



(51) International Patent Classification:
A63B 53/04 (2006.01)

(21) International Application Number:

PCT/US2012/052113

(22) International Filing Date:

23 August 2012 (23.08.2012)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

61/526,323 23 August 2011 (23.08.2011) US

(71) Applicant (for all designated States except US): **NIKE INTERNATIONAL LTD.** [US/US]; One Bowerman Drive, Beaverton, Oregon 97005-6453 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **SLAUGHTER, Byron Cole** [US/US]; c/o Nike, Inc., One Bowerman Drive, Beaverton, Oregon 97005-6453 (US). **ARVIZU, Jorge** [US/US]; c/o Nike, Inc., One Bowerman Drive, Beaverton, Oregon 97005-6453 (US). **LUKASIEWICZ, JR., Robert** [US/US]; c/o Nike, Inc., One Bowerman Drive, Beaverton, Oregon 97005-6453 (US). **DUMAS, Ronald D.** [US/US]; c/o Nike, Inc., One Bowerman Drive, Beaverton, Oregon 97005-6453 (US). **BOYD, Robert** [US/US]; c/o Nike, Inc., One Bowerman Drive, Beaverton, Oregon 97005-6453 (US). **OLDKNOW, Andrew** [US/US]; c/o Nike, Inc., One Bowerman Drive, Beaverton,

Oregon 97005-6453 (US). **FINN, Michael** [US/US]; c/o Nike, Inc., One Bowerman Drive, Beaverton, Oregon 97005-6453 (US).

(74) Agent: **SCHLENZ, Gregory G.**; Banner & Witcoff, Ltd., 10 South Wacker Drive, Suite 3000, Chicago, Illinois 60606-7407 (US).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

[Continued on next page]

(54) Title: GOLF CLUB HEAD OR OTHER BALL STRIKING DEVICE HAVING COLOR COMPONENT

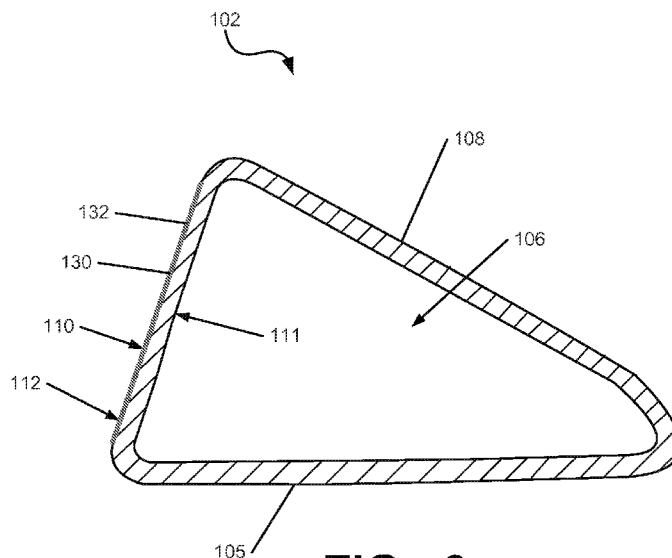


FIG. 6

(57) Abstract: A ball striking device, such as a golf club head (102), has a head that includes a face (112) configured for striking a ball and a body (108) connected to the face, the body being adapted for connection of a shaft proximate a heel thereof. At least one component (130) of the head includes a coloring that creates a different visual impression. Such a coloring may be integrally formed as part of the outer surface of component. The head may include a face that is at least partially colored as described herein.

WO 2013/028894 A1



Published:

— *with international search report (Art. 21(3))*

**GOLF CLUB HEAD OR OTHER BALL STRIKING DEVICE
HAVING COLOR COMPONENT**

5 CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] The present application claims priority to and the benefit of U.S. Provisional Application No. 61/526,323, filed August 23, 2011, which is incorporated by reference herein in its entirety.

TECHNICAL FIELD

- 10 [0002] The invention relates generally to ball striking devices, such as golf clubs and golf club heads, having a component that is colored a desired color. Certain aspects of this invention relate to golf club heads having a ball striking face that has a color that may be integrally formed on the face.

BACKGROUND

- 15 [0003] Golf is enjoyed by a wide variety of players – players of different genders, and players of dramatically different ages and skill levels. Golf is somewhat unique in the sporting world in that such diverse collections of players can play together in golf outings or events, even in direct competition with one another (e.g., using handicapped scoring, different tee boxes, etc.), and still enjoy the golf outing or competition. These factors,
20 together with increased 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.

- [0004] Golfers at all skill levels may desire golf clubs with more pleasing and/or
25 interesting visual appearance. A greater variety of different visual appearances may likewise be desirable. Current techniques for coloring or otherwise altering the visual appearance of a golf club or golf club head have limitations such that different types of visual appearances cannot be created on at least some portions of the club head without unsuitably altering the functional performance of the club head. In one example, current techniques do not provide
30 the ability to apply many desired visual appearances to the face of a club head without

unsuitably altering the performance of the face, such as impact characteristics, durability, etc. Other such examples exist.

[0005] The present device and method are provided to address the problems discussed above and other problems, and to provide advantages and aspects not provided by prior ball striking devices of this type. A full discussion of the features and advantages of the present invention is deferred to the following detailed description, which proceeds with reference to the accompanying drawings.

BRIEF SUMMARY

[0006] The following presents a general summary of aspects of the invention in order to provide a basic understanding of the invention. This summary is not an extensive overview of the invention. It is not intended to identify key or critical elements of the invention or to delineate the scope of the invention. The following summary merely presents some concepts of the invention in a general form as a prelude to the more detailed description provided below.

[0007] Aspects of the invention relate to a head for a ball striking device that includes a face having an outer periphery, a striking surface configured for striking a ball, and a rear surface opposite the striking surface, and a body connected to at least a portion of the outer periphery of the face and extending rearwardly from the face. The head has an outer surface including an exterior surface of the body and the striking surface of the face. Additionally, at least a majority of the face is formed of a first material. A second material is integrally connected to the outer surface and covers at least a portion of the outer surface. The second material forms a coloring on the outer surface, such that the coloring has a different visual appearance from the first material. The coloring may have a different visual appearance than the first material in an un-colored state, in one example. The club head may be a wood-type head, an iron-type head, a putter head, or other golf club head type, in various embodiments.

[0008] According to one aspect, the first material is a metallic material and the second material is an anodized oxide layer, and the coloring is formed by a dye applied to the anodized oxide layer.

[0009] According to another aspect, the first material is a first metallic material and the second material is a second metallic material that is integrally connected to the first metallic

material to form a layer. The layer has a thickness that is substantially lower than the thickness of the first material. For example, the first material may be a titanium material and the second material may be an aluminum material that is integrally connected to the titanium material by an explosion welding technique. The aluminum layer may further be anodized.

5 [0010] According to a further aspect, the second material is integrally connected by one or more of the following techniques: anodizing, welding, thin film deposition techniques, and surface composition modification.

[0011] According to yet another aspect, the second material is at least partially coated with a third material having at least a greater durability and/or a different surface texture than
10 the second material. The third material may be a polymer based material that is at least partially transparent.

[0012] Additional aspects of the invention relate to a head for a ball striking device that includes a face having an outer periphery, a striking surface configured for striking a ball, and a rear surface opposite the striking surface, and a body connected to at least a portion of the
15 outer periphery of the face and extending rearwardly from the face. A coloring material is applied to at least a portion of the striking surface and covers at least a portion of the striking surface, and the coloring material applies a coloring to the striking surface, such that the coloring has a different visual appearance from the first material. A coating material is applied to at least a portion of the coloring material and covers the at least a portion of the
20 coloring material. The coating material may be a polymer based material that is at least partially transparent so that the coloring can be viewed through the coating material, and the coating material may have at least a greater durability and/or a different surface texture than the coloring material.

[0013] According to one aspect, the coloring material includes one or more of the
25 following: paints, inks, dyes, anodized oxide coatings, color-polarizing layers, and colored polymer films.

[0014] According to another aspect, the coating material also includes a particulate material embedded in the polymer based material.

[0015] Further aspects of the invention relate to a head for a ball striking device that
30 includes a face having an outer periphery, a striking surface configured for striking a ball, and

a rear surface opposite the striking surface, and a body connected to at least a portion of the outer periphery of the face and extending rearwardly from the face, with the body having an exterior surface. A coloring material is applied to at least a portion of the exterior surface of the body and covers at least a portion of the exterior surface. The coloring material may include a cast vinyl film material having a coloring applied thereto, and the coloring material forms the coloring on the exterior surface, such that the coloring has a different visual appearance from the exterior surface. A coating material is applied to at least a portion of the coloring material and covers the at least a portion of the coloring material. The coating material may be a polymer based material and may be at least partially transparent so that the coloring can be viewed through the coating material. The coating material may also have at least a greater durability and/or a different surface texture than the cast vinyl film material.

[0016] According to one aspect, the cast vinyl film material is adhesively connected to the exterior surface of the body.

[0017] According to another aspect, the coloring material has a graphic design at least partially forming the different visual appearance from the exterior surface.

[0018] Other aspects of the invention relate to a method that includes providing a golf club head as described above, and connecting a coloring material or other second material to at least a portion of the outer surface of the head to create a different visual appearance, as described above.

[0019] Still other aspects of the invention relate to golf clubs that include a golf club head as described above and a shaft connected to the head, or a set of golf clubs including at least one golf club having a head as described above.

[0020] Other features and advantages of the invention will be apparent from the following description taken in conjunction with the attached drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021] To allow for a more full understanding of the present invention, it will now be described by way of example, with reference to the accompanying drawings in which:

FIG. 1 is a front view of one embodiment of a ball striking device according to aspects of the invention, in the form of a wood-type golf club;

FIG. 2 is a top view of a head of the ball striking device of FIG. 1;

FIG. 3 is a front view of the head of FIG. 2, with one embodiment of a color component;

FIG. 4 is a front view of the head of FIG. 2, with another embodiment of a color component;

FIG. 5 is a front view of the head of FIG. 2, with another embodiment of a color component;

FIG. 6 is a cross-section view of the head of FIG. 2;

FIG. 7 is a front view of another embodiment of a ball striking device according to aspects of the invention, in the form of an iron-type golf club;

FIG. 8 is a front view of a head of the ball striking device of FIG. 7;

FIG. 9 is a rear view of the head of FIG. 8;

FIG. 10 is a cross-section view taken along lines 10-10 of FIG. 9;

FIG. 11 is a magnified cross-section view of a portion of the face of FIG. 2, with another embodiment of a color component;

FIG. 12 is a cross-section view of another embodiment of a face for a head of a ball striking device having a color component; and

FIG. 13 is a cross-section view of the head of FIG. 2, with another embodiment of a color component.

DETAILED DESCRIPTION

[0022] In the following description of various example structures according to 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 devices, systems, and environments in which aspects of the invention may be practiced. It is to be understood that other specific arrangements of parts, example devices, systems, and environments 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," "side," "rear," "primary," "secondary," 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 or the orientation during typical use. Additionally, the term "plurality," as used herein, indicates any number greater than one, either disjunctively or conjunctively, as necessary, up to an infinite number.

Nothing in this specification should be construed as requiring a specific three dimensional orientation of structures in order to fall within the scope of this invention. Also, the reader is advised that the attached drawings are not necessarily drawn to scale.

5 [0023] The following terms are used in this specification, and unless otherwise noted or clear from the context, these terms have the meanings provided below.

[0024] "Ball striking device" means any device constructed and designed to strike a ball or other similar objects (such as a hockey puck). In addition to generically encompassing "ball striking heads," which are described in more detail below, examples of "ball striking devices" include, but are not limited to: golf clubs, putters, croquet mallets, polo mallets, 10 baseball or softball bats, cricket bats, tennis rackets, badminton rackets, field hockey sticks, ice hockey sticks, and the like.

[0025] "Ball striking head" means the portion of a "ball striking device" that includes and is located immediately adjacent (optionally surrounding) the portion of the ball striking device designed to contact the ball (or other object) in use. In some examples, such as many 15 golf clubs and putters, the ball striking head may be a separate and independent entity from any shaft or handle member, and it may be attached to the shaft or handle in some manner.

[0026] The term "shaft" includes the portion of a ball striking device (if any) that the user holds during a swing of a ball striking device.

20 [0027] The term "integrally connected" means that two materials are connected together in a way that includes at least some penetration of at least one of the materials into the other material, which may be achieved by various welding techniques, anodizing, and various deposition techniques, including physical vapor deposition (PVD) and other techniques described herein. It is understood that more than two materials may be integrally connected together and that a bonding material may be used to integrally connect two materials 25 together.

[0028] In general, aspects of this invention relate to ball striking devices, such as golf club heads, golf clubs, putter heads, putters, and the like. Such ball striking devices, according to at least some examples of the invention, may include a ball striking head and a ball striking surface. In the case of a golf club, the ball striking surface may constitute a 30 substantially flat surface on one face of the ball striking head, although some curvature may

be provided (e.g., “bulge” or “roll” characteristics). Some more specific aspects of this invention relate to wood-type golf clubs and golf club heads, including drivers, fairway woods, hybrid-type clubs, iron-type golf clubs, and the like, although aspects of this invention also may be practiced on other types of golf clubs or other ball striking devices, if
5 desired.

[0029] According to various aspects of this invention, the ball striking device may be formed of one or more of a variety of materials, such as metals (including metal alloys), ceramics, polymers, composites, fiber-reinforced composites, and wood, and the devices may be formed in one of a variety of configurations, without departing from the scope of the
10 invention. In one embodiment, some or all components of the head, including the face and at least a portion of the body of the head, are made of metal materials. It is understood that the head also may contain components made of several different materials. Additionally, the components may be formed by various forming methods. For example, metal components (such as titanium, aluminum, titanium alloys, aluminum alloys, steels (such as stainless
15 steels), and the like) may be formed by forging, molding, casting, stamping, machining, and/or other known techniques. In another example, composite components, such as carbon fiber-polymer composites, can be manufactured by a variety of composite processing techniques, such as prepreg processing, powder-based techniques, mold infiltration, and/or other known techniques.

[0030] The various figures in this application illustrate examples of ball striking devices and portions thereof according to this 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.

[0031] At least some examples of ball striking devices according to this invention relate
25 to golf club head structures, including heads for wood-type golf clubs, including drivers. Such devices may include a one-piece construction or a multiple-piece construction. Example structures of ball striking devices according to this invention will be described in detail below in conjunction with FIGS. 1-6, and will be referred to generally using reference numeral “100.” It is understood that the features described herein can be utilized with
30 different types of golf clubs and other ball striking devices, including fairway woods, hybrids, and other wood-type golf clubs, as well as iron-type clubs (e.g. device 200 in FIGS. 7-10), putters, chippers, etc.

[0032] FIGS. 1-6 illustrate examples of a ball striking device 100 in the form of a golf driver, in accordance with at least some examples of this invention. The ball striking device 100 includes a ball striking head 102 and a shaft 104 connected to the ball striking head 102 and extending therefrom. The ball striking head 102 of the ball striking device 100 of

5 FIGS. 1-6 has a face 112 connected to a body 108, with a hosel 109 extending therefrom. Any desired hosel and/or head/shaft interconnection structure may be used without departing from this invention, including conventional hosel or other head/shaft interconnection structures as are known and used in the art, or an adjustable, releasable, and/or

interchangeable hosel or other head/shaft interconnection structure such as those shown and

10 described in U.S. Patent 6,890,269 dated May 10, 2005, in the name of Bruce D. Burrows, U.S. Published Patent Application No. 2009/0011848, filed on July 6, 2007, in the name of John Thomas Stites, et al., U.S. Published Patent Application No. 2009/0011849, filed on July 6, 2007, in the name of John Thomas Stites, et al., U.S. Published Patent Application No. 2009/0011850, filed on July 6, 2007, in the name of John Thomas Stites, et al., and U.S.

15 Published Patent Application No. 2009/0062029, filed on August 28, 2007, in the name of John Thomas Stites, et al., all of which are incorporated herein by reference in their entireties.

[0033] For reference, the head 102 generally has a top 116, a bottom or sole 118, a heel 120 proximate the hosel 109, a toe 122 distal from the hosel 109, a front 124, and a back or rear 126. The shape and design of the head 102 may be partially dictated by the intended use
20 of the device 100. In the club 100 shown in FIGS. 1-6, the head 102 has a relatively large volume, as the club 100 is designed for use as a driver or wood-type club, intended to hit the ball accurately over long distances. In other applications, such as for a different type of golf club, the head may be designed to have different dimensions and configurations. When configured as a driver, the club head may have a volume of at least 400 cc, and in some
25 structures, at least 450 cc, or even at least 460 cc. Other appropriate sizes for other club heads may be readily determined by those skilled in the art.

[0034] In the embodiment illustrated in FIGS. 1-6, the head 102 has a hollow structure defining an inner cavity 106 (e.g., defined by the face 112 and the body 108). Thus, the head 102 has a plurality of inner surfaces defined therein. In one embodiment, the hollow center
30 cavity 106 may be filled with air. However, in other embodiments, the head 102 could be filled with another material, such as a foam. In still further embodiments, the solid materials of the head may occupy a greater proportion of the volume, and the head may have a smaller

cavity or no inner cavity at all. It is understood that the inner cavity 106 may not be completely enclosed in some embodiments.

[0035] The face 112 is located at the front 124 of the head 102, and has a ball striking surface 110 located thereon and a rear or inner surface 111 opposite the ball striking surface 110. The ball striking surface 110 is configured to face a ball in use, and is adapted to strike the ball when the device 100 is set in motion, such as by swinging. As shown, the ball striking surface 110 occupies most of the face 112. The ball striking surface 110 may include grooves 121 (e.g., generally horizontal grooves 121 extending across portions of the face 112 in the illustrated example). For reference purposes, the portion of the face 112 near the top face edge 113 and the heel face edge 117 is referred to as the “high-heel area”; the portion of the face 112 near the top face edge 113 and the toe face edge 119 is referred to as the “high-toe area”; the portion of the face 112 near the bottom face edge 115 and the heel face edge 117 is referred to as the “low-heel area”; and the portion of the face 112 near the bottom face edge 115 and the toe face edge 119 is referred to as the “low-toe area”. Conceptually, these areas may be recognized as quadrants of substantially equal size (and/or quadrants extending from a geometrical center of the face 112), though not necessarily with symmetrical dimensions. The face 112 may include some curvature in the top to bottom and/or heel to toe directions (e.g., bulge and roll characteristics), as is known and is conventional in the art. In other embodiments, the surface 110 may occupy a different proportion of the face 112, or the body 108 may have multiple ball striking surfaces 110 thereon. In the embodiment shown in FIGS. 1-6, the ball striking surface 110 is inclined slightly (i.e., at a loft angle), to give the ball slight lift and/or spin when struck. In other embodiments, the ball striking surface 110 may have a different incline or loft angle, to affect the trajectory of the ball. Additionally, the face 112 may have one or more internal or external inserts in some embodiments.

[0036] It is understood that the face 112, the body 108, and/or the hosel 109 can be formed as a single piece or as separate pieces that are joined together. In one embodiment, the face 112 may be formed from a face member, such as a face member having a cup-face structure, an L-shaped structure, or another structure with a wall or walls extending transverse and rearward from the edges of the face 112. The face member may be a plate member in another embodiment. The body 108 can be formed at least partially as a separate piece or pieces joined to the face member, such as by an integral joining technique, e.g., welding, cementing, or adhesively joining, and extending rearwardly from the face member.

Other known techniques for joining these parts can be used as well, including many mechanical joining techniques, such as releasable mechanical engagement techniques. If desired, the hosel 109 may be integrally formed as part of the body member or the face member.

5 [0037] The ball striking device 100 may include a shaft 104 connected to or otherwise engaged with the ball striking head 102, as shown in FIG. 1. The shaft 104 is adapted to be gripped by a user to swing the ball striking device 100 to strike the ball. The shaft 104 can be formed as a separate piece connected to the head 102, such as by connecting to the hosel 109, as shown in FIG. 1 and described above. In other embodiments, at least a portion of the shaft
10 104 may be an integral piece with the head 102, and/or the head 102 may not contain a hosel 109 or may contain an internal hosel structure. Still further embodiments are contemplated without departing from the scope of the invention. The shaft 104 may be constructed from one or more of a variety of materials, including metals, ceramics, polymers, composites, or wood. In some exemplary embodiments, the shaft 104, or at least portions thereof, may be
15 constructed of a metal, such as stainless steel, or a composite, such as a carbon/graphite fiber-polymer composite. However, it is contemplated that the shaft 104 may be constructed of different materials without departing from the scope of the invention, including conventional materials that are known and used in the art.

[0038] In general, the head 102 of the ball striking device 100 has at least one component
20 or portion of the outer surface that is colored to give the component a different visual appearance. In one embodiment, a component may be considered to have a different visual appearance if the component appears differently than the material forming the component would normally have appeared (i.e. in an un-colored state). The component that is colored may be the face 112, the body 108, the hosel 109, the shaft 104, or another component, or
25 smaller portions of such components. In one embodiment, the coloring is applied to at least a portion of the outer surface of the head 102, which is defined by the ball striking surface 110, the exterior surface 105 of the body 108, and possibly some other surfaces, such as surfaces of the hosel 109 or surfaces of other components (e.g. weights or inserts) that may be connected to the head 102. It is understood that the coloring may be a solid color, multiple or
30 mixed colors, a pattern, etc., or combinations of such colorings. The coloring may be integrally formed with the outer surface of the component, such as by a technique described below.

[0039] FIGS. 3-5 illustrate various embodiments of a head 102 as shown in FIGS. 1-2, with faces 112 that have different colorings. The face 112 of FIG. 3 has a colored portion 130 with an underlying black color and a red coloring that is intense around the center of the face 112 and fades toward the heel 120 and the toe 122 of the head 102. Additionally, some of the grooves 121 are colored to have a white appearance, and a logo or other symbol (not shown) may also be formed by coloring. The face 112 of FIG. 4 is not colored, however some of the grooves 121 on the face 112 are colored to have a red appearance. The face 112 of FIG. 5 has a colored portion with a red coloring applied over the natural metallic, and the red coloring is intense around the center of the face 112 and fades toward the heel 120 and the toe 122. The colored portion 130 includes an intense red outline around the peripheral edges 113, 115, 117, 119 of the face 112 as well. Additionally, some of the grooves 121 are colored to have a white appearance. In one embodiment, the red coloring achieved in FIGS. 3 and 5 is approximately color 187-C in the Pantone® Matching System and corresponds to light of about 660nm in wavelength. In other embodiments, the colored portion 130 may have another color or colors, and in one embodiment, an anodized titanium surface may be formed with a pink or rose coloring.

[0040] The colorings of the face 112 in FIGS. 3-5 or another component of the head 102 can be applied to the component(s) using one or more of a variety of different techniques. In one embodiment, the coloring is integrally formed and/or integrally connected with the component. Additionally, the coloring may be created by a second material that is integrally connected to the face 112, the body 108, or other component of the head 102, and covers at least a portion of such component. In one embodiment, the second material is different from the material to which it is connected, or is different from a material that forms at least a majority of the component to which it is connected. The second material may have a thickness that is substantially lower than the thickness of the component to which it is connected, such as being at least 1/10 or at least 1/100 as thick. For example, titanium and/or other metal components (e.g. the face 112) can be integrally colored by anodizing or other oxidizing technique, forming at least a partial layer of a second material (an oxide) that is integrally connected to the metal component. Anodizing can produce a more uniform, dense, and hard oxide layer than natural oxidation, and can be used to color a metal's surface. Anodized titanium or titanium alloy having a titanium oxide layer can achieve different colors by using different thicknesses of layers. Such coatings may have thicknesses ranging from several nanometers to a few micrometers, and may be produced using the techniques

described in AMS 2487 and/or AMS 2488. Anodizing can also be performed on a variety of metals in order to enhance the adhesion of paints, dyes, and other colorings, and it is understood that a component of the head 102 can be anodized in addition to other coloring techniques. Aluminum is an example of such a metal that can be anodized, as described in
5 greater detail below with respect to FIG. 12.

[0041] Paints, inks, dyes, and other applied coatings can be utilized to create coloring, and may be organic or inorganic in nature. The surface may be treated before application of paint, ink, dye, etc., such as by anodizing (as described above), application of a primer, or other treatments that may enhance adhesion, etc. A variety of other coatings or layers may
10 also be used, including various polymer/resin coatings, which may be transparent or translucent, or thin coatings of another metal or other material. One example of such a coating is a color-polarizing layer. A multi-layered structure can also be used, including a plurality of different layers with different optical properties. Such multi-layered structures can also be used to form different patterns and color shadings. Multi-layered structures may
15 also be used to change surface texture, increase durability, or provide other properties, as described below. Nanofilms may be used in some embodiments. Decals or other applicable material may also be used to create layers. In an exemplary embodiment, the coloring is an integral portion of the club head such as the ball striking face.

[0042] Any of a variety of surface treatment techniques other than anodizing can be used
20 to apply coloring to the surface of the component, and may be usable to integrally form the coloring. For example, atomic (i.e. thin-film) deposition techniques such as chemical vapor deposition or other chemical deposition; physical vapor deposition, sputtering, or other physical deposition; molecular beam epitaxy; and others. Such techniques may be used to form elemental thin films or molecular thin films such as oxides, nitrides (e.g. TiN), carbides,
25 chromates, etc., which may result in coloring of the surface of the component. Techniques such as anodizing, PVD, and other deposition techniques can be used to create a coloring material that is integrally connected to the surface of the club head 102. Further, two different films can be deposited on top of one another, in order to give the surface a two-toned color, such as the ball striking surface 110 of the face 112 of FIG. 3. Other surface
30 treatments using techniques that are mechanical, chemical, electrical, etc. in nature may also be used.

[0043] A different surface composition can also be used to create a coloring. For example, a component may have a composite surface that is created by adding a filler or secondary material to the matrix material at the surface of the component, with the secondary material imparting a color to the surface. It is understood that the component may have the secondary material throughout a larger portion of the component, including throughout the entirety of the component.

[0044] FIG. 6 illustrates one embodiment where the face 112 of the head 102 of a wood-type golf club 100 has a colored portion 130 formed by a coloring coating or layer 132 that is applied to the ball striking surface 110. The layer 132 may be created by any of the techniques described above, including integral forming techniques, and may be extremely thin (nanometer scale), such as a thin film deposited by anodizing or other surface treatment, or may be significantly thicker.

[0045] It is understood that the colorings of the faces 112 in FIGS. 3-5 may be produced using a combination of coloring techniques. For example, the face 112 in FIG. 3 may be produced by first coloring the face 112 black, such as by an integral surface treatment technique (e.g. anodizing, PVD), and then coloring a portion of the face 112 red, such as by a different integral surface treatment technique. The selected grooves 121 can then be colored, such as by painting or applying ink. As another example, the face 112 in FIG. 5 may utilize an integral surface treatment technique to produce the red colored face 112, and then the selected grooves 121 can then be colored, such as by painting or applying ink. Other combinations are usable in further embodiments.

[0046] In one embodiment, the coloring of the component is sufficiently durable to withstand conditions of use. For example, if a face 112 of a golf club head 102 is colored, the coloring must be sufficiently durable to withstand thousands of ball strikes on the face 112 without cracking, fading, or other damage or destruction. Forming the coloring integrally with the face 112, such as by using an anodizing or PVD technique, may improve durability.

[0047] Application of a layer or layers 132 to the outside of the head 102 may alter the texture and/or friction properties of the surface. This may be of particular concern when applying materials to the face 112, because affecting the texture may affect the spin imparted to the ball on contact, and may also implicate applicable USGA rules. In one embodiment, a layer 132 may be applied to the face 112 to apply coloring, as discussed herein and shown in

FIG. 6, and a texturing technique may be applied to the surface of the coating to alter the texture, such as by the use of abrasives in one example. The texturing may be performed to mimic the texture of brushed metal. In another embodiment, as illustrated in FIG. 11, a first layer 132 may be applied to the face 112 to apply a coloring component 130, as discussed
5 herein, and a second layer 134 may be applied over the first coating 132. This second layer 134 may be used to create an altered texture, and may additionally or alternately be used to achieve one or more other effects, such as adding durability, further altering the visual appearance, etc. Such a second coating 134 may be at least partially transparent or translucent so as not to obscure the coloring, and may be formed of a polymer based material
10 in one embodiment. One example of a suitable coating utilizes tiny polymer spheres or other particles embedded in a clear or substantially clear polymer based coating to impart a texture to the coating, which may also increase durability. In one embodiment, such a coating may be applied over a paint layer to achieve a desired texture and to increase the durability of the surface. It is understood that the technique depicted in FIG. 11 may be used to impart a
15 coloring to the body 108 in addition to, or instead of, the face 112. In a further embodiment, most or all of the head 102 may have a coloring applied by using one or more of the techniques described herein.

[0048] FIG. 12 illustrates a further example embodiment of a structure for producing a coloring on at least the face 112 of a head 102 as described above. In this example
20 embodiment, the face 112 may include a face plate 136 made of a typical metallic material, such as stainless steel or titanium, with a coating layer 138 of another metal integrally connected to the face plate 136. The coating layer 138 may have a thickness that is substantially lower than the thickness of the face plate 136, such as being at least 1/10 or at least 1/100 as thick as the face plate 136. For example, in one embodiment, the layer 138
25 may be integrally connected to the face plate 136 by an explosion welding technique or other non-fusion welding technique, such as friction welding. Alternate bonding techniques, including various fusion welding techniques, may be used in other embodiments. The layer 138 may cover at least a portion of the face plate 136, and in one embodiment, the layer 138 occupies the entire ball striking surface 110 of the face 112. Additionally, the layer 138 may
30 apply a coloring component 130 to the face 112, and may also be treated to create the coloring, such as by anodizing, PVD, or other techniques. Such treatment may be applied before or after joining of the layer 138 to the face plate 136. In one embodiment, the face plate 136 may have a layer of aluminum (which may include aluminum alloy) coating the

surface, with the layer 138 having a thickness of about 0.001 inch. The layer 138 of aluminum may be anodized to produce an oxide layer, and can then be colored (such as through application of dye) to produce a red surface or other colored surface. This anodizing can be performed according to specifications such as AMS 2469, AMS 2470, AMS 2471, AMS 2472, and/or AMS 2482, and may produce an oxide layer that is at least 0.5 micrometers thick. The surface of the layer 138 may also be treated to create other properties, such as durability and/or texture. This treatment may be performed using techniques described herein, such as abrasion or coating with an additional layer. It is understood that this technique or a similar technique may be utilized on the body 108 or other component of the head 102.

[0049] In another embodiment, such as the embodiment shown in FIG. 2, the exterior surface 105 of the body 108 (or portions thereof) can be colored to have a different visual appearance. In the embodiment of FIG. 2, the crown 116 of the body 108 has a colored portion 130 with a “rippled” pattern formed by coloring as described above, such as through anodizing, paint, other surface treatment, etc., including other techniques described herein. Other portions of the body 108 may be colored in other embodiments, including the sole 118. In another embodiment, as shown in FIG. 13, multiple layers 140, 142 may be applied to at least a portion of the exterior surface 105 of the body 108 to apply a coloring component 130 to the body 108. The multi-layered structure may include a first layer 140 that applies a coloring to the surface and a second layer 142 coating the first layer 140 and increasing the durability of the surface and/or imparting other useful properties. For example, the first layer 140 may be a porous cast vinyl film or other polymer film, which may be adhesively bonded to the body 108, and which may include a coloring 130 and/or a pattern or other graphic design. A second layer 142 of a clear coat material or other durable and protective material may be used to cover the first layer 140 and provide protection. This same multi-layer structure may additionally or alternately be applied to the face 112 in a further embodiment. Alternately, a single-layer structure may be used.

[0050] FIGS. 7-10 illustrate a ball striking device 200 in the form of a golf iron, in accordance with at least some examples of this invention. The embodiment of the iron-type ball striking device 200 illustrated in FIGS. 7-10 contains features similar to those of the embodiments described above with respect to FIGS. 1-6, and similar components in the embodiment of FIGS. 7-10 are similarly referred to using the “2xx” series of reference

numbers. It is understood that discussion of some features of the embodiment of FIGS. 7-10 that have already been described above may be reduced or eliminated in the interests of brevity. The ball striking device 200 includes a golf club head 202 and a shaft 204 attached to the head 202. The golf club head 202 of FIGS. 7-10 may be representative of any iron-type golf club head in accordance with examples of the present invention.

[0051] As shown in FIGS. 7-10, the golf club head 202 includes a face 212 connected to a body 208 and a hosel 209 extending from the body 208 for attachment of the shaft 204. The shaft 204, and the connection between the shaft 204 and the hosel 209 may be similar to that described above with respect to the device 100 of FIGS. 1-6. The shaft 204 may also include a grip 203 as described above. For reference, the head 202 generally has a top 216, a bottom or sole 218, a heel 220 proximate the hosel 209, and a toe 222 distal from the hosel 209, as well as a front 224 and a back or rear 226. In the embodiment shown, the face 212 extends upward from the sole 218 of the head 202. The shape and design of the head 202 may be partially dictated by the intended use of the device 200. The heel portion 220 is attached to and/or extends from a hosel 209 (e.g., as a unitary or integral one piece construction, as separate connected elements, etc.).

[0052] The face 212 is located at the front 224 of the head 202, and has a ball striking surface 210 located thereon and a rear or inner surface 211 opposite the ball striking surface 210. The head 202 has a rear cavity 206 that is defined by the rear surface 211 of the face 212, one or more walls 225 extending rearward from the face 212. The rear cavity 206 is open in this embodiment, however in other embodiments, the head 202 may include a rear wall that leaves the rear cavity 211 partially open or completely closed. In a further embodiment, the head 202 may include no rear cavity 206, such as in a blade-type iron. It is understood that in some embodiments of an iron-type golf club 200, the rear surface 211 of the face 212 may be a surface of the body 208, such as when the head 202 has no internal cavity.

[0053] The ball striking surface 210 is typically an outer surface of the face 212 configured to face a ball (not shown) in use, and is adapted to strike the ball when the device 200 is set in motion, such as by swinging. As shown, the ball striking surface 210 is relatively flat, occupying most of the face 212. The ball striking surface 210 may include grooves 221 (e.g., generally horizontal grooves 221 extending across the face 212 in the illustrated example) for the removal of water and grass from the face 212 during a ball strike.

Of course, any number of grooves, desired groove patterns, and/or groove constructions may be provided (or even no groove pattern, if desired), including conventional groove patterns and/or constructions, without departing from this invention.

[0054] For reference purposes, the portion of the face 212 nearest the top face edge 213 and the heel face edge 217 is referred to as the “high-heel area”; the portion of the face 212 nearest the top face edge 213 and the toe face edge 219 is referred to as the “high-toe area”; the portion of the face 212 nearest the bottom face edge 215 and the heel face edge 217 is referred to as the “low-heel area”; and the portion of the face 212 nearest the bottom face edge 215 and the toe face edge 219 is referred to as the “low-toe area”. Conceptually, these areas may be recognized and referred to as quadrants of substantially equal size (and/or quadrants extending from a geometric center of the face 212), though not necessarily with symmetrical dimensions. The face 212 may include some curvature in the top to bottom and/or heel to toe directions (e.g., bulge and roll characteristics), as is known and is conventional in the art. In other embodiments, the surface 210 may occupy a different proportion of the face 212, or the body 208 may have multiple ball striking surfaces 210 thereon. In the illustrative embodiment shown in FIGS. 7-10, the ball striking surface 210 is inclined (i.e., at a loft angle), to give the ball an appreciable degree of lift and spin when struck. In other illustrative embodiments, the ball striking surface 210 may have a different incline or loft angle, to affect the trajectory of the ball. Additionally, the face 212 may have a variable thickness and/or may have one or more internal or external inserts in some embodiments.

[0055] The face 212, the body 208, and/or the hosel 209 can be formed as a single piece or as separate pieces that are joined together. For example, the face 212, the body 208, and the hosel 209 can be formed together as a single piece by forging, casting, or other integral forming techniques. As another example, the face 212, the body 208, and the hosel 209 can be formed as separate pieces, such as a face member and a body member, which can be joined together by an integral joining technique, such as welding, or other joining technique.

[0056] Any components of the head 202 of FIGS. 7-10 can be colored using the techniques described above with respect to FIGS. 1-6 and 11-13. For example, the techniques described above can be used to apply coloring to the face 212 (e.g., the ball striking surface 210), the body 208 (e.g., the exterior surface 205 thereof), the hosel 209, the shaft 204, or other components or portions of the outer surface of the head 202, or smaller

components thereof. As described above, the coloring may be integrally formed with the outer surface of the component, and may be sufficiently durable to withstand the conditions of use of the head 202.

[0057] FIG. 10 illustrates one embodiment where the face 212 of the head 202 of a wood-type golf club 200 has a colored portion 230 formed by a coloring coating or layer 232 that is applied to the ball striking surface 210. The layer 232 may be created by any of the techniques described above, including integral forming techniques, and may be extremely thin (nanometer scale), such as a thin film deposited by anodizing or other surface treatment, or may be significantly thicker.

[0058] It is understood that any of the embodiments of ball striking devices 100, 200, heads 102, 202, faces 112, 212, and other components described herein may include any of the features described herein with respect to other embodiments described herein, unless otherwise noted. It is understood that the specific sizes, shapes, orientations, and locations of various components of the ball striking devices 100, 200 and heads 102, 202 described herein are simply examples, and that any of these features or properties may be altered in other embodiments.

[0059] Heads 102, 202, incorporating the features disclosed herein may be used as a ball striking device or a part thereof. For example, a golf club 100, 200 as shown in FIGS. 1 and 7 may be manufactured by attaching a shaft or handle 104 to a head that is provided, such as the head 102 as described above. "Providing" the head, as used herein, refers broadly to making an article available or accessible for future actions to be performed on the article, and does not connote that the party providing the article has manufactured, produced, or supplied the article or that the party providing the article has ownership or control of the article. In other embodiments, different types of ball striking devices can be manufactured according to the principles described herein. In one embodiment, a set of golf clubs can be manufactured, where at least one of the clubs has a head according to one or more embodiments described herein. Such a set may include at least one wood-type club and/or at least one iron-type club. For example, a set of iron-type golf clubs can be provided, with each club having a different loft angle, and each club having a head as described above. Further, one or more clubs can be customized for a particular user by providing a club with a head as described above, with a color component 130, 230, that has a color and/or other visual features as desired by the user.

Still further embodiments and variations are possible, including further techniques for customization.

[0060] The techniques described herein can be used to create ball striking devices with distinct visual appearances, including coloring or other visual effects. Additionally, the coloring or other visual effect may be formed to be durable with the conditions of use of the head 102, 202, such as by using techniques to integrally form the coloring with the component(s) of the head 102, 202. Further, the coloring or other visual effect may be formed without unsuitably affecting the functional properties of the device. Still further benefits can be recognized and appreciated by those skilled in the art.

[0061] While the invention has been described with respect to 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.

CLAIMS

What is claimed is:

1. A head for a ball striking device comprising:

5 a face having an outer periphery, a striking surface configured for striking a ball, and
a rear surface opposite the striking surface, wherein at least a majority of the face is formed
of a first material;

a body connected to at least a portion of the outer periphery of the face and extending
rearwardly from the face, wherein the head has an outer surface including an exterior surface
of the body and the striking surface of the face; and

10 a second material integrally connected to the outer surface and covering at least a
portion of the outer surface, wherein the second material forms a coloring on the outer
surface, such that the coloring has a different visual appearance from the first material.

2. The head of claim 1, wherein the first material is a metallic material and the
second material is an anodized oxide layer, and wherein the coloring is formed by a dye
15 applied to the anodized oxide layer.

3. The head of claim 1, wherein the second material is integrally connected by at
least one technique selected from a group consisting of: anodizing, welding, thin film
deposition techniques, and surface composition modification.

4. The head of claim 1, wherein the coloring has a different visual appearance
20 than the first material in an un-colored state.

5. The head of claim 1, wherein the second material is at least partially coated
with a third material having at least one of a greater durability than the second material and a
different surface texture than the second material.

6. The head of claim 5, wherein the third material is a polymer based material
25 and is at least partially transparent.

7. A golf club comprising the head of claim 1 and a shaft engaged with the head.

8. A head for a ball striking device comprising:

a face having an outer periphery, a striking surface configured for striking a ball, and
a rear surface opposite the striking surface;

30 a body connected to at least a portion of the outer periphery of the face and extending
rearwardly from the face;

a coloring material applied to at least a portion of the striking surface and covering at least a portion of the striking surface, wherein the coloring material applies a coloring to the striking surface, such that the coloring has a different visual appearance from the first material; and

5 a coating material applied to at least a portion of the coloring material and covering the at least a portion of the coloring material, wherein the coating material is a polymer based material and is at least partially transparent so that the coloring can be viewed through the coating material, and wherein the coating material has at least one of a greater durability and a different surface texture than the coloring material.

10 9. The head of claim 8, wherein the coloring material is selected from a group consisting of: paints, inks, dyes, anodized oxide coatings, color-polarizing layers, and colored polymer films.

10. The head of claim 8, wherein the coating material further comprises a particulate material embedded in the polymer based material.

15 11. A golf club comprising the head of claim 8 and a shaft engaged with the head.

12. A head for a ball striking device comprising:

a face having an outer periphery, a striking surface configured for striking a ball, and a rear surface opposite the striking surface;

20 a body connected to at least a portion of the outer periphery of the face and extending rearwardly from the face, the body having an exterior surface;

25 a coloring material applied to at least a portion of the exterior surface of the body and covering at least a portion of the exterior surface, wherein the coloring material comprises a cast vinyl film material having a coloring applied thereto, and wherein the coloring material forms the coloring on the exterior surface, such that the coloring has a different visual appearance from the exterior surface; and

30 a coating material applied to at least a portion of the coloring material and covering the at least a portion of the coloring material, wherein the coating material is a polymer based material and is at least partially transparent so that the coloring can be viewed through the coating material, and wherein the coating material has at least one of a greater durability and a different surface texture than the cast vinyl film material.

13. The head of claim 12, wherein the cast vinyl film material is adhesively connected to the exterior surface of the body.

14. The head of claim 12, wherein the coloring material has a graphic design at least partially forming the different visual appearance from the exterior surface.

15. A golf club comprising the head of claim 12 and a shaft engaged with the head.

5 16. A method comprising:

providing a head for a ball striking device comprising a face having an outer periphery, a striking surface configured for striking a ball, and a rear surface opposite the striking surface, wherein at least a majority of the face is formed of a first material, and a body connected to at least a portion of the outer periphery of the face and extending rearwardly from the face, wherein the head has an outer surface including an exterior surface of the body and the striking surface of the face; and

connecting a second material to the outer surface and covering at least a portion of the outer surface, wherein the second material forms a coloring on the outer surface, such that the coloring has a different visual appearance from the first material.

15 17. The method of claim 16, wherein the second material is integrally connected to the outer surface by at least one technique selected from a group consisting of: anodizing, welding, thin film deposition techniques, and surface composition modification.

18. The method of claim 16, wherein the second material comprises a cast vinyl film material having the coloring applied thereto, further comprising:

20 applying a coating material to at least a portion of the second material and covering the at least a portion of the second material, wherein the coating material is a polymer based material and is at least partially transparent so that the coloring can be viewed through the coating material, and wherein the coating material has at least one of a greater durability and a different surface texture than the cast vinyl film material.

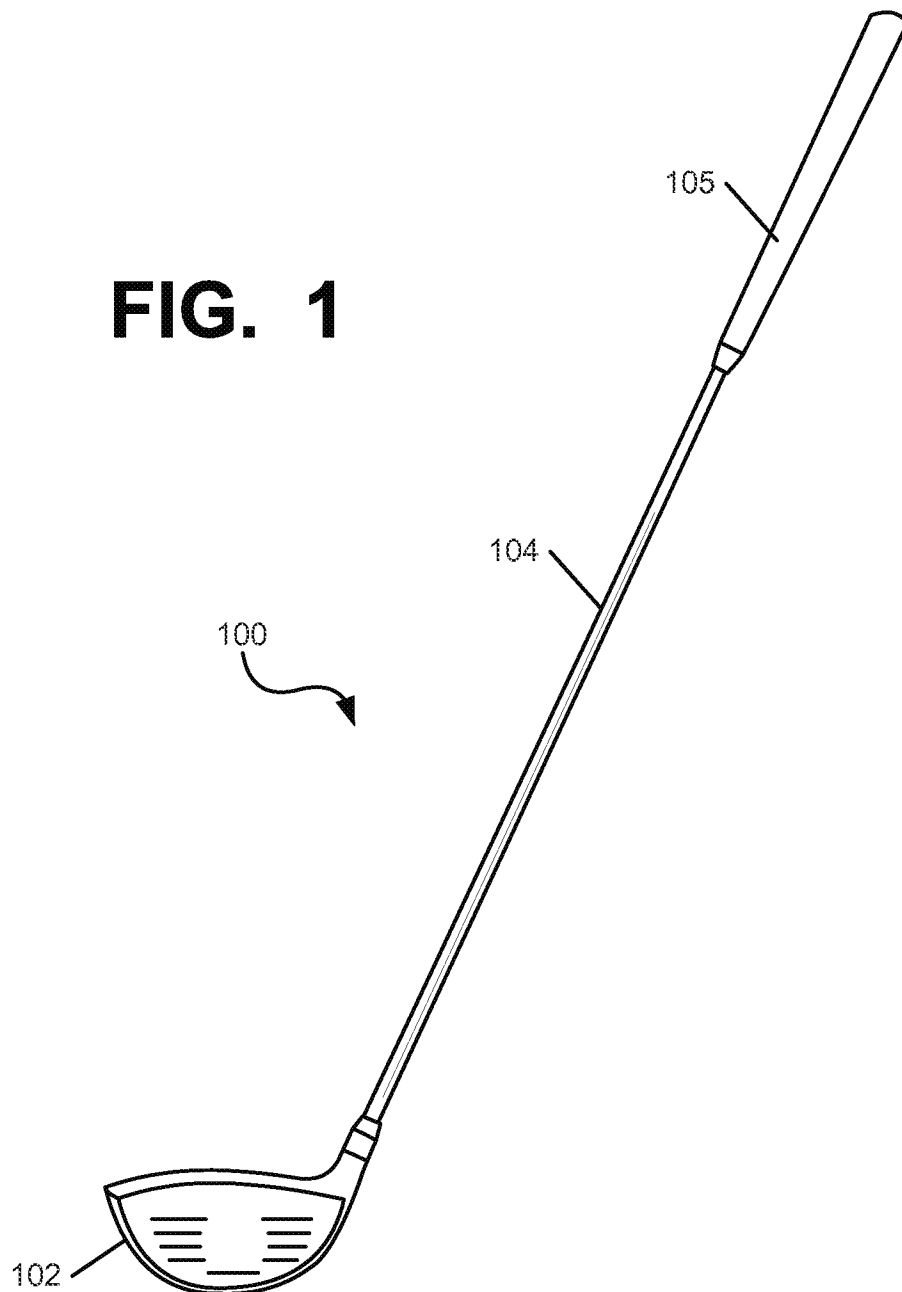
25 19. The method of claim 16, further comprising:

applying a coating material to at least a portion of the second material and covering the at least a portion of the second material, wherein the coating material is a polymer based material and is at least partially transparent so that the coloring can be viewed through the coating material, and wherein the coating material has at least one of a greater durability and a different surface texture than the cast vinyl film material.

30

20. The method of claim 19, wherein the second material comprises a cast vinyl film material having the coloring applied thereto, wherein the cast vinyl film material is adhesively connected to the outer surface.

FIG. 1



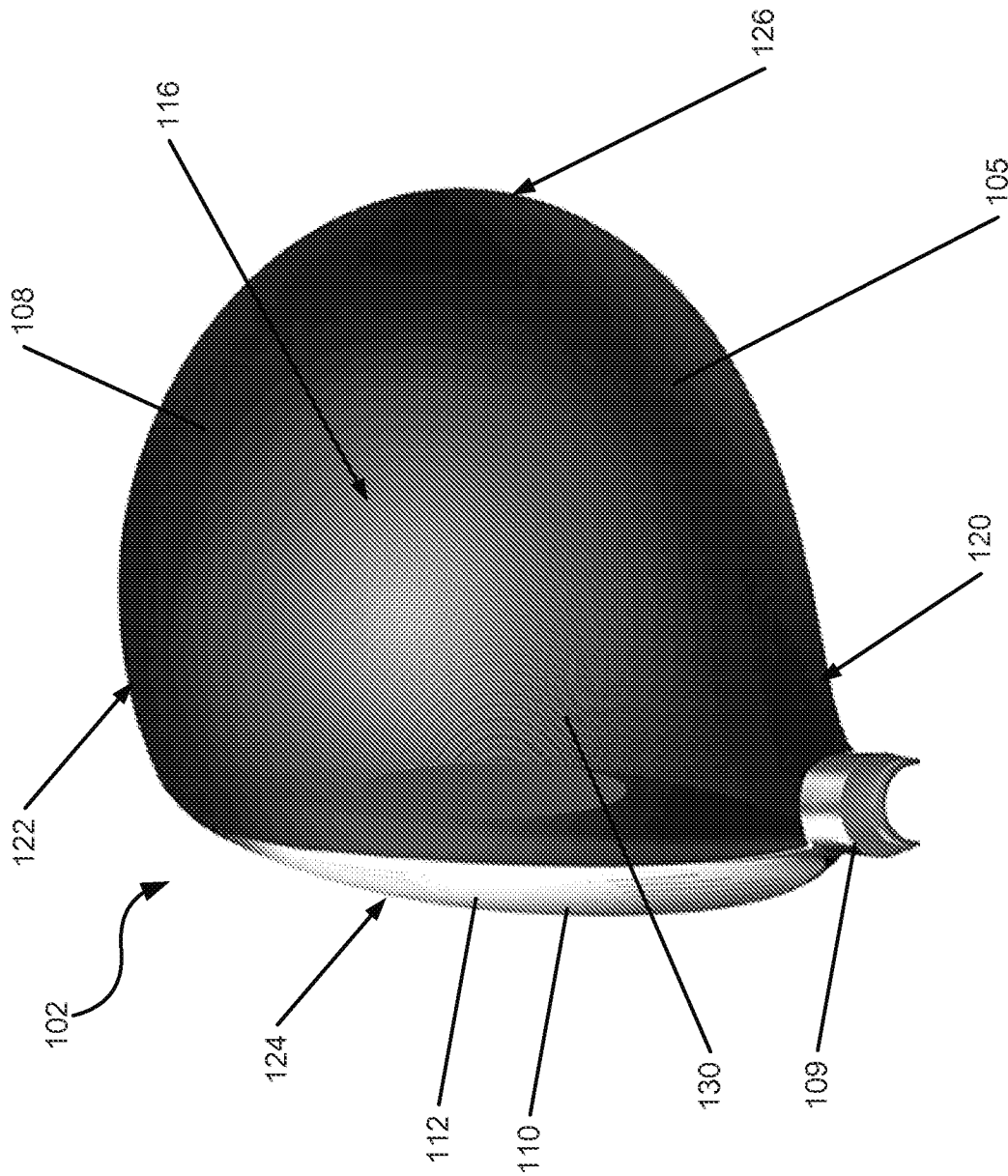


FIG. 2

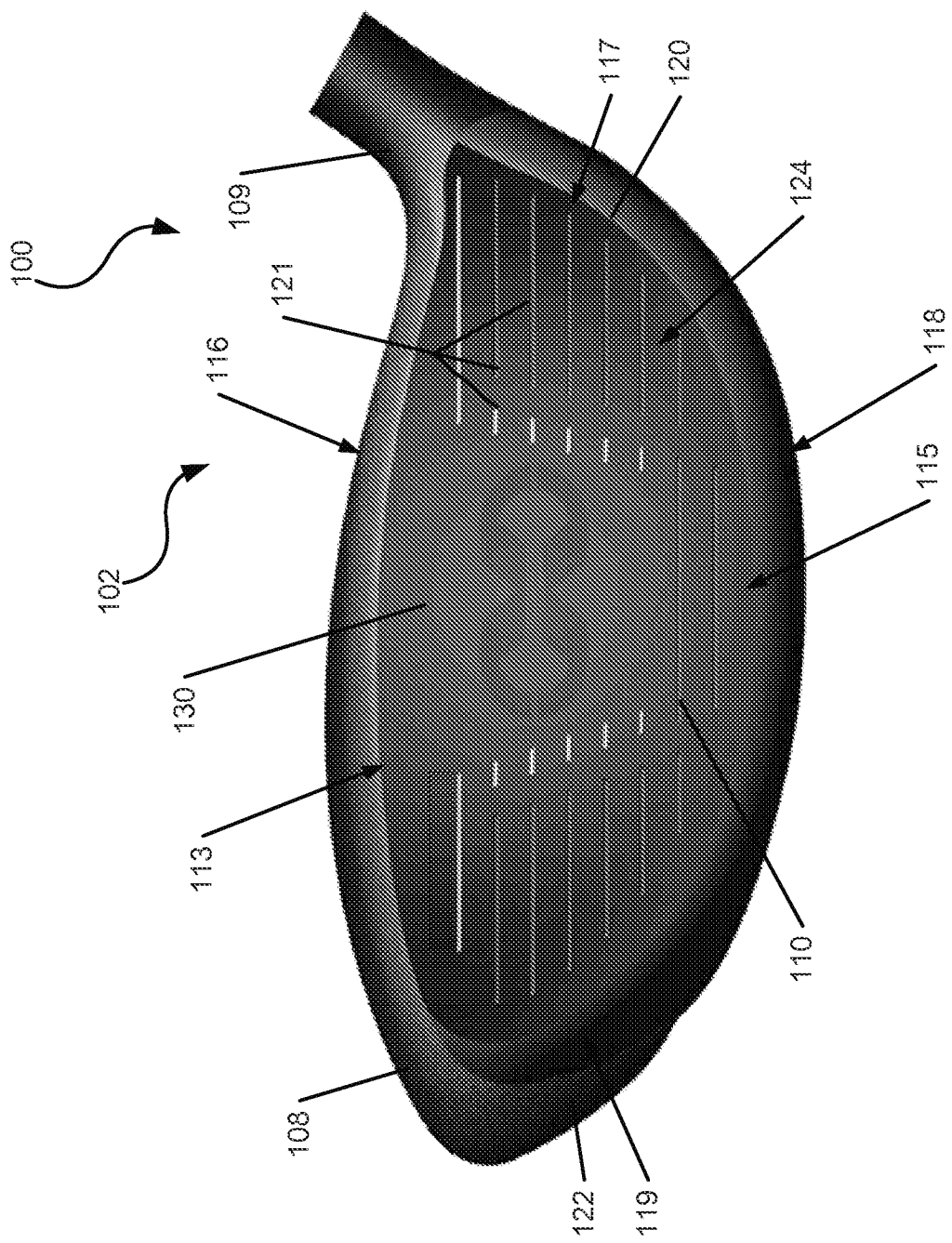


FIG. 3

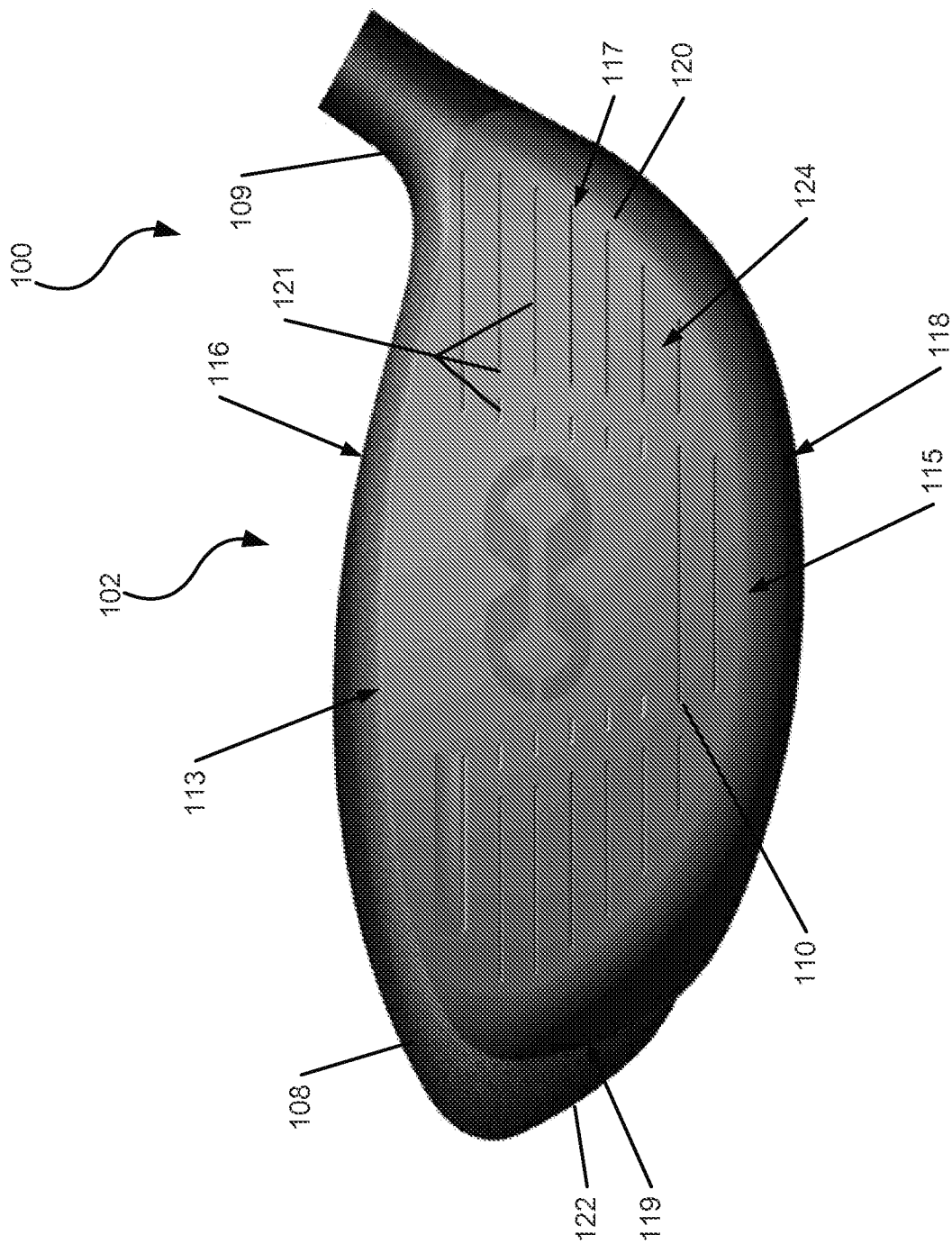


FIG. 4

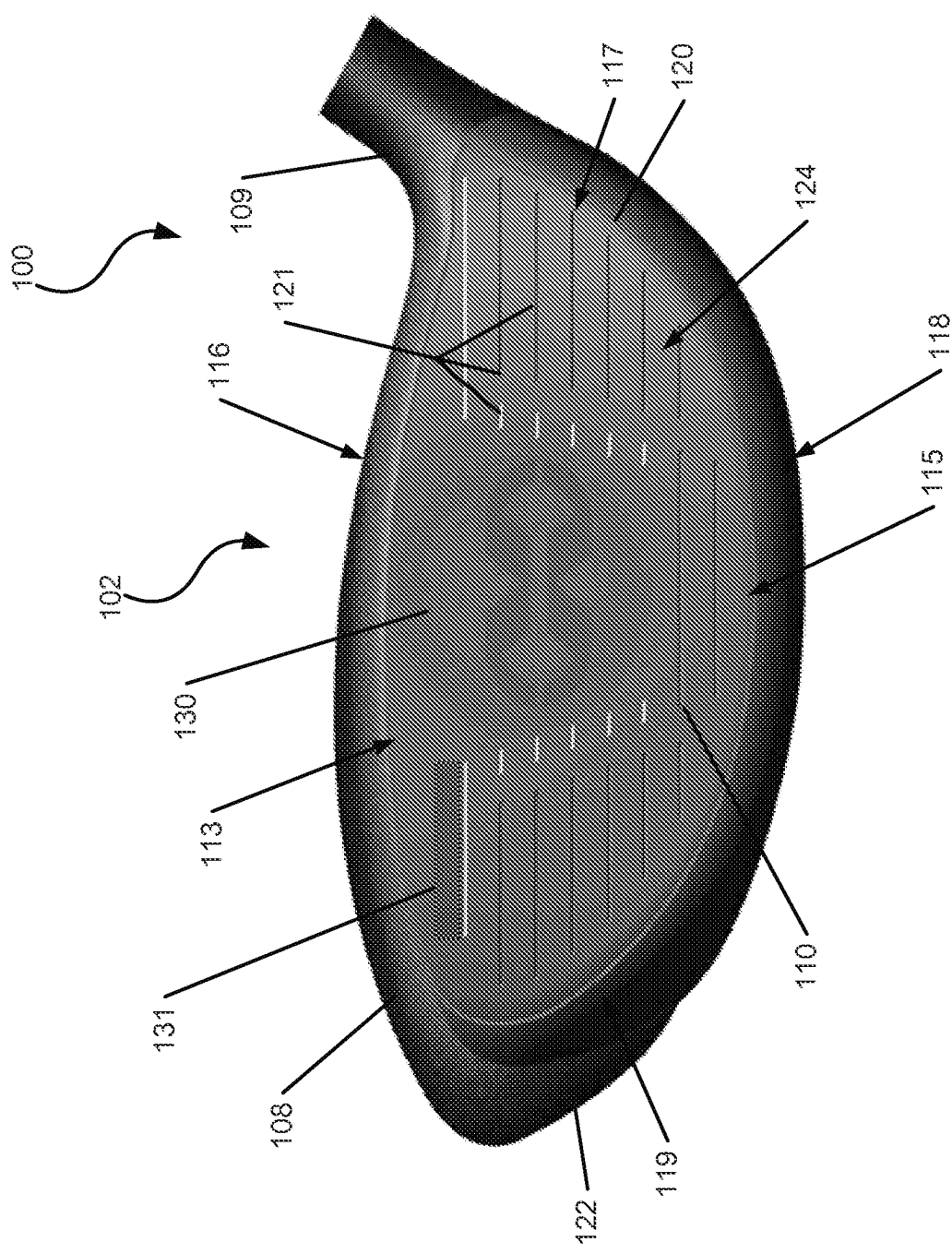
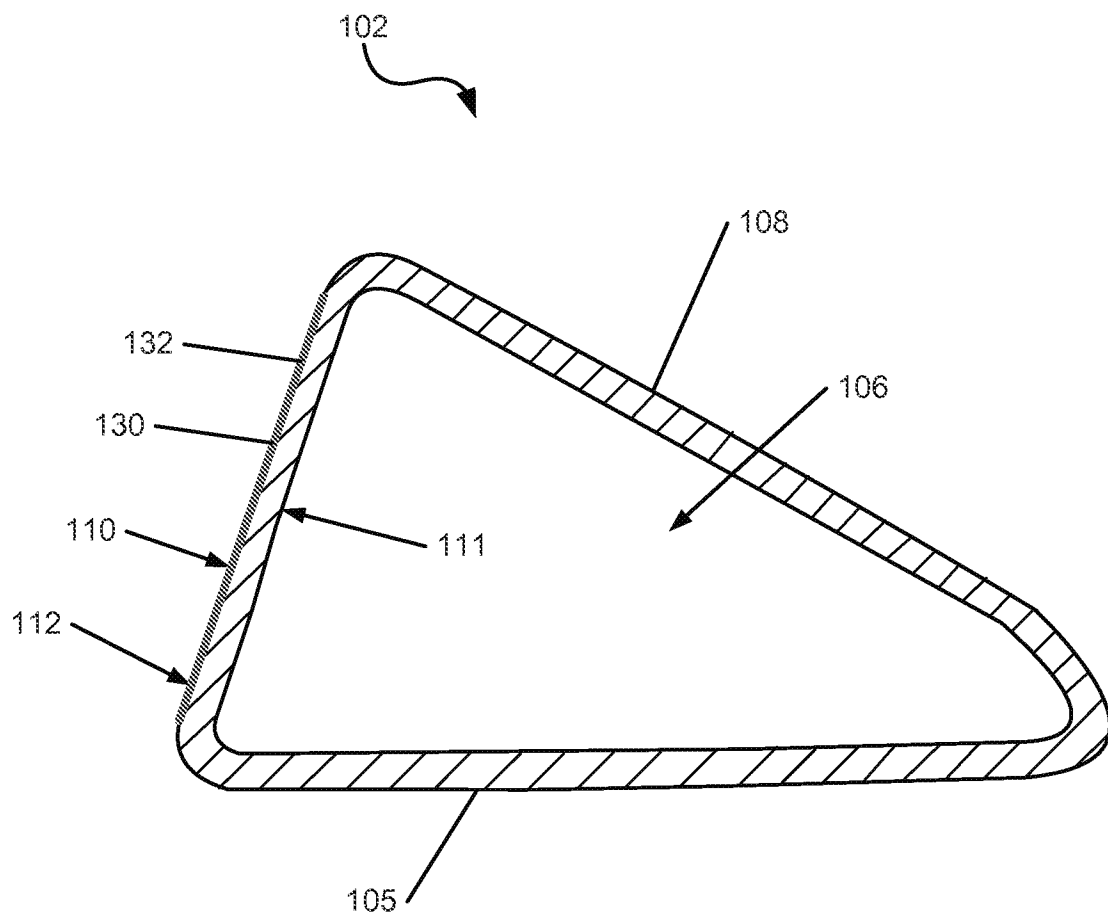


FIG. 5

**FIG. 6**

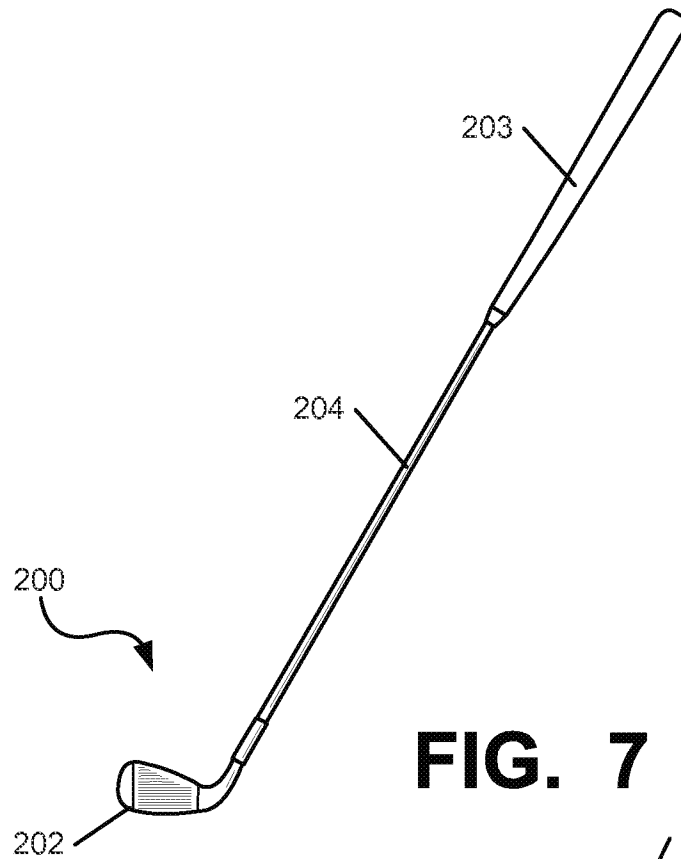


FIG. 7

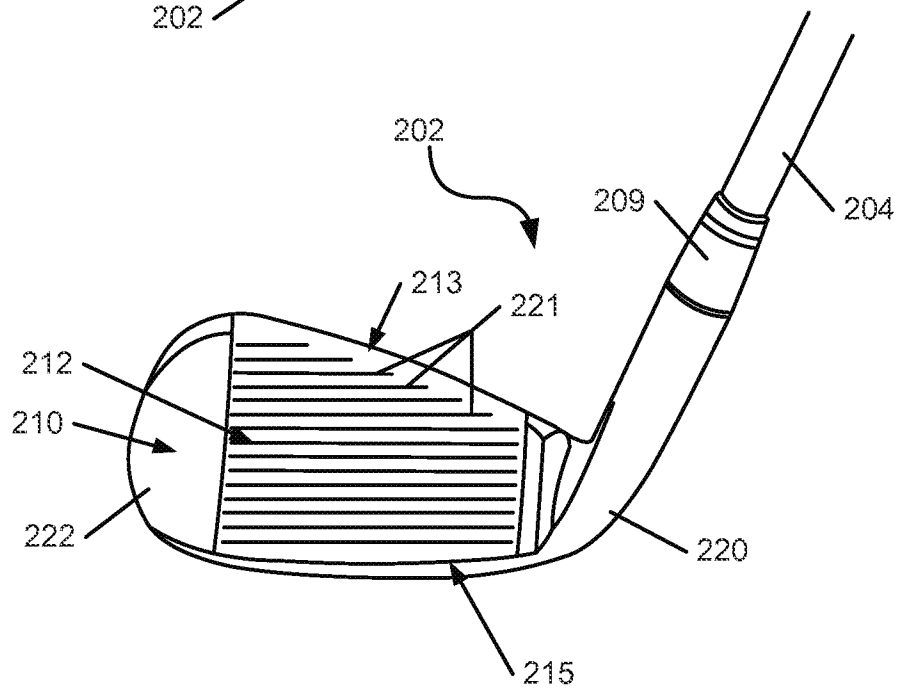


FIG. 8

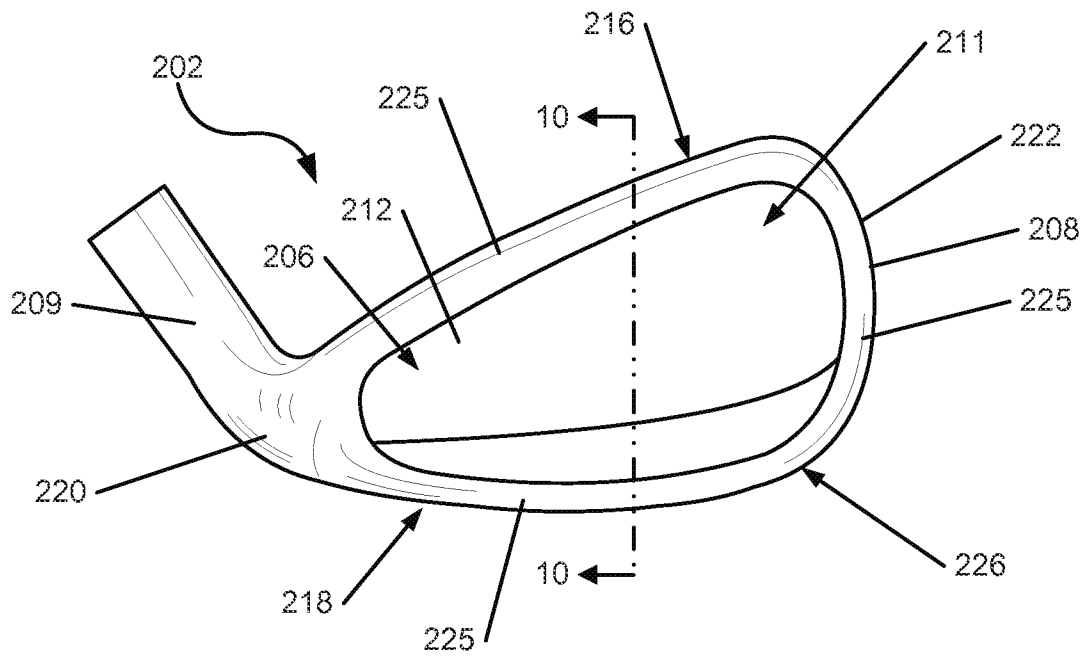


FIG. 9

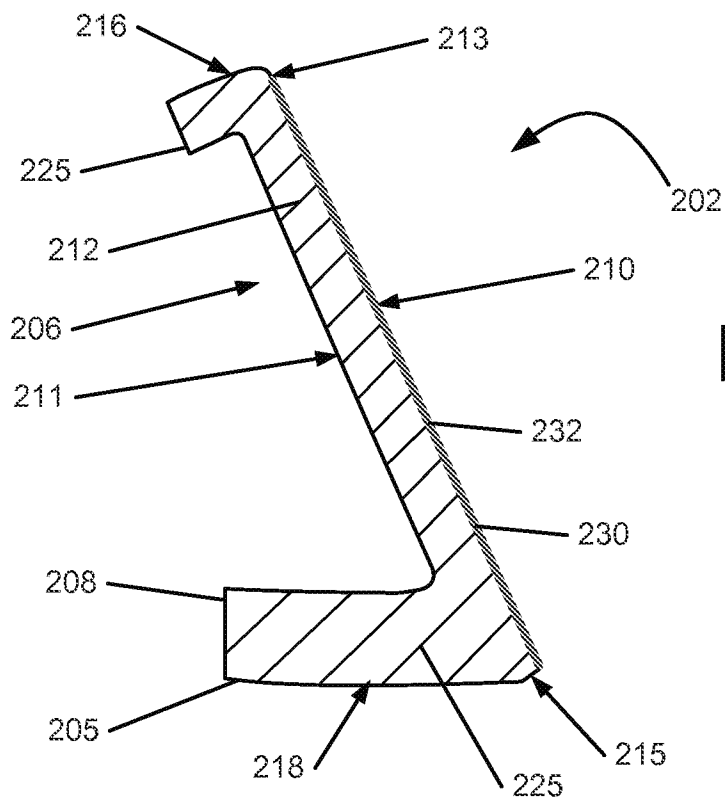


FIG. 10

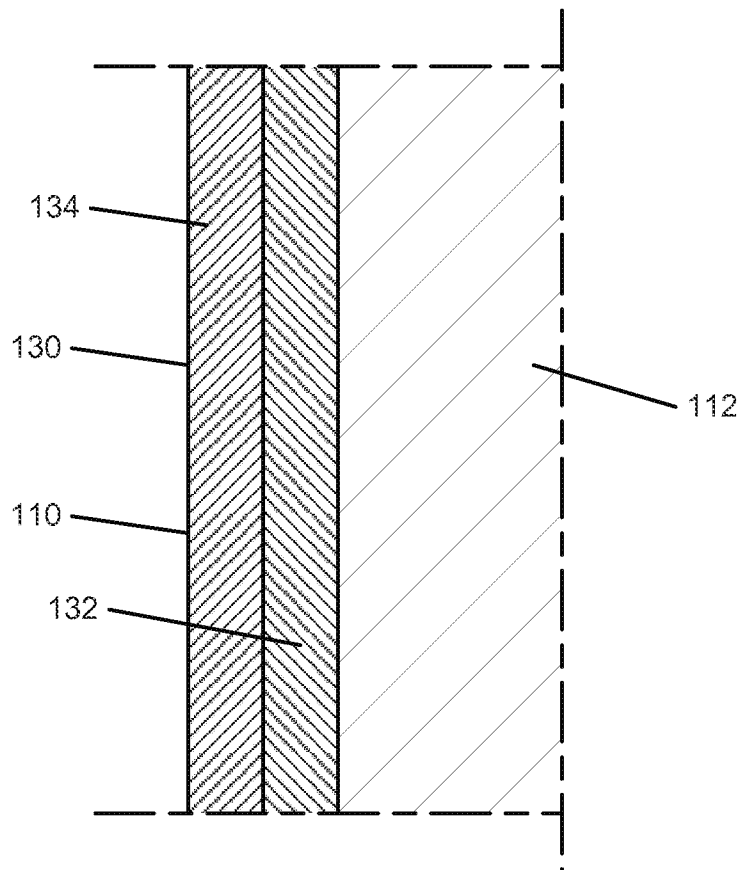


FIG. 11

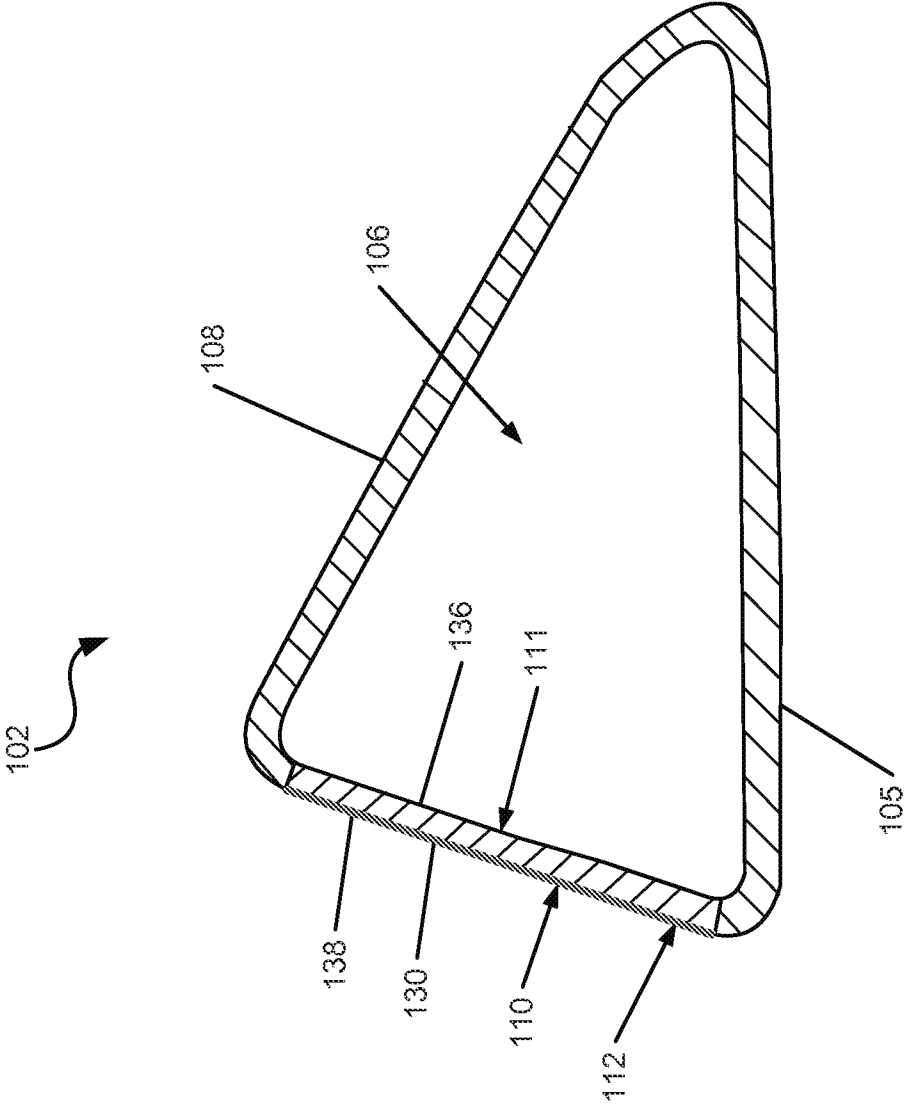


FIG. 12

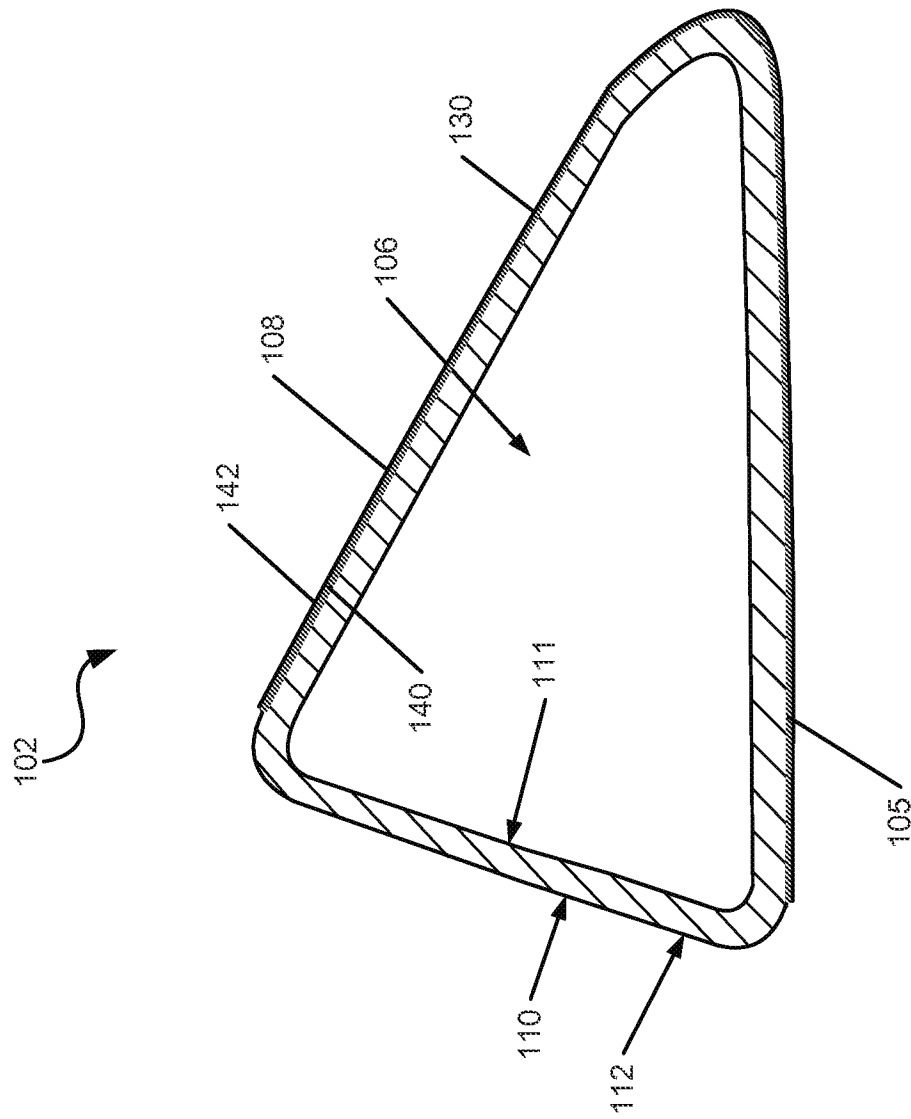


FIG. 13

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2012/052113

A. CLASSIFICATION OF SUBJECT MATTER
INV. A63B53/04
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A63B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EP0-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2008/076597 A1 (ROACH RYAN L [US] ET AL) 27 March 2008 (2008-03-27) paragraph [0038] - paragraph [0041] -----	1-11, 16, 17
X	US 2008/076598 A1 (LIN YUAN-FU [TW]) 27 March 2008 (2008-03-27) paragraph [0024] - paragraph [0032]; figures -----	1, 3-11, 16, 17
X	JP 2 080069 A (DAIWA GOLF) 20 March 1990 (1990-03-20) abstract; figures -----	1, 3-11, 16, 17
X	US 5 158 289 A (OKUMOTO TAKAHARU [JP] ET AL) 27 October 1992 (1992-10-27) the whole document ----- -/--	1, 3-11, 16, 17

☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

26 October 2012

Date of mailing of the international search report

06/11/2012

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax: (+31-70) 340-3016

Authorized officer

Lundblad, Hampus

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2012/052113

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 2002 224248 A (SUMITOMO RUBBER IND) 13 August 2002 (2002-08-13) paragraph [0014] - paragraph [0015] paragraph [0021] - paragraph [0027] -----	1,3-11, 16,17
X	US 6 348 011 B1 (REYES HERBERT [US] ET AL) 19 February 2002 (2002-02-19) paragraph [0018] - paragraph [0026] paragraph [0037] - paragraph [0044] -----	1,3-11, 16,17
X	US 2007/004524 A1 (HARRISON THOMAS B [US]) 4 January 2007 (2007-01-04) paragraph [0020] - paragraph [0021] -----	1,3-7, 12-16, 18-20
X	CN 102 151 391 A (FU SHENG IND CO LTD) 17 August 2011 (2011-08-17) paragraph [0022] - paragraph [0031]; figures -----	1,3-7, 16,17
X	JP 2006 271771 A (MIZUNO TECHNICS KK) 12 October 2006 (2006-10-12) paragraph [0025] - paragraph [0026] -----	1,3-7, 16,17
X	JP 2006 110008 A (SRI SPORTS LTD) 27 April 2006 (2006-04-27) paragraph [0031] - paragraph [0034] -----	1,3-7, 16,17
X	JP 2005 087314 A (SUMITOMO RUBBER IND) 7 April 2005 (2005-04-07) paragraph [0016] - paragraph [0019] paragraph [0021] - paragraph [0023] -----	1-7,16, 17
X	JP 2004 299170 A (MIZUNO KK; MIZUNO TECHNICS KK) 28 October 2004 (2004-10-28) paragraph [0018] - paragraph [0025] -----	1,3-7, 16,17
X	US 2004/142764 A1 (SANO YOSHINORI [JP]) 22 July 2004 (2004-07-22) paragraph [0018] - paragraph [0024] paragraph [0029] - paragraph [0038] -----	1-7,16, 17
X	US 2003/203766 A1 (SANO YOSHINORI [JP] ET AL) 30 October 2003 (2003-10-30) paragraph [0025] - paragraph [0053] -----	1-7,16, 17
X,P	US 8 226 789 B1 (GLASER ANDREW [US]) 24 July 2012 (2012-07-24) paragraph [0027] - paragraph [0029]; figures -----	12-18
X,P	US 2011/207549 A1 (STITES JOHN T [US]) 25 August 2011 (2011-08-25) paragraph [0048] - paragraph [0052] ----- -/--	12-18

INTERNATIONAL SEARCH REPORT

International application No

PCT/US2012/052113

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X, P	US 2012/010011 A1 (PIEPHO CRAIG T [US]) 12 January 2012 (2012-01-12) paragraph [0026] - paragraph [0029] -----	12-18

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2012/052113

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2008076597 A1	27-03-2008	JP 2008100056 A	01-05-2008
		US 2008076597 A1	27-03-2008
		US 2008096690 A1	24-04-2008
		US 2011118057 A1	19-05-2011
US 2008076598 A1	27-03-2008	NONE	
JP 2080069 A	20-03-1990	JP 2000553 C	20-12-1995
		JP 2080069 A	20-03-1990
		JP 6091903 B	16-11-1994
US 5158289 A	27-10-1992	NONE	
JP 2002224248 A	13-08-2002	NONE	
US 6348011 B1	19-02-2002	JP 2001129135 A	15-05-2001
		US 6348011 B1	19-02-2002
US 2007004524 A1	04-01-2007	NONE	
CN 102151391 A	17-08-2011	NONE	
JP 2006271771 A	12-10-2006	JP 4521820 B2	11-08-2010
		JP 2006271771 A	12-10-2006
JP 2006110008 A	27-04-2006	JP 4355274 B2	28-10-2009
		JP 2006110008 A	27-04-2006
JP 2005087314 A	07-04-2005	JP 4373746 B2	25-11-2009
		JP 2005087314 A	07-04-2005
JP 2004299170 A	28-10-2004	NONE	
US 2004142764 A1	22-07-2004	JP 2004222906 A	12-08-2004
		US 2004142764 A1	22-07-2004
US 2003203766 A1	30-10-2003	JP 4080779 B2	23-04-2008
		JP 2003310805 A	05-11-2003
		US 2003203766 A1	30-10-2003
US 8226789 B1	24-07-2012	US 8226789 B1	24-07-2012
		US 8282504 B1	09-10-2012
US 2011207549 A1	25-08-2011	US 2011207549 A1	25-08-2011
		WO 2011106161 A1	01-09-2011
US 2012010011 A1	12-01-2012	NONE	