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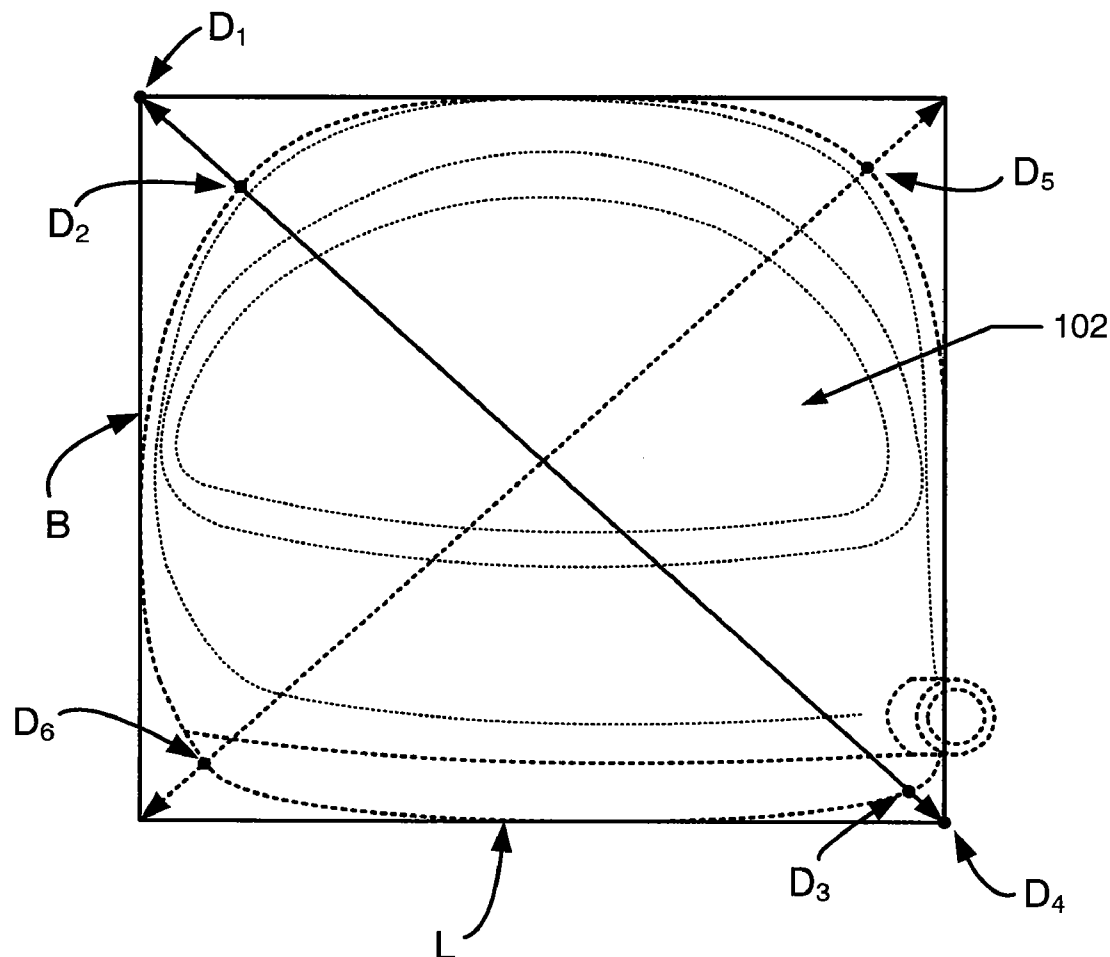
(19) **United States**(12) **Patent Application Publication****Stites et al.**(10) **Pub. No.: US 2007/0298903 A1**(43) **Pub. Date: Dec. 27, 2007**(54) **GOLF CLUBS AND GOLF CLUB HEADS****Publication Classification**

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(73) Assignee: **NIKE, INC.**, Beaverton, OR (US)(21) Appl. No.: **11/425,737**(22) Filed: **Jun. 22, 2006**(51) **Int. Cl.****A63B 53/00** (2006.01)(52) **U.S. Cl.** **473/324; 473/334; 473/345; 473/349**(57) **ABSTRACT**

Wood-type golf clubs and/or golf club heads include a club head body having a breadth to length ratio of at least 0.9, optionally a club head volume of at least 450 cubic centimeters, and a diagonal dimension of at least 75% of a theoretical maximum diagonal dimension (as measured along a diagonal of a bounding box enclosing the club head body and defined by the length dimension and the breadth dimension). In some examples, the diagonal dimension may be at least 80%, 85%, or even 90% of the theoretical maximum diagonal dimension. Additionally or alternatively, if desired, at least one horizontal cross section of the club head body will enclose or encompass an area of at least $0.8 \times BL$, at least $0.85 \times BL$, at least $0.9 \times BL$, or even at least $0.95 \times BL$.



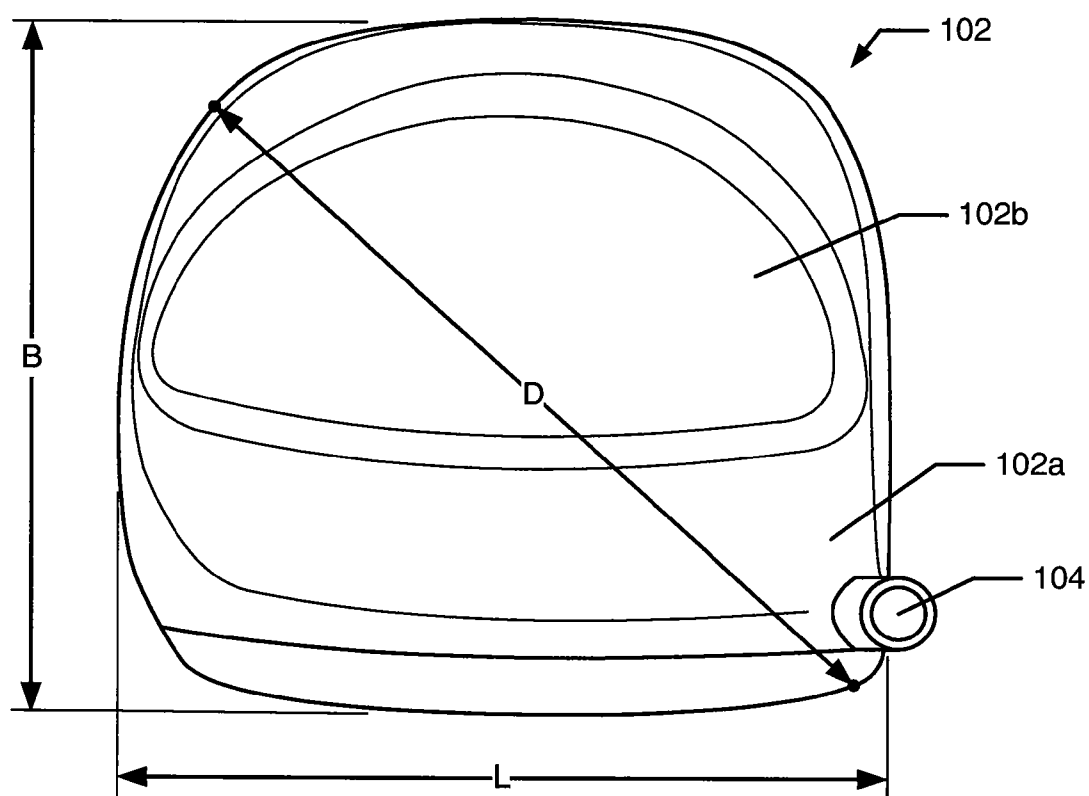


FIG. 1A

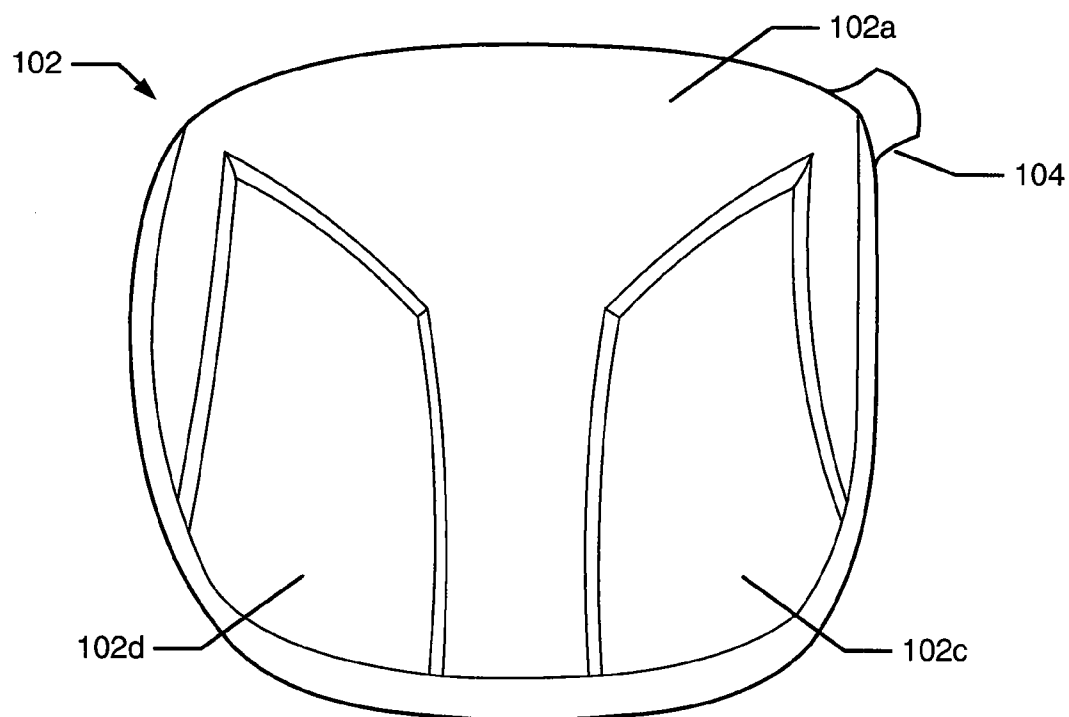


FIG. 1B

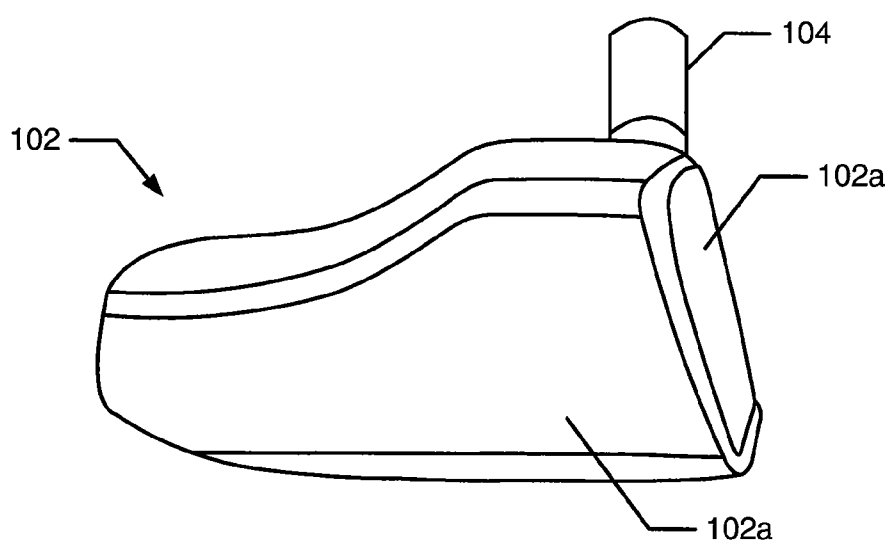


FIG. 1C

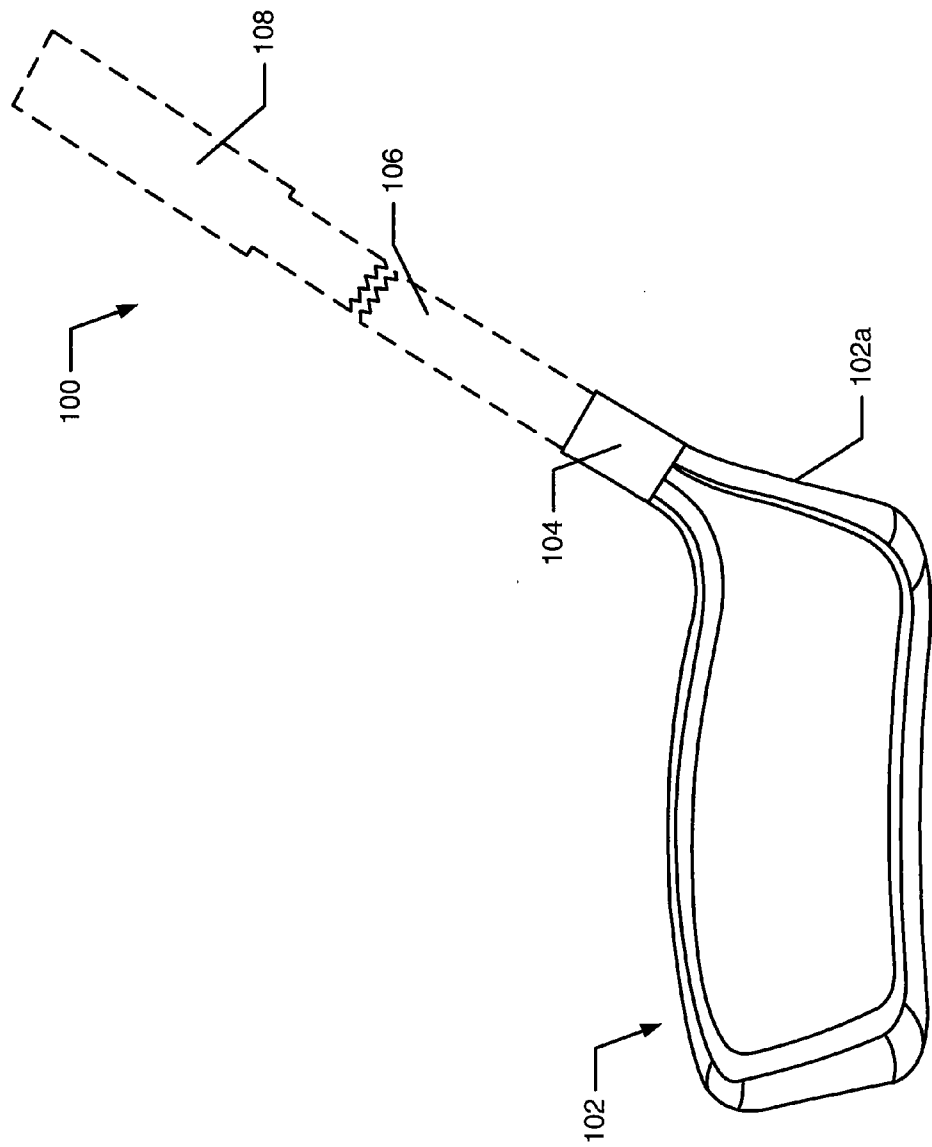


FIG. 1D

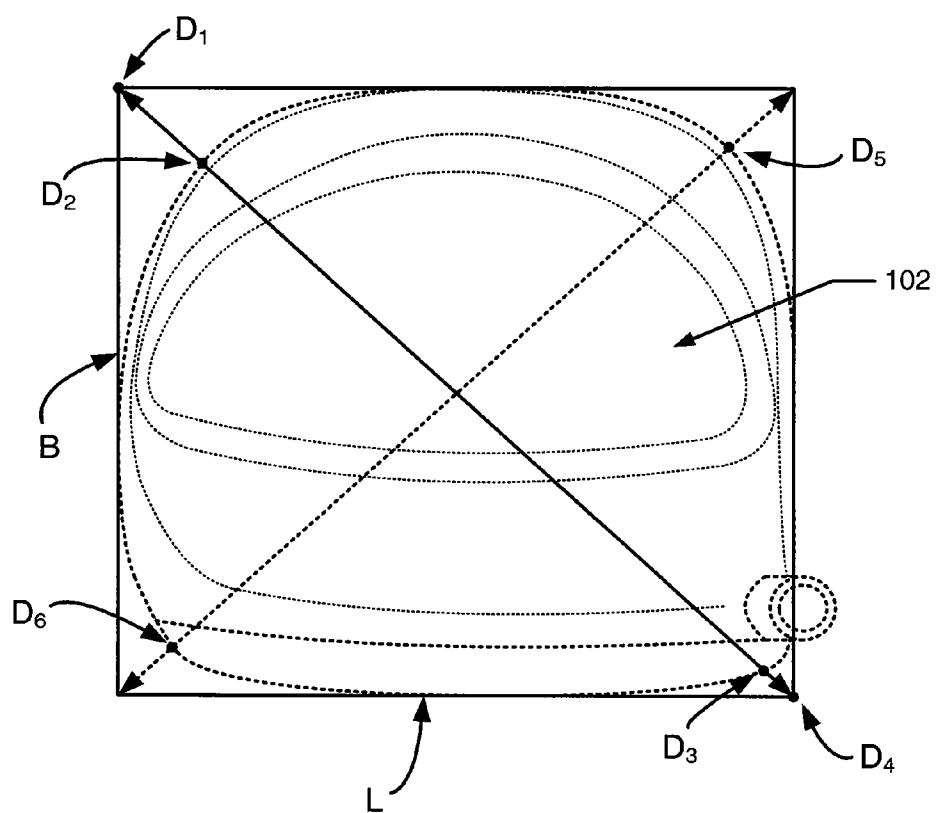


FIG. 1E

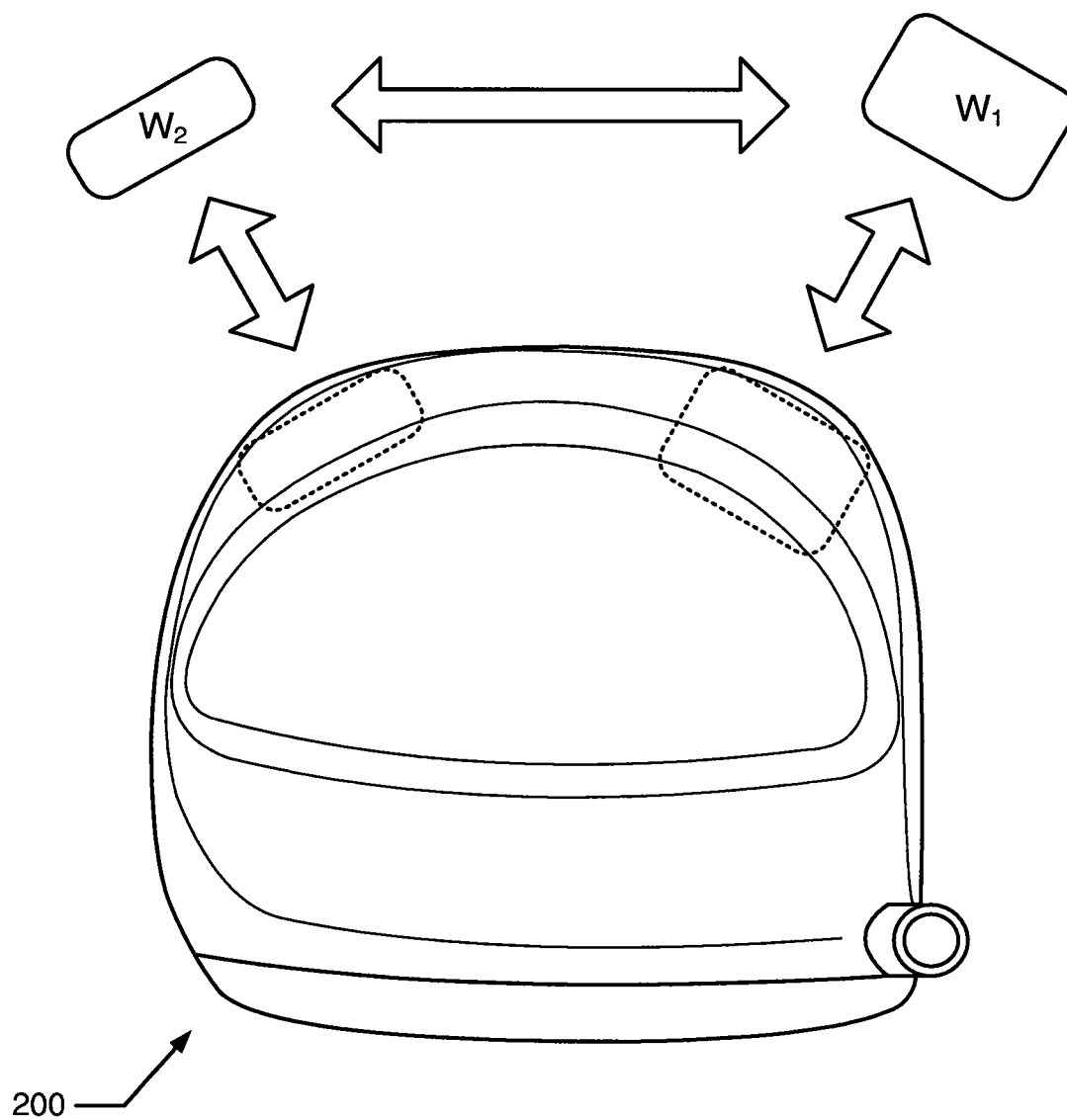


FIG. 2A

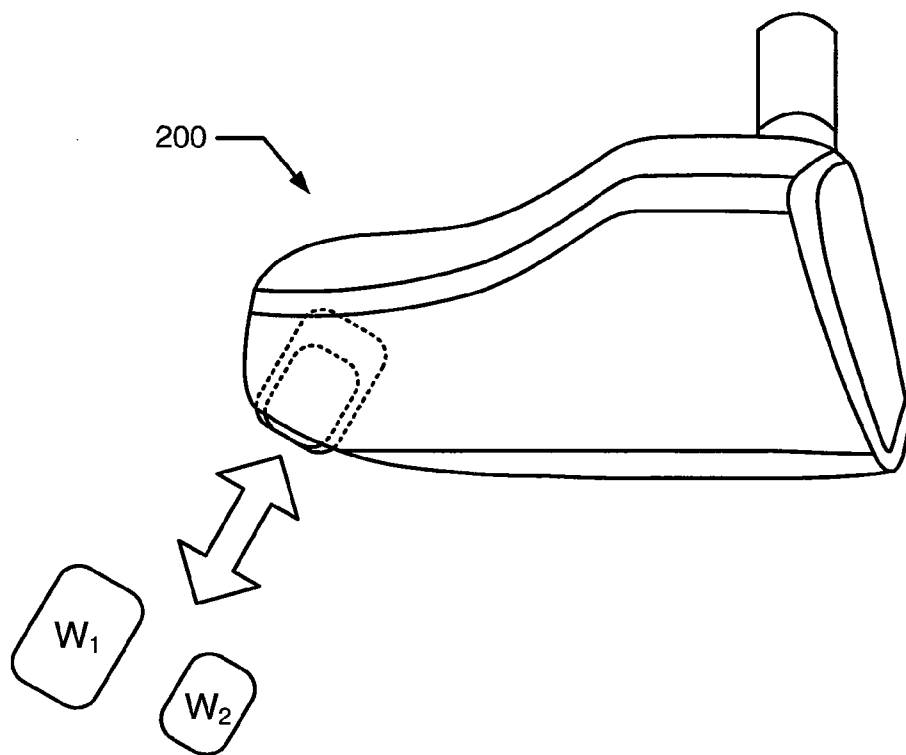


FIG. 2B

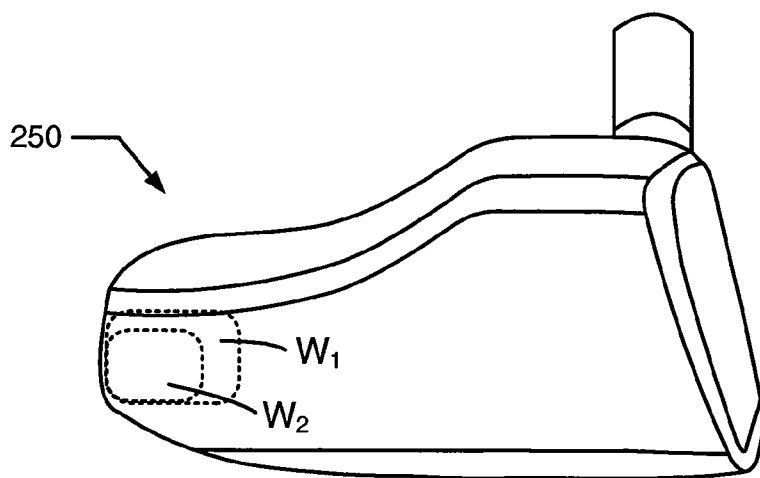


FIG. 2C

GOLF CLUBS AND GOLF CLUB HEADS

FIELD OF THE INVENTION

[0001] This invention relates generally to golf clubs and golf club heads, including “wood-type” golf clubs and golf club heads, e.g., for drivers, fairway woods, “wood-type” hybrid or utility clubs, or the like.

BACKGROUND

[0002] Golf is enjoyed by a wide variety of players—players of different genders and dramatically different ages and/or skill levels. Golf is somewhat unique in the sporting world in that such diverse collections of players can play together in golf events, even in direct competition with one another (e.g., using handicapped scoring, different tee boxes, in team formats, etc.), and still enjoy the golf outing or competition. These factors, together with the increased availability of golf programming on television (e.g., golf tournaments, golf news, golf history, and/or other golf programming) and the rise of well known golf superstars, at least in part, have increased golf’s popularity in recent years, both in the United States and across the world. The number of individuals participating in the game and the number of golf courses have increased steadily in recent years.

[0003] Golfers at all skill levels seek to improve their performance, lower their golf scores, and reach that next performance “level.” Manufacturers of all types of golf equipment have responded to these demands, and in recent years, the industry has witnessed dramatic changes and improvements in golf equipment. For example, a wide range of different golf ball models now are available, with balls designed to complement specific swing speeds and/or other player characteristics or preferences, e.g., with some balls designed to fly farther and/or straighter; some designed to provide higher or flatter trajectories; some designed to provide more spin, control, and/or feel (particularly around the greens); some designed for faster or slower swing speeds; etc. A host of swing and/or teaching aids also are available on the market that promise to help lower one’s golf scores.

[0004] Being the sole instrument that sets a golf ball in motion during play, golf clubs also have been the subject of much technological research and advancement in recent years. For example, the market has seen dramatic changes and improvements in putter designs, golf club head designs, shafts, and grips in recent years. Additionally, other technological advancements have been made in an effort to better match the various elements and/or characteristics of the golf club and characteristics of a golf ball to a particular user’s swing features or characteristics (e.g., club fitting technology, ball launch angle measurement technology, ball spin rates, etc.).

[0005] Despite recent technological advances, “wood-type” golf clubs, particularly the driver, can be very difficult for some players to hit consistently well. Accordingly, additional technological advances that improve a player’s ability to get a golf ball airborne; increase distance, direc-

tion, and/or control; and/or otherwise improve the playability of wood-type golf clubs, particularly the driver, would be welcome in the golf world.

SUMMARY

[0006] The following presents a general summary of aspects of the invention in order to provide a basic understanding of the invention and various aspects of it. In general, some example aspects of this invention relate to wood-type golf clubs and/or golf club heads (such as drivers or fairway woods, “wood-type” utility or hybrid clubs, and/or the like) that include a club head body having a relatively square or rectangular cross sectional appearance and/or shape over at least a portion of its height. Such club heads allow club designers to place weight rearward, outward, and/or downward in the overall club head structure, thereby increasing the moment of inertia of the club head (i.e., resistance to twisting, particularly about a vertical or z-axis (e.g., I_{zz})).

[0007] More specific examples of golf club heads and golf clubs in accordance with examples of this invention include club head structures having a club head length (dimension “L” in the heel-to-toe direction) and a club head breadth (dimension “B” in the front-to-rear direction), wherein the club head body has a breadth dimension to length dimension ratio (“B/L” ratio) of at least 0.9, optionally a club head volume of at least 450 cubic centimeters, and at least one overall diagonal dimension of at least 75% of a theoretical maximum diagonal dimension (the overall diagonal dimension and the theoretical maximum diagonal dimension are measured along a diagonal of a bounding box enclosing the club head body and defined by the overall length dimension and the overall breadth dimension) or at least $0.75 \times (B^2 + L^2)^{1/2}$. In some more specific examples, the overall diagonal dimension may be at least 80%, 85%, 90%, or even 95% of the theoretical maximum diagonal dimension (e.g., at least $0.8 \times (B^2 + L^2)^{1/2}$, $0.85 \times (B^2 + L^2)^{1/2}$, $0.9 \times (B^2 + L^2)^{1/2}$, or even $0.95 \times (B^2 + L^2)^{1/2}$).

[0008] Additionally or alternatively, if desired, golf club heads and golf club structures according to at least some examples of this invention will include at least one horizontal cross section of the club head body that encloses or encompasses an area of at least $0.8 \times BL$, and in some examples, at least $0.85 \times BL$, at least $0.9 \times BL$, or even at least $0.95 \times BL$.

[0009] Golf club heads in accordance with at least some examples of this invention (e.g., having at least some of the characteristics described above) further may include one or more weighted portions or weight members integrally formed in and/or engaged with the club head body (e.g., at or proximate to a rear of the club head body portion, optionally toward the rear toe and/or rear heel portions of the club head and/or toward the rear sole portion of the club head). Golf club heads in accordance with this invention further may be incorporated into a golf club structure, e.g., by attaching a shaft to the club head body and/or a grip or handle member to the shaft.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] A more complete understanding of the present invention and certain advantages thereof may be acquired by referring to the following detailed description in consideration with the accompanying drawings, in which:

[0011] FIGS. 1A through 1D illustrate an example golf club and golf club head in accordance with this invention;

[0012] FIG. 1E illustrates the diagonal dimension and/or cross-sectional area characteristics of club heads in accordance with at least some examples of this invention; and

[0013] FIGS. 2A through 2C illustrate examples of weighting club head structures in accordance with at least some examples of this invention.

[0014] The reader is advised that the attached drawings are not necessarily drawn to scale.

DETAILED DESCRIPTION

[0015] In the following description of various example structures in accordance with the invention, reference is made to the accompanying drawings, which form a part hereof, and in which are shown by way of illustration various example golf club heads and golf club structures in accordance with the invention. Certain dimensions, characteristics, and ranges of dimensions and characteristics are provided in the following description and are associated with the example golf club head structures shown in FIGS. 1A through 2C. Those skilled in the art will understand, however, that the drawings, dimensions, characteristics, and ranges of dimensions and characteristics described below represent examples of golf club and golf club head structures and characteristics that may be used or exhibited in accordance with at least some examples of this invention. The actual dimensions and/or characteristics of a club head may vary substantially and still fall within the scope of the present invention as defined by the appended claims. Additionally, it is to be understood that other specific arrangements of parts and structures may be utilized, and structural and functional modifications may be made without departing from the scope of the present invention. Also, while the terms “top,” “bottom,” “front,” “back,” “rear,” “side,” “underside,” “overhead,” and the like may be used in this specification to describe various example features and elements of the invention, these terms are used herein as a matter of convenience, e.g., based on the example orientations shown in the figures and/or the orientations in typical use. Nothing in this specification should be construed as requiring a specific three dimensional or spatial orientation of structures in order to fall within the scope of this invention.

A. General Description of Golf Clubs and Golf Club Heads According to Examples of the Invention

[0016] In general, as described above, aspects of this invention relate to wood-type golf club heads, golf clubs, and the like (such as drivers or fairway woods, “wood-type” utility or hybrid clubs, and/or the like). One aspect of golf clubs and golf club heads in accordance with at least some examples of this invention relates to the club head’s generally “squared” or rectangular design. In at least some example structures according to the invention, the golf club heads may be somewhat square or rectangular shaped so as to allow club designers to move weight (and thereby the club head’s center of gravity) rearward, outward (i.e., toward the heel and/or toe areas), and/or low (i.e., toward the sole) in the overall club head structure. Optionally, the club head’s center of gravity will be located as far away from the club head face member and/or as close to the club head sole

member as reasonably possible, e.g., in order to create a golf club structure that is easier to use (e.g., easier to get balls airborne, helps make balls fly farther and/or straighter, provides a club head with a higher moment of inertia, particularly about a vertical axis (e.g., I_{zz}), etc.).

[0017] More specific examples of golf club heads according to this invention include a club head body having a club head length dimension (“L”) and a club head breadth dimension (“B”), wherein the club head body has a breadth dimension to length dimension ratio of at least 0.9, optionally a club head volume of at least 450 cubic centimeters, and at least one overall diagonal dimension of at least 75% of a theoretical maximum diagonal dimension (the overall diagonal dimension and the theoretical maximum diagonal dimension are measured along a diagonal of a bounding box enclosing or encompassing the club head body and defined by the length dimension L and the breadth dimension B) or at least $0.75 \times (B^2 + L^2)^{1/2}$. In some more specific examples, the overall diagonal dimension may be at least 80%, at least 85%, at least 90%, or even at least 95% of the theoretical maximum diagonal dimension (e.g., at least $0.8 \times (B^2 + L^2)^{1/2}$, at least $0.85 \times (B^2 + L^2)^{1/2}$, at least $0.9 \times (B^2 + L^2)^{1/2}$, or even at least $0.95 \times (B^2 + L^2)^{1/2}$).

[0018] Additionally or alternatively, if desired, golf club heads and golf club structures according to at least some examples of this invention will include at least one horizontal cross section of the club head body (when the club head is oriented for typical use) that encloses or encompasses an area of at least $0.8 \times BL$, and in some examples, at least $0.85 \times BL$, at least $0.9 \times BL$, or even at least $0.95 \times BL$. In at least some structures, a majority of the club head’s height will have horizontal cross sectional areas having the features described above (i.e., at least 50% of the overall club head height (from the sole to crown) will have these cross sectional characteristics).

[0019] The club head body may be made in a wide variety of ways and/or from a wide variety of materials and parts without departing from this invention, including in conventional ways, from conventional materials and parts, as are known and used in the art. In some more specific examples, the club head body may be made from one or more of: metal materials (e.g., metal alloys, such as alloys containing steel, titanium, magnesium, aluminum, etc.); composite or other non-metal materials (e.g., carbon fiber composites, basalt fiber composites, etc., for a crown portion, a skirt portion, a sole portion, an aft body portion, a ball striking face portion, etc.); polymeric materials; etc.

[0020] The golf club head further may include one or more weighted portions or members integrally formed in and/or engaged with the club head body. Advantageously, in accordance with at least some examples of this invention, the weighted portion(s) or member(s) will be located at or proximate to a rear of the club head body portion, optionally toward the rear toe, the rear heel, and/or the rear sole portions of the club head. If desired, the weighted portion(s) or member(s) may be selectively removable from the club head body, e.g., to allow customization, interchange, replacement, and/or club-fitting (e.g., to provide a draw biased club, to provide a fade biased club, to provide a high trajectory biased club, to provide a low trajectory biased club, to provide a club to help compensate for undesired ball flights or swing flaws (e.g., to help correct hooks, slices, etc., to help get balls airborne, to help prevent ballooning ball flights, etc.), etc.).

[0021] Additional aspects of this invention relate to golf clubs including golf club heads of the various types described above. Such golf clubs further may include a shaft member engaged with the club head body (e.g., via an external hosel member, via an internal hosel member, through an opening provided in the club head, via adhesives, via mechanical connectors (e.g., threads, retaining elements, etc.), etc.). Golf clubs in accordance with examples of this invention further may include grip or handle members engaged with or formed as part of the shaft member, to provide a location for the user to grip the club.

[0022] Specific examples of the invention are described in more detail below. The reader should understand that these specific examples are set forth merely to illustrate the invention, and they should not be construed as limiting the invention.

B. Specific Examples of the Invention

[0023] FIGS. 1A through 2C illustrate example golf club and golf club head structures in accordance with the invention. When the same reference number appears in more than one drawing, that reference number is used consistently in this specification and the drawings to refer to the same or similar parts throughout.

[0024] Example golf club and golf club head structures in accordance with this invention may constitute “wood-type” golf clubs and golf club heads, e.g., clubs and club heads typically used for drivers and fairway woods, as well as for “wood-type” utility or hybrid clubs, or the like. Such club head structures may have a relatively “squared” or rectangular shape and appearance, e.g., as illustrated in the figures and described in more detail below. The club heads may include a multiple piece construction and structure, e.g., including one or more of a sole member, a face member (optionally including a ball striking face integrally formed therein or attached thereto), one or more body members (e.g., ribbons of material making up the club head body), a crown member, a face plate, an aft body, etc. Of course, if desired, various portions of the club head structure may be integrally formed with one another, as a unitary, one piece construction, without departing from the invention (e.g., the body member(s) may be integrally formed with the sole and/or crown members, the face member may be integrally formed with the sole, body, and/or crown members, etc.). Optionally, if desired, the various portions of the club head structure (such as the sole member, the crown member, the face member, the body member(s), etc.) individually may be formed from multiple pieces of material without departing from this invention. Also, as other alternatives, if desired, the entire club head may be made as a single, one piece, unitary construction, or a face plate member may be attached to a one piece club head aft body. More specific examples and features of golf club heads and golf club structures according to this invention will be described in detail below in conjunction with the example golf club structures illustrated in FIGS. 1A through 2C.

[0025] FIGS. 1A through 1D illustrate an example golf club 100 and/or golf club head 102 in accordance with this invention. In addition to the golf club head 102, the overall golf club structure 100 of this example includes a hosel region 104, a shaft member 106 received in and/or inserted into and/or through the hosel region 104, and a grip or handle member 108 attached to the shaft member 106. Optionally, if desired, the external hosel region 104 may be

eliminated and the shaft member 106 may be directly inserted into and/or otherwise attached to the head member 102 (e.g., through an opening provided in the top of the club head 102, through an internal hosel member (e.g., provided within an interior chamber defined by the club head 102), etc.).

[0026] The shaft member 106 may be received in, engaged with, and/or attached to the club head 102 in any suitable or desired manner, including in conventional manners known and used in the art, without departing from the invention. As more specific examples, the shaft member 106 may be engaged with the club head 102 via a hosel member 104 and/or directly to the club head structure 102, e.g., via adhesives, cements, welding, soldering, mechanical connectors (such as threads, retaining elements, or the like), through a shaft-receiving sleeve or element extending into the club head body 102, etc. The shaft member 106 also may be made from any suitable or desired materials, including conventional materials known and used in the art, such as graphite based materials, composite or other non-metal materials, steel materials (including stainless steel), aluminum materials, other metal alloy materials, polymeric materials, combinations of various materials, and the like. Also, the grip or handle member 108 may be attached to, engaged with, and/or extend from the shaft member 106 in any suitable or desired manner, including in conventional manners known and used in the art, e.g., using adhesives or cements; via welding, soldering, adhesives, or the like; via mechanical connectors (such as threads, retaining elements, etc.); and/or in any other desired manner. As another example, if desired, the grip or handle member 108 may be integrally formed as a unitary, one-piece construction with the shaft member 106. Additionally, any desired grip or handle member 108 materials may be used without departing from this invention, including rubber materials, leather materials, rubber or other materials including cord or other fabric material embedded therein, polymeric materials, and the like.

[0027] The club head 102 itself also may be constructed in any suitable or desired manner and/or from any suitable or desired materials without departing from this invention, including from conventional materials and/or in conventional manners known and used in the art. For example, in the example structure 102 shown in FIGS. 1A through 1D, the club head 102 includes a base member 102a, which makes up a major portion of this example club head structure 102, including, for example, the ball striking face, at least a portion of the crown, at least a portion of the sole, the body portions between the crown and the sole, etc. If desired, the base member 102a may be made from multiple pieces that are connected together (e.g., by welding or other fusing techniques, by mechanical connectors, etc.). The base member 102a may be made from any desired materials, including materials that are conventionally known and used in the art, such as metal materials, including lightweight metal materials. More specific examples of suitable materials include steel, titanium alloys, aluminum alloys, magnesium alloys, composite or other non-metal materials, polymeric materials, etc. In some specific example structures, a separate face plate member may be attached to a front face frame member that makes up at least a portion of the base member 102a.

[0028] In order to reduce the club head 102 weight, if desired, one or more portions of the club head structure 102 may be made from a composite material, such as from

carbon fiber composite materials that are conventionally known and used in the art. Other suitable composite or other non-metal materials that may be used for one or more portions of the club head structure **102** include, for example: glass fiber composite materials, basalt fiber composite materials, polymer materials, etc. As some more specific examples, if desired, at least some portion(s) of the crown member (e.g., portion **102b**) may be made from a composite or other non-metal material. Additionally or alternatively, if desired, at least some portion(s) of the sole member (e.g., portions **102c** and **102d**) may be made from a composite or other non-metal material. As still additional examples or alternatives, if desired, one or more portions of the club head's body member (the region extending between the crown and the sole) may be made from a composite or other non-metal material. As yet further examples, if desired, the body portion aft of a club head face member, or optionally the entire club head, may be made from a composite or other non-metal material without departing from this invention. The composite or other non-metal material may be incorporated as part of the club head structure **102** in any desired manner, including in conventional manners that are known and used in the art. Reducing the club head's weight (e.g., through the use of composite or other non-metal materials, lightweight metals, metallic foam or other cellular structured materials, etc.) allows club designers to selectively position additional weight in the overall club head structure, e.g., to desirable locations to increase the moment of inertia and/or affect other playability characteristics of the club head structure **102**.

[0029] The various individual parts that make up a club head structure **102**, if made from multiple pieces, may be engaged with one another and/or held together in any suitable or desired manner, including in conventional manners known and used in the art. For example, the various parts of the club head structure **102**, such as the base member **102a** and the composite (or other non-metal) portions(s) **102b**, **102c**, and/or **102d**, may be joined and/or fixed together (directly or indirectly through intermediate members) by adhesives, cements, welding, soldering, or other bonding or finishing techniques; by mechanical connectors (such as threads, screws, nuts, bolts, or other connectors); and the like. If desired, the side edges of various parts of the club head structure **102** (e.g., the edges where composite members **102b**, **102c**, and/or **102d** contact and join to the main body **102a**) may include one or more raised ribs, tabs, ledges, or other engagement elements that fit into or onto corresponding grooves, slots, surfaces, ledges, or openings provided in or on the facing side edge to which it is joined. Cements, adhesives, mechanical connectors, finishing material, or the like may be used in combination with the raised rib/groove/ledge/edge or other connecting structures described above to further help secure the various parts of the club head structure **102** together.

[0030] The dimensions and/or other characteristics of a golf club head structure according to examples of the invention may vary significantly without departing from the invention. As some more specific examples, club heads in accordance with at least some examples of this invention may have dimensions and/or other characteristics that fall within the various example ranges of dimensions and/or characteristics of the club heads described in U.S. patent application. Ser. No. 11/125,327 filed May 10, 2005 (and corresponding to U.S. Published Patent Appln. No. 2005-

0239576 A1 published Oct. 27, 2005). Note, for example, the Tables in these documents. This U.S. patent application and publication each is entirely incorporated herein by reference.

[0031] As described above, club heads **102** in accordance with at least some examples of this invention may have a relatively "squared" or rectangular shape or appearance, particularly when viewed from overhead and down on the crown portion of the club head as shown in FIG. 1A. FIG. 1A further illustrates that the club head **102** has an overall length dimension L in the heel to toe direction and an overall breadth dimension B in the front to rear direction. In accordance with at least some examples of this invention, the breadth dimension to length dimension ratio ("B/L") in the club head structures will be at least 0.9, and in some examples, this ratio may be at least 0.92, at least 0.93, at least 0.94, at least 0.95, at least 0.96, at least 0.97, or even at least 0.98.

[0032] The relatively "squared" or rectangular shape or appearance of golf club heads in accordance with examples of this invention is advantageous because it allows weight in the club head structure **102** (e.g., weight saved by using composite materials, lightweight metal alloys, cellular structure metals or other materials, metal foam materials, polymeric materials, etc.) to be selectively located in the club head structure **102**, e.g., situated rearward, toward the heel and/or toe areas, and/or toward the sole portion of the club head structure **102**. Such weight arrangements can help increase the club head's moment of inertia characteristics, particularly its moment of inertia about a vertical axis (e.g., I_{zz}).

[0033] Various ways of evaluating the "squareness" (e.g., the angles and side orientations) of a club head structure are possible. One way involves use of the "theoretical maximum diagonal dimension" of the club head. FIG. 1E helps illustrate this "squareness" measuring tool. Specifically, FIG. 1E illustrates the club head structure **102** of FIG. 1A with a bounding box enclosing the club head body **102**. The bounding box extends tangent to the club head body's outer surface (at its maximum width and depth points) and is defined by the club head's length dimension L and its breadth dimension B (which make up the four sides of the bounding box) arranged at right angles to one another to define the corners of the bounding box. The bounding box therefore defines a rectangular structure at the extreme dimensions of the club head body **102** along the four major sides of the club head **102** when viewed from overhead (e.g., the smallest rectangular box that encloses the club head body **102**).

[0034] The bounding box also defines the theoretical maximum diagonal dimension, which extends from one corner of the bounding box to its diagonally opposite corner. This diagonal dimension is the theoretical maximum diagonal dimension for a perfectly square or rectangular club head (i.e., if the club head **102** were perfectly square or rectangular, with each and every corner a right angle and its opposite sides parallel to one another, its diagonal dimension would be the length from points D₁ to D₄ in FIG. 1E (which also corresponds to the length $(B^2 + L^2)^{1/2}$). The club head **102**, however, is not perfectly "square" or rectangular. Therefore, its overall diagonal dimension D along the same diagonal line (i.e., from points D₂ to D₃ in FIG. 1E) is less than the length from points D₁ to D₄ (or less than $(B^2 + L^2)^{1/2}$). In accordance with at least some examples of this

invention, the actual overall diagonal dimension of club heads (e.g., from points D_2 to D_3 in FIG. 1E) will be at least $0.75 \times (\text{the length from points } D_1 \text{ to } D_4 \text{ in FIG. 1E})$ or at least $0.75 \times (B^2 + L^2)^{1/2}$. In some example club head structures according to this invention, the actual overall diagonal dimension of club heads (e.g., from points D_2 to D_3 in FIG. 1E) will be at least $0.8 \times (\text{the length from points } D_1 \text{ to } D_4 \text{ in FIG. 1E})$ or at least $0.8 \times (B^2 + L^2)^{1/2}$, at least $0.85 \times (\text{the length from points } D_1 \text{ to } D_4 \text{ in FIG. 1E})$ or at least $0.85 \times (B^2 + L^2)^{1/2}$, or even at least $0.9 \times (\text{the length from points } D_1 \text{ to } D_4 \text{ in FIG. 1E})$ or at least $0.9 \times (B^2 + L^2)^{1/2}$.

[0035] If desired, in accordance with examples of this invention, either one or both diagonals of the club head structure **102** (i.e., the diagonal from D_2 to D_3 in FIG. 1E and/or the diagonal from D_5 to D_6 in FIG. 1E) may have the dimensional characteristics described above. The diagonal (s) may be measured at a vertical height or level in the overall club head structure **102** at which the club head body cross section encloses or encompasses the greatest total area (e.g., so as to provide the club head's largest actual diagonal dimension D), or it may be measured using the widest points on the club head body along the diagonal line, irrespective of the vertical height location of these widest points, as shown in FIG. 1E (also called the "overall diagonal dimension").

[0036] In the example structure illustrated in FIG. 1E, the dimension along the diagonal line D from D_1 to D_2 (also called the "open portion of the diagonal") may be less than 1 inch, and in some examples less than 0.75 inches, or even less than 0.5 inches. In general, the smaller this open portion of the diagonal dimension, the more "square" or rectangular the structure.

[0037] Another way of evaluating the "squareness" of a club head involves use of horizontal cross sectional area enclosed or encompassed by the club head (e.g., horizontal with respect to the club head's orientation during typical use, e.g., when addressing and/or hitting a golf ball or with the club head oriented at its lie angle and/or resting on its sole plate). As illustrated in FIG. 1E, if the club head **102** were perfectly "square" or rectangular (i.e., with the front, rear, and side edges arranged orthogonally in a rectangular arrangement), at least one horizontal cross section of the club head would enclose or encompass an area defined by the club head's length (dimension L) and breadth (dimension B) (Maximum Theoretical Area = $B \times L$). Because the actual club head **102** design has somewhat rounded corners and/or curved edges, the largest horizontal cross sectional area encompassed by an outer peripheral section of the club head **102** is less than the maximum theoretical area $B \times L$. In accordance with at least some examples of this invention, golf club heads **102** will include at least one horizontal cross section (when the club head is oriented for typical use, on its sole, and/or at its intended lie angle), and optionally multiple horizontal cross sections, that encloses or encompasses an area of at least $0.75 \times BL$, at least $0.8 \times BL$, at least $0.85 \times BL$, at least $0.9 \times BL$, or even at least $0.95 \times BL$.

[0038] As described above, the generally "squared" or rectangular configuration of golf club heads in accordance with examples of this invention allows additional weight to be positioned deep (toward the club head rear), wide (toward the club head heel and/or toe), and/or low (toward the club head sole) in the overall club head structure. FIGS. 2A through 2C illustrate various examples. More specifically, FIGS. 2A and 2B show a club head structure **200** that

includes at least two separate weight members W_1 and W_2 arranged toward the lower, rear corners of the club head structure **200**. As illustrated in this example structure **200**, one or both of the weight members W_1 and W_2 may be removably mounted to the club head structure **200**, e.g., to enable removal, replacement, interchange, customization, etc. In the illustrated example structure **200**, a larger (or heavier) weight is provided toward the heel side of the club head structure **200**, to better promote a drawing golf shot (e.g., to provide a draw biased club, to help correct a slicing or excessively fading ball flight, etc.). Of course, club head **200** may be provided with a variety of weights of different masses and/or a variety of weight port locations for receiving weight members W_1 and/or W_2 (including ports at different overall heights in the club head structure **200**), to enable a variety of weight orientation and customization options (e.g., to provide a draw biased club, to provide a fade biased club, to provide a high trajectory biased club, to provide a low trajectory biased club, to provide a club to help compensate for undesired ball flights or swing flaws (to correct hooks, slices, etc., to help get balls airborne, to the prevent ballooning ball flights, etc.), etc.). As a more specific example, FIG. 2C illustrates the weight member(s) (e.g., W_1 and W_2) arranged somewhat higher and differently in the club head structure **250**. If desired, the weight arrangements of both FIGS. 2B and 2C may be provided in a single club head structure (e.g., with the set of weight port locations provided in FIG. 2C located somewhat higher and/or inside the weight port locations provided in FIG. 2B).

[0039] Also, any number of weight members may be provided in a club head structure **200** (zero, one, two, or more) without departing from this invention. If desired, one or more available weight ports in a club head structure may remain empty. When removably attached, the weight member(s) (e.g., W_1 and W_2) may be attached to the club head structure **200** and/or **250** in any desired manner without departing from this invention, including via conventional manners that are known and used in the art, such as via mechanical connectors (e.g., threaded connections, etc.), retaining systems, adhesives, and the like.

[0040] Any type of weight member may be provided without departing from this invention, including, for example, tungsten-containing or lead-containing members, including tungsten or lead elements, tungsten or lead alloys, tungsten or lead-containing polymers, etc. Also, while FIGS. 2A through 2C illustrate separate and individual weight members (e.g., W_1 and W_2), this is not a requirement. Rather, if desired, a single weight member, optionally of varying size and/or density along at least one dimension, may be provided. As another example, if desired, the body of the club head structure (e.g., structure **102**) may be integrally formed to provide weighting in one or more desired areas. This may be accomplished in any desired manner without departing from this invention. For example, weighted regions may be provided by including a weighted material (e.g., tungsten or lead) in the metal, composite, or other structural materials of the club head **102** at the desired rear, sole, and/or side positions. As another example, if desired, weighted regions may be provided by making desired portions of the club head **102** from a thicker metal (or other) material or by making the desired portions of the club head from a different, heavier metal (or other) material. The weight member(s) or region(s) may be provided inside or partially inside the club head structure (e.g., engaged with

or fixed to an interior wall or structure, etc.); may be provided outside or partially outside the club head structure (e.g., engaged with or fixed to an exterior wall or structure); may be integrally formed at a desired position in one or more wall structures; may be provided in one or more ports formed in or engaged with the club head structure; etc. Any desired ways of providing weighted regions at desired locations in an overall club head structure 102 may be used without departing from this invention.

[0041] While specific dimensions, characteristics, and/or ranges of dimensions and characteristics may be used for a given club head structure (such as the ranges described in U.S. Published Patent Appln. No. 2005-0239576 A1 published Oct. 27, 2005), those skilled in the art will recognize that these dimensions and ranges are simply examples that may be used in at least some example club head structures of the invention. Many variations in the ranges and the specific dimensions and characteristics may be used without departing from this invention, e.g., depending on the type of club, user preferences, user swing characteristics, and the like. For example, various dimensions and/or characteristics may be used (such as various loft angles, face angles, head weights, lie angles, center of gravity angles, inset distances, lengths, breadths, heights, face thicknesses, crown thicknesses, sole thicknesses, body member thicknesses, hosel diameters, volumes, bulge radii, roll radii, body densities, etc.), e.g., depending on whether the golf club head is a driver, a 2-wood, a 3-wood, a 4-wood, a 5-wood, a 7-wood, a 9-wood, a wood-type hybrid club, etc. Also, various dimensions and/or characteristics may be provided to suit a user's preferences and/or swing characteristics; to provide the desired launch angle, carry distance, and/or other characteristics for the club; etc. Additionally, various different shaft characteristics (such as stiffness, flex point, kick point, etc.) may be used to further allow change and control over the club's and the club head's feel and characteristics.

[0042] As noted above, golf club heads in accordance with examples of this invention may use the club head design and/or geometry to produce other desired club head characteristics. For example, in some club head structures in accordance with this invention, the club head will have a larger head and/or face length (e.g., heel to toe) relative to the club head's depth or breadth (e.g., front to back) and a "squared" structure, which results in a club head that is more torsionally stable (i.e., more resistant to twisting), thereby producing a more consistent, reliable, and/or straight golf ball flight. Golf club heads and golf clubs in accordance with at least some of these example aspects of the invention may include a club head body having an overall club head length dimension L of at least 4.5 inches, at least 4.6 inches, at least 4.7 inches, at least 4.8 inches, or even at least 4.9 inches, and a ratio of an overall club head breadth dimension to the overall club head length dimension of 0.9 or more and 1 or less. Club heads in accordance with at least some examples of this invention may have a ratio of club head breadth to club head length of at least 0.94, at least 0.95, at least 0.96, at least 0.97, or even at least 0.98.

[0043] In golf club heads in accordance with at least some examples of this invention, the overall club head breadth B dimension may be at least 4.2 inches, at least 4.3 inches, at least 4.4 inches, at least 4.5 inches, at least 4.6 inches, at least 4.7 inches, at least 4.8 inches, or even at least 4.9 inches. As with the examples described above, the club head body according to at least some examples of this aspect of

the invention may be dimensioned such that the overall club head length dimension L is at least 4.7 inches, at least 4.8 inches, or even at least 4.9 inches, and/or such that the overall club head body size is 500 cm³ or less, 470 cm³ or less, or even 460 cm³ or less. In some examples, the overall club head body size or volume will be at least 350 cc, at least 400 cc, at least 420 cc, or even at least 450 cc.

[0044] While a wide variety of specific dimensions are possible, in one more specific example, the overall club head length dimension L will be about 4.93 inches, the overall club head breadth dimension B will be about 4.86 inches, and the club head overall diagonal dimension D will be at least 0.9 (B²+L²)^{1/2} (or at least 6.23 inches). In such club head structures, the "open portion of the diagonal" dimension (e.g., along the diagonal line D from D₁ to D₂ in FIG. 1E) may be less than 0.5 inches, and in some specific examples, it may be about 0.44 inches.

[0045] Of course, many modifications to the overall club head structures and/or the overall golf club structures may be made without departing from this invention. For example, many modifications may be made to the part or parts making up the club head structure, to the materials used in making the club head structure, to the manner in which the club head structure is joined together, etc. Also, many modifications may be made to the thickness, weight, shape, and/or other physical characteristics of the part or parts making up the overall golf club structure, to the manner in which these parts are fixed together, to the materials used in these parts, etc.

CONCLUSION

[0046] While the invention has been described in detail in terms of specific examples including presently preferred modes of carrying out the invention, those skilled in the art will appreciate that there are numerous variations and permutations of the above described systems and methods. Thus, the spirit and scope of the invention should be construed broadly as set forth in the appended claims.

1. A golf club head, comprising:

a club head body having a club head length dimension L and a club head breadth dimension B, wherein the club head body has a breadth dimension to length dimension ratio of at least 0.9, a club head volume of at least 450 cubic centimeters, and an overall diagonal dimension of at least $0.75 \times (B^2 + L^2)^{1/2}$, wherein the overall diagonal dimension is measured along a diagonal of a bounding box enclosing the club head body and defined by the length dimension and the breadth dimension.

2. A golf club head according to claim 1, wherein the overall diagonal dimension is at least $0.8 \times (B^2 + L^2)^{1/2}$.

3. A golf club head according to claim 1, wherein the overall diagonal dimension is at least $0.85 \times (B^2 + L^2)^{1/2}$.

4. A golf club head according to claim 1, wherein the club head body includes at least one non-metal portion.

5. A golf club head according to claim 4, wherein the at least one non-metal portion includes a non-metal crown portion.

6. A golf club head according to claim 5, wherein the at least one non-metal portion includes a non-metal sole portion.

7. A golf club head according to claim 4, wherein the at least one non-metal portion includes a non-metal sole portion.

8. A golf club head according to claim 4, wherein the club head body includes a metal member, wherein the at least one non-metal portion is engaged with the metal member.

9. (canceled)

10. A golf club head according to claim 1, further comprising:

a weight member engaged with the club head body and located at or proximate to a rear portion of the club head body.

11. A golf club head according to claim 10, wherein at least some of the weight member is located toward a heel side of the rear portion of the club head body.

12. A golf club head according to claim 10, wherein at least some of the weight member is located toward a toe side of the rear portion of the club head body.

13. A golf club head according to claim 1, further comprising:

a weight member removably engaged with the club head body.

14. A golf club head according to claim 1, further comprising:

a weight member engaged with the club head body and located within an interior chamber at least partially defined by the club head body.

15. A golf club head according to claim 1, further comprising:

a weighted portion integrally formed as part of the club head body.

16. A golf club head according to claim 15, wherein the weighted portion is located at or proximate to a rear portion of the club head body.

17. A golf club head according to claim 16, wherein at least some of the weighted portion is located toward a heel side of the rear portion of the club head body.

18. A golf club head according to claim 16, wherein at least some of the weighted portion is located toward a toe side of the rear portion of the club head body.

19. A golf club head according to claim 1, further comprising:

a first weight member engaged with the club head body at or proximate to the rear portion of the club head body; and

a second weight member engaged with the club head body at or proximate to a rear portion of the club head body, wherein the second weight member is separate from the first weight member.

20-21. (canceled)

22. A golf club head according to claim 19, wherein the first weight member is located toward a heel side of the rear portion of the club head body and the second weight member is located toward a toe side of the rear portion of the club head body.

23. A golf club head according to claim 19, wherein the first weight member is removably engaged with the club head body and the second weight member is removably engaged with the club head body.

24. A golf club head according to claim 1, wherein the length dimension is at least 4.5 inches.

25. A golf club head, comprising:

a club head body including a metal body portion and a non-metal portion engaged with the metal body portion, wherein the club head body has an overall club head length dimension L of at least 4.5 inches, a breadth dimension B to length dimension ratio of at

least 0.9, a club head volume of at least 450 cubic centimeters, and an overall diagonal dimension of at least $0.75 \times (B^2 + L^2)^{1/2}$, wherein the overall diagonal dimension is measured along a diagonal of a bounding box enclosing the club head and defined by the length dimension and the breadth dimension; and

a weight engaged with or integrally formed at or proximate to a rear portion of the club head body.

26. A golf club head according to claim 25, wherein the overall diagonal dimension is at least $0.8 \times (B^2 + L^2)^{1/2}$.

27. A golf club head according to claim 25, wherein the overall diagonal dimension is at least $0.85 \times (B^2 + L^2)^{1/2}$.

28-39. (canceled)

40. A golf club head, comprising:

a club head body having a club head length dimension L and a club head breadth dimension B, wherein the club head body has a breadth dimension to length dimension ratio of at least 0.9 and a club head volume of at least 450 cubic centimeters, and wherein at least one horizontal cross section of the club head body encloses an area of at least $0.8 \times BL$.

41. A golf club head according to claim 40, wherein the area is at least $0.85 \times BL$.

42. A golf club head according to claim 40, wherein the area is at least $0.9 \times BL$.

43. A golf club head according to claim 40, wherein the club head body includes at least one non-metal portion.

44. A golf club head according to claim 43, wherein the at least one non-metal portion includes a non-metal crown portion.

45. A golf club head according to claim 44, wherein the at least one non-metal portion includes a non-metal sole portion.

46. A golf club head according to claim 43, wherein the at least one non-metal portion includes a non-metal sole portion.

47. A golf club head according to claim 43, wherein the club head body includes a metal member, wherein the at least one non-metal portion is engaged with the metal member.

48. (canceled)

49. A golf club head according to claim 40, further comprising:

a weight member is engaged with the club head body and located at or proximate to a rear portion of the club head body.

50. A golf club head according to claim 49, wherein at least some of the weight member is located toward a heel side of the rear portion of the club head body.

51. A golf club head according to claim 49, wherein at least some of the weight member is located toward a toe side of the rear portion of the club head body.

52. A golf club head according to claim 40, further comprising:

a weight member removably engaged with the club head body.

53. A golf club head according to claim 40, further comprising:

a weight member is engaged with the club head body and located within an interior chamber at least partially defined by the club head body.

54. A golf club head according to claim **40**, further comprising:

a weighted portion integrally formed as part of the club head body.

55. A golf club head according to claim **54**, wherein the weighted portion is located at or proximate to a rear portion of the club head body.

56. A golf club head according to claim **55**, wherein at least some of the weighted portion is located toward a heel side of the rear portion of the club head body.

57. A golf club head according to claim **55**, wherein at least some of the weighted portion is located toward a toe side of the rear portion of the club head body.

58. A golf club head according to claim **40**, further comprising:

a first weight member engaged with the club head body at or proximate to the rear portion of the club head body; and

a second weight member engaged with the club head body at or proximate to a rear portion of the club head body, wherein the second weight member is separate from the first weight member.

59-60. (canceled)

61. A golf club head according to claim **58**, wherein the first weight member is located toward a heel side of the rear portion of the club head body and the second weight member is located toward a toe side of the rear portion of the club head body.

62. A golf club head according to claim **58**, wherein the first weight member is removably engaged with the club head body and the second weight member is removably engaged with the club head body.

63. A golf club head according to claim **40**, wherein the length dimension is at least 4.5 inches.

64. A golf club, comprising:

a club head body having a club head length dimension L and a club head breadth dimension B, wherein the club head body has a breadth dimension to length dimension ratio of at least 0.9, a club head volume of at least 450 cubic centimeters, and an overall diagonal dimension of at least $0.75 \times (B^2 + L^2)^{1/2}$, wherein the overall diagonal dimension is measured along a diagonal of a bounding box enclosing the club head and defined by the length dimension and the breadth dimension; and a shaft member engaged with the club head body.

65. A golf club according to claim **64**, wherein the overall diagonal dimension is at least $0.8 \times (B^2 + L^2)^{1/2}$.

66. A golf club according to claim **64**, wherein the overall diagonal dimension is at least $0.85 \times (B^2 + L^2)^{1/2}$.

67-88. (canceled)

89. A golf club, comprising:

a club head body including a metal body portion and a non-metal portion engaged with the metal body portion, wherein the club head body has an overall club head length dimension L of at least 4.5 inches, a breadth dimension B to length dimension ratio of at least 0.9, a club head volume of at least 450 cubic centimeters, and an overall diagonal dimension of at least $0.75 \times (B^2 + L^2)^{1/2}$, wherein the overall diagonal dimension is measured along a diagonal of a bounding box enclosing the club head body and defined by the length dimension and the breadth dimension;

a weight engaged with or integrally formed at or proximate to a rear portion of the club head body; and

a shaft member engaged with the club head body.

90. A golf club according to claim **89**, wherein the overall diagonal dimension is at least $0.8 \times (B^2 + L^2)^{1/2}$.

91. A golf club according to claim **89**, wherein the overall diagonal dimension is at least $0.85 \times (B^2 + L^2)^{1/2}$.

92-104. (canceled)

105. A golf club, comprising:

a club head body having a club head length dimension L and a club head breadth dimension B, wherein the club head body has a breadth dimension to length dimension ratio of at least 0.9 and a club head volume of at least 450 cubic centimeters, and wherein at least one horizontal cross section of the club head body encloses an area of at least $0.8 \times BL$; and

a shaft member engaged with the club head body.

106. A golf club according to claim **105**, wherein the area is at least $0.85 \times BL$.

107. A golf club according to claim **105**, wherein the area is at least $0.9 \times BL$.

108-129. (canceled)

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