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