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Adams

(54) **GOLF CLUB HEAD AND GOLF CLUB SHAFT**

(75) Inventor: **Edwin H. Adams**, Santa Monica, CA (US)

Correspondence Address:
WELSH & FLAXMAN LLC
2000 DUKE STREET, SUITE 100
ALEXANDRIA, VA 22314 (US)

(73) Assignee: **Edwin H. Adams**

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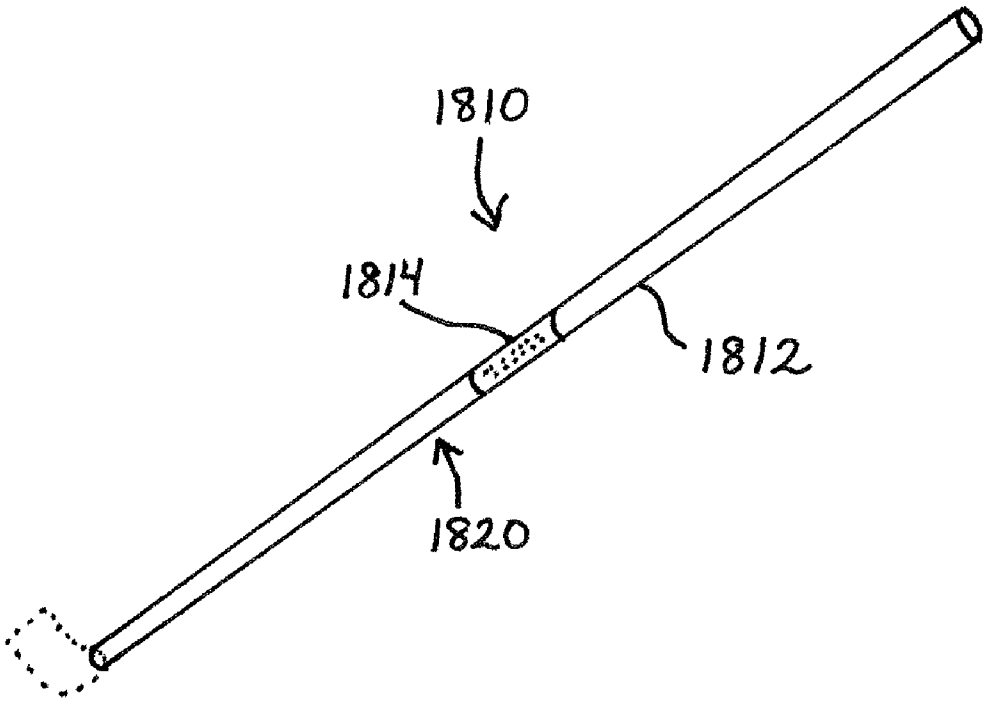
(57) **ABSTRACT**

A golf club head includes a club head body having a striking face, a soleplate, a crown, a toe, a heel and a hosel shaped and dimensioned for receiving a shaft. The club head body includes a body shell composed of the striking face, soleplate, crown, toe and heel, wherein the body shell has a reduced mass allowing for greater weight manipulation within the club head body.



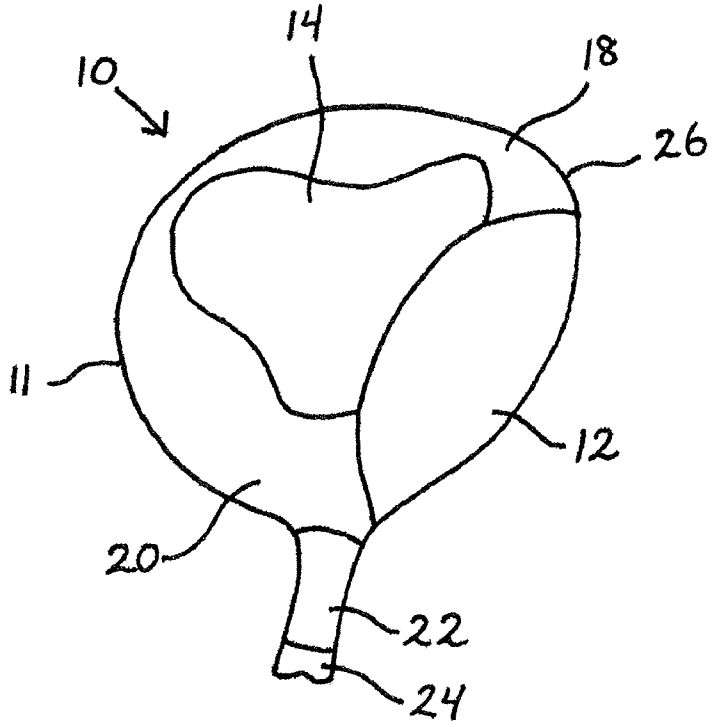
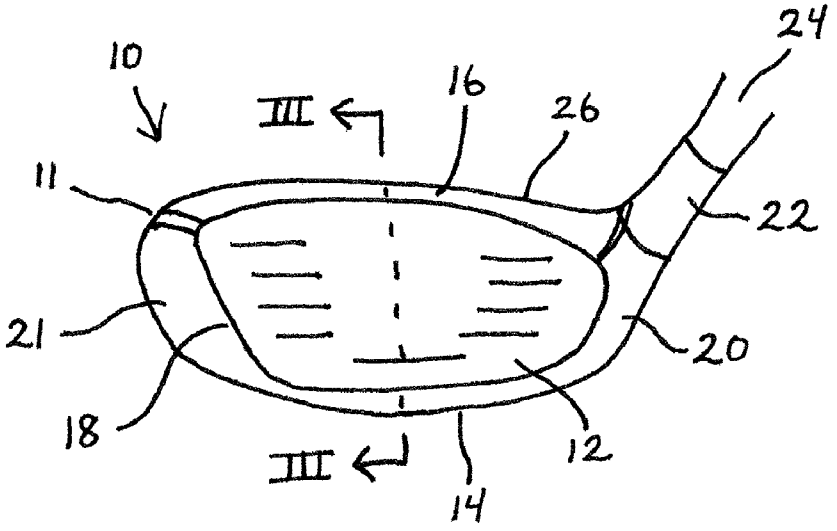


Fig. 1



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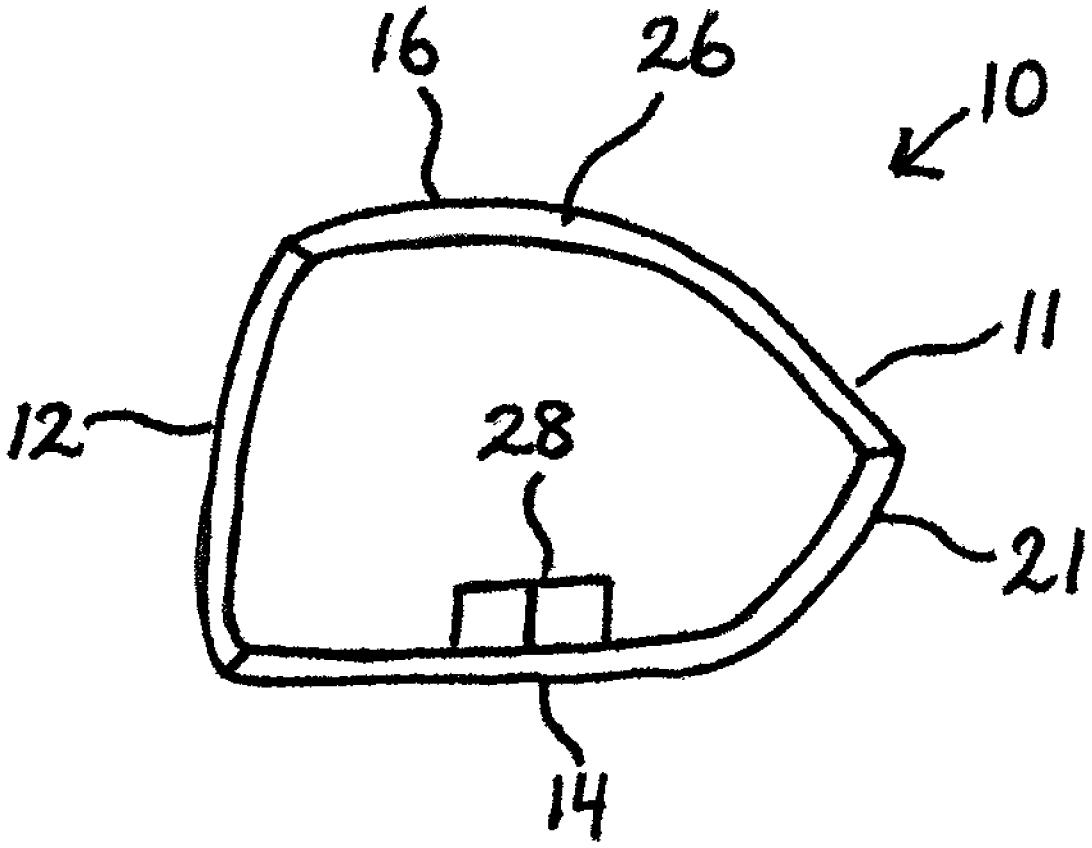

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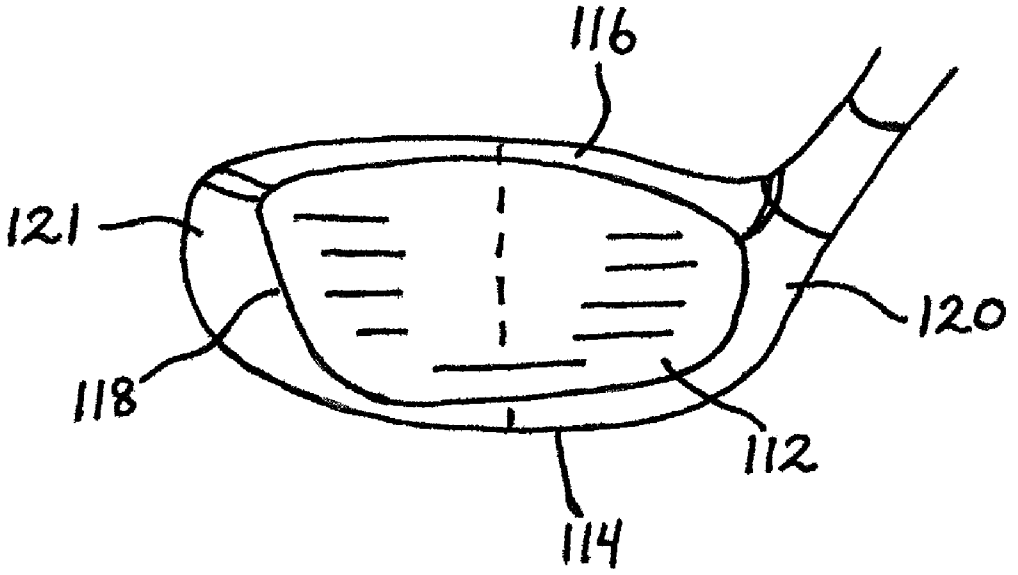

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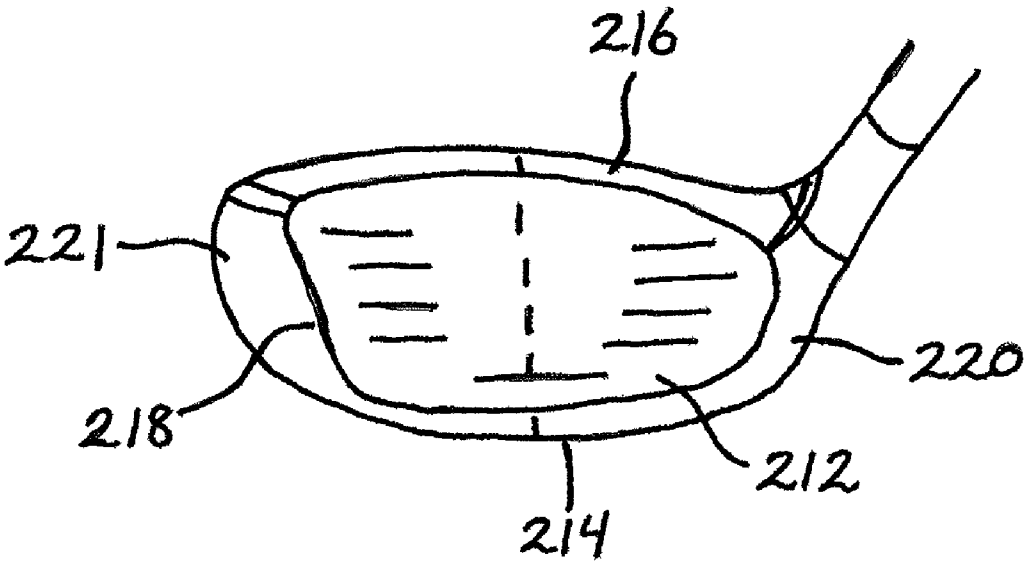

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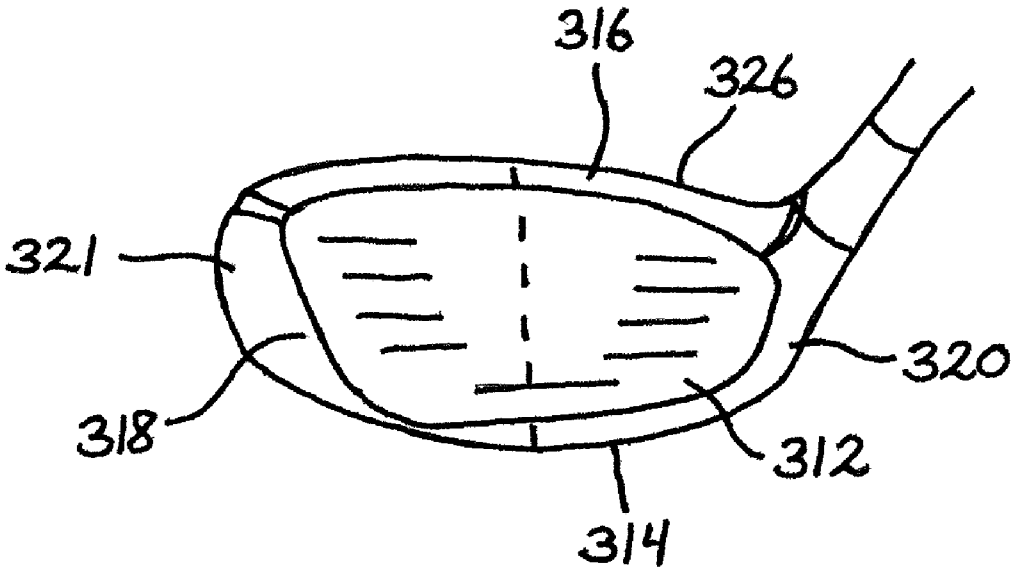

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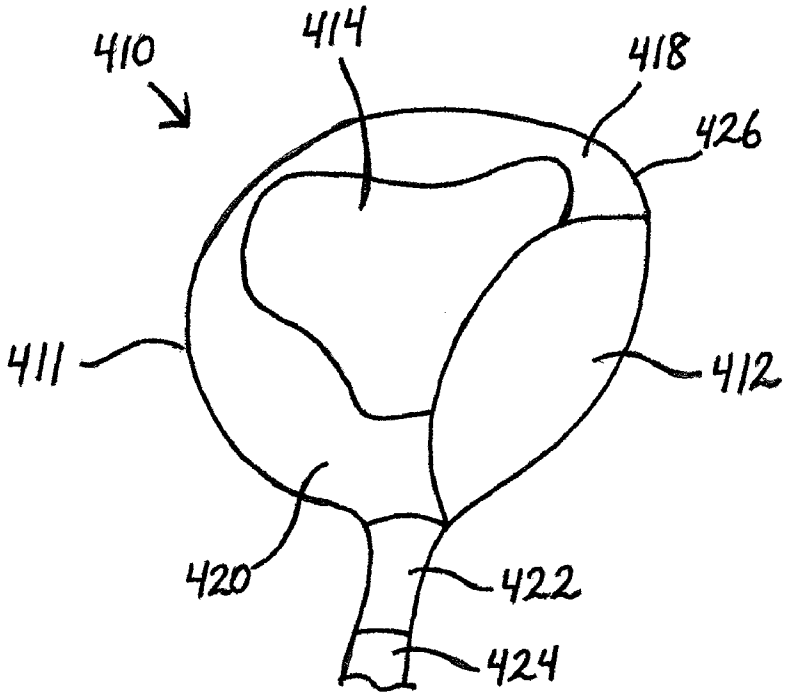
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Fig. 7

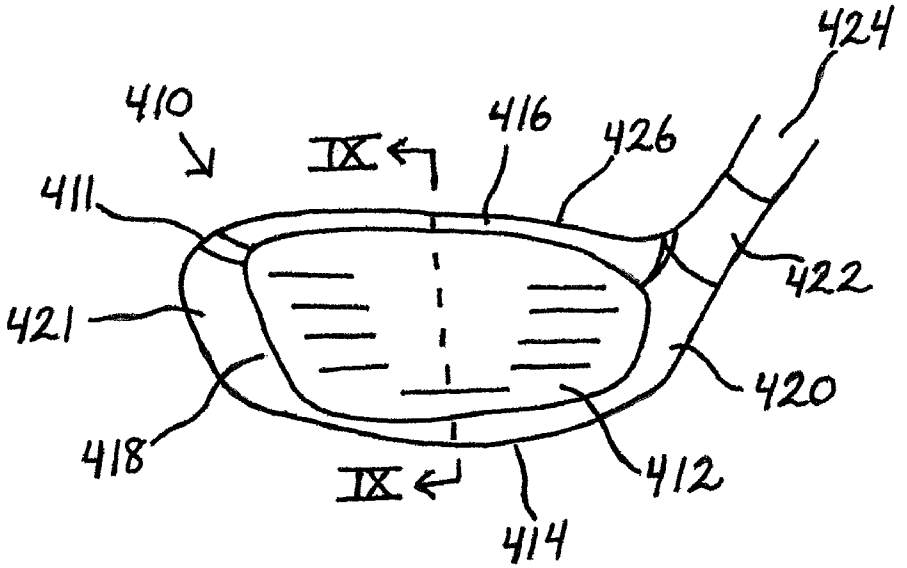
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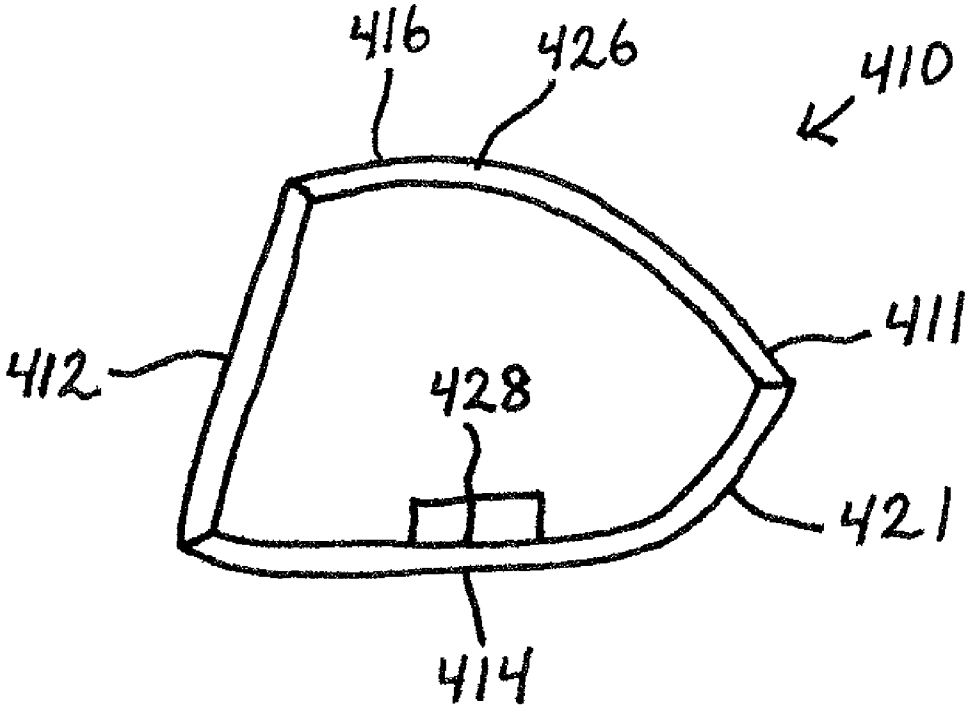
Fig. 8



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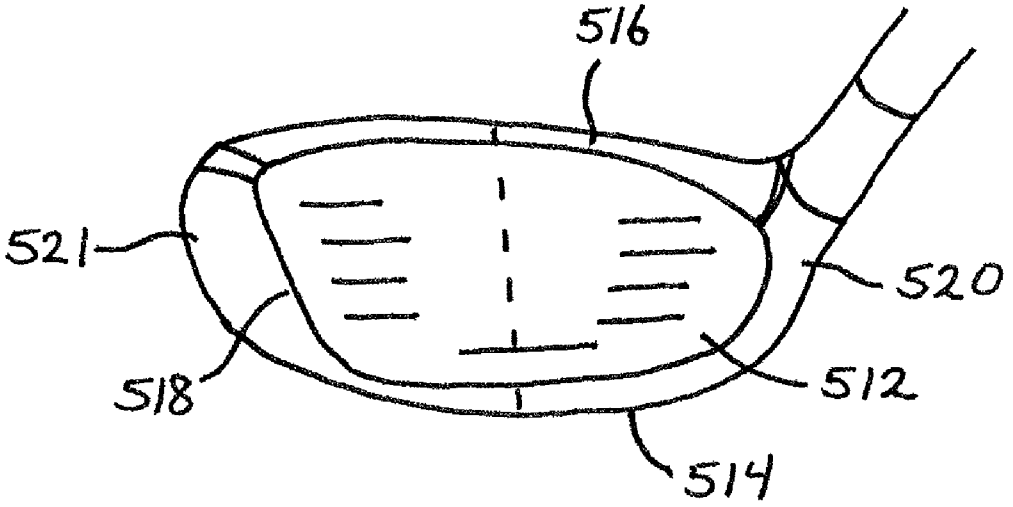

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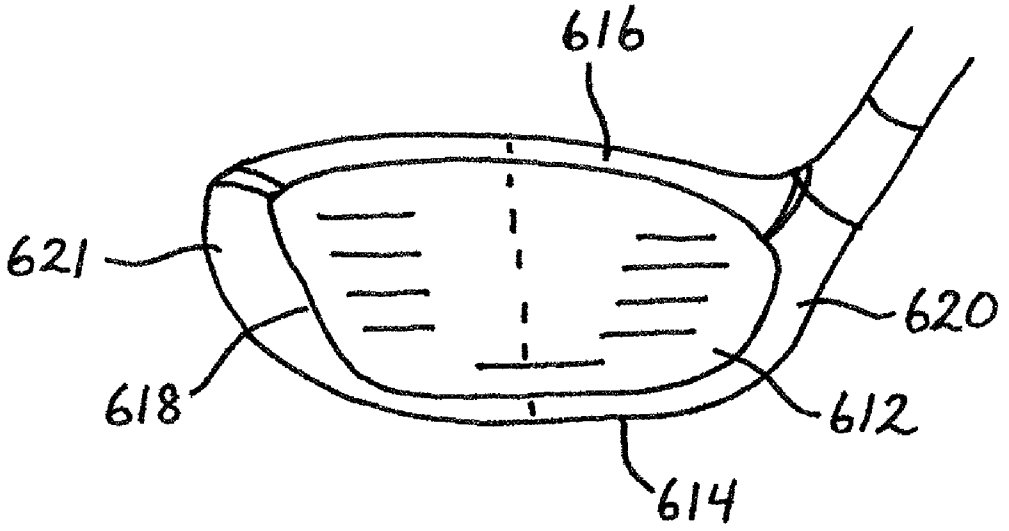

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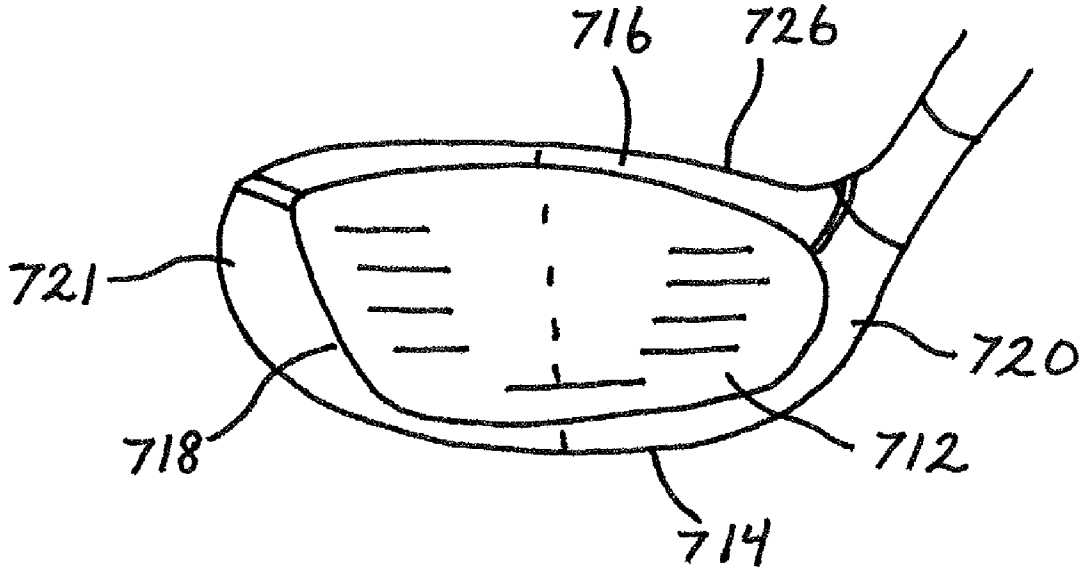

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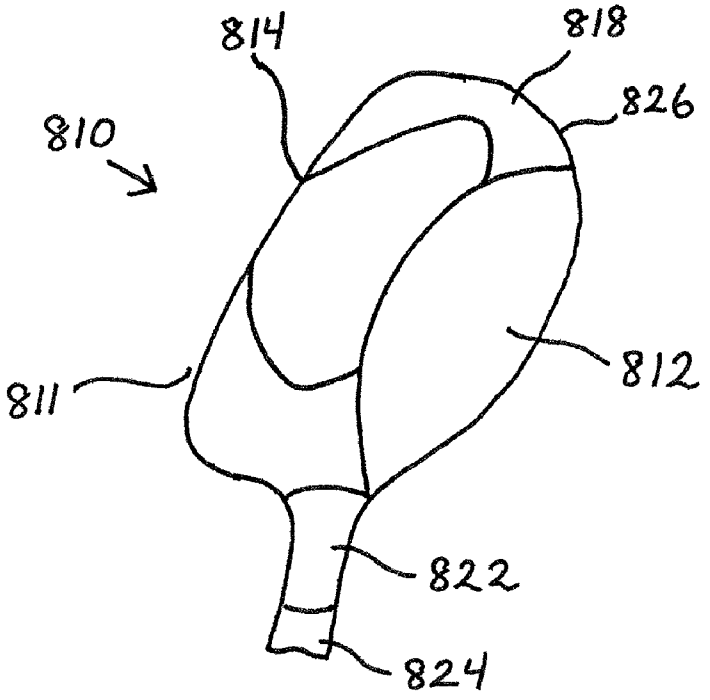
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Fig. 13

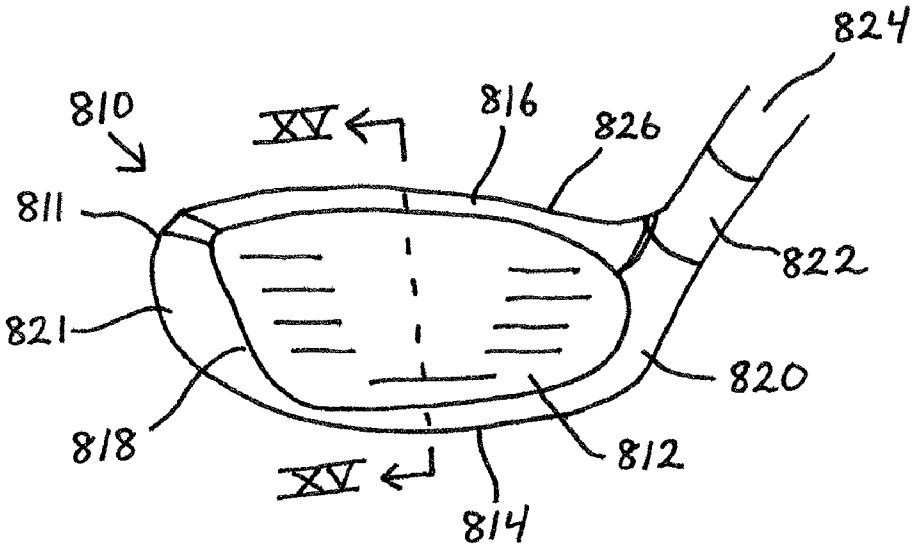
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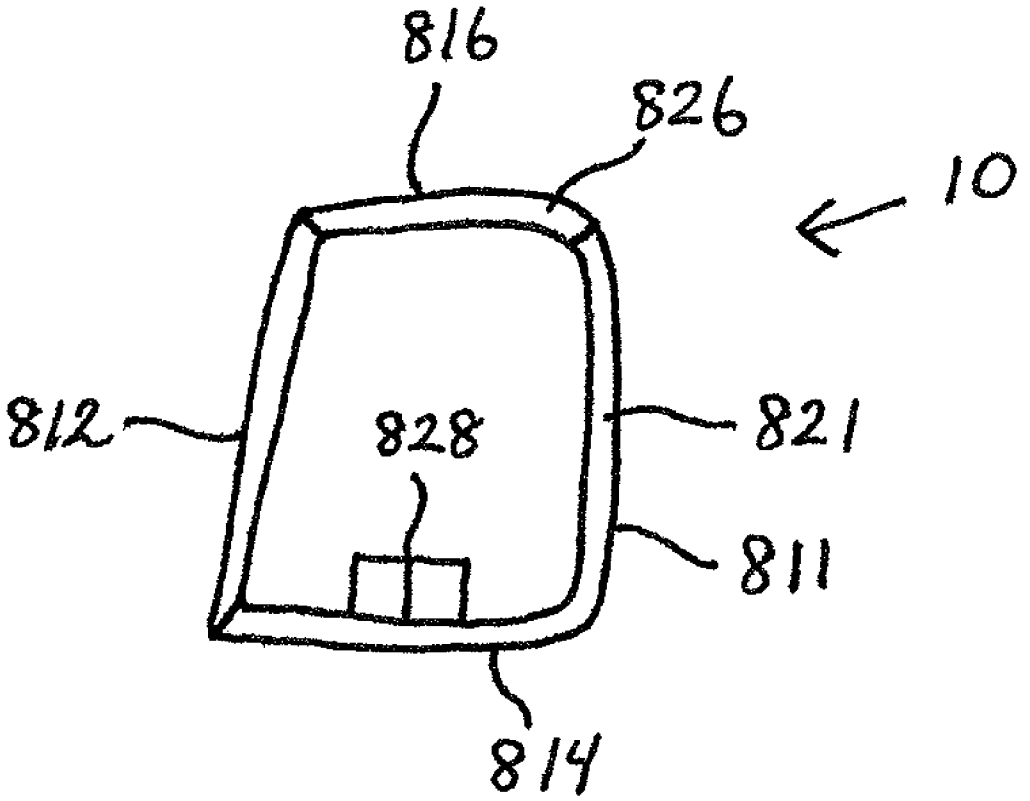
Fig. 14



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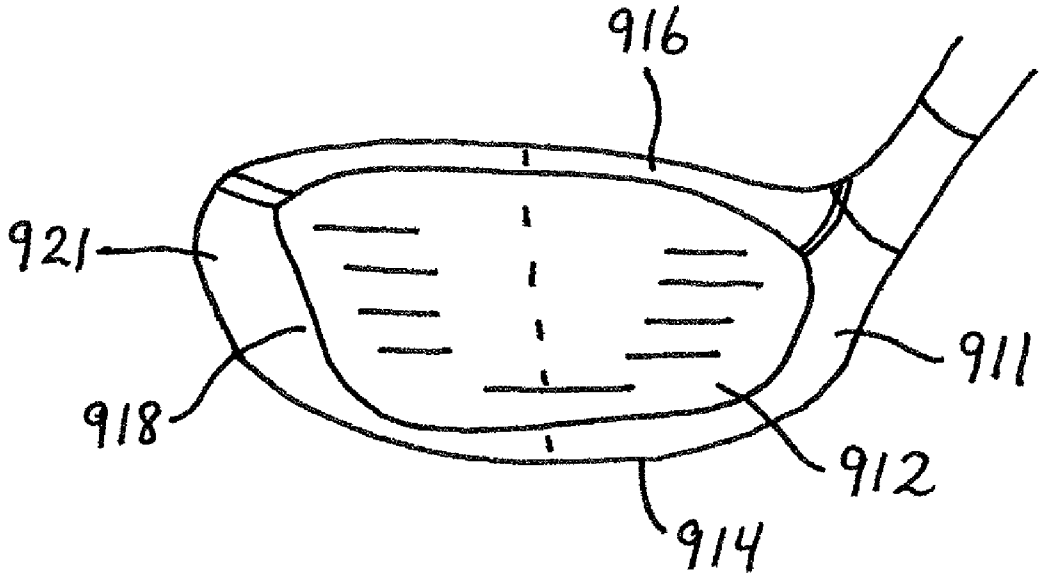

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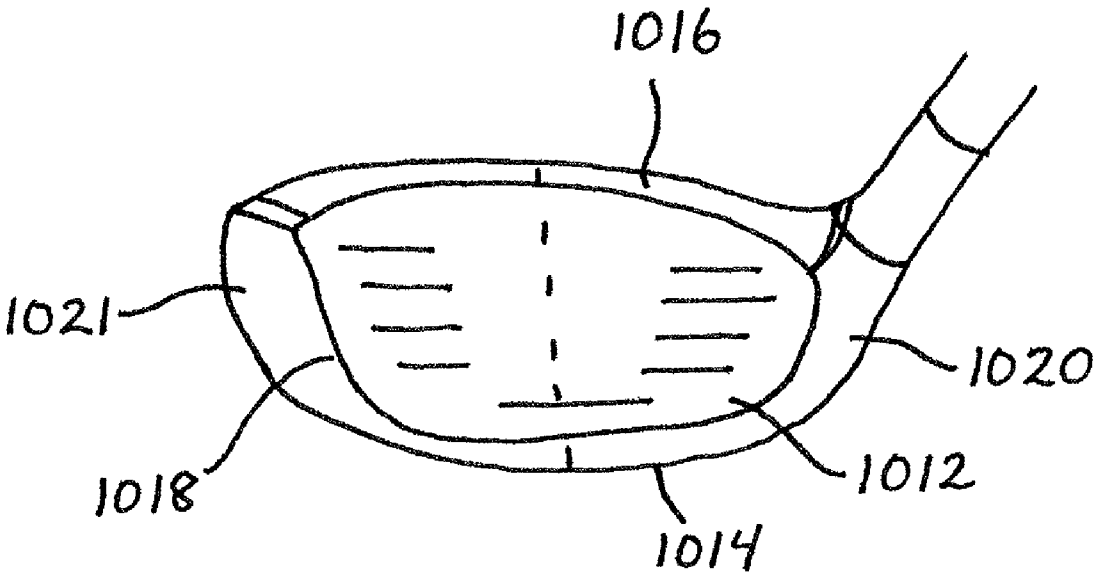

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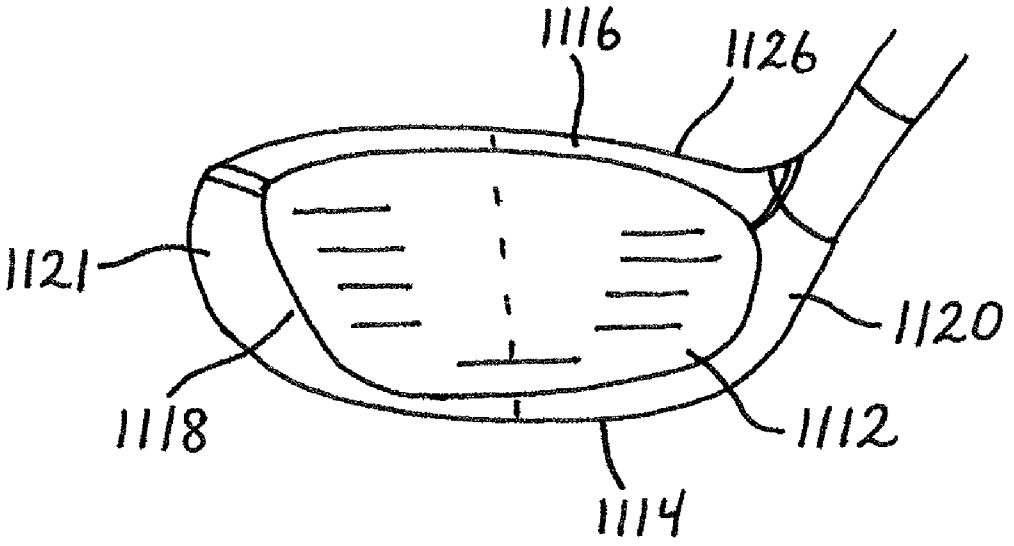

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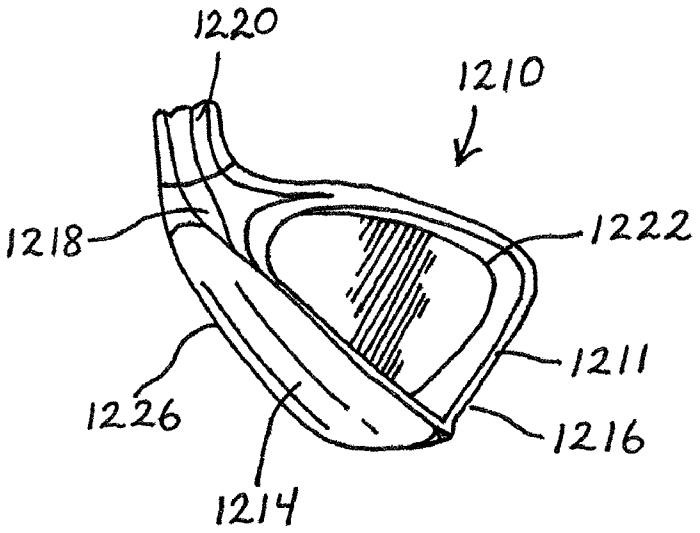
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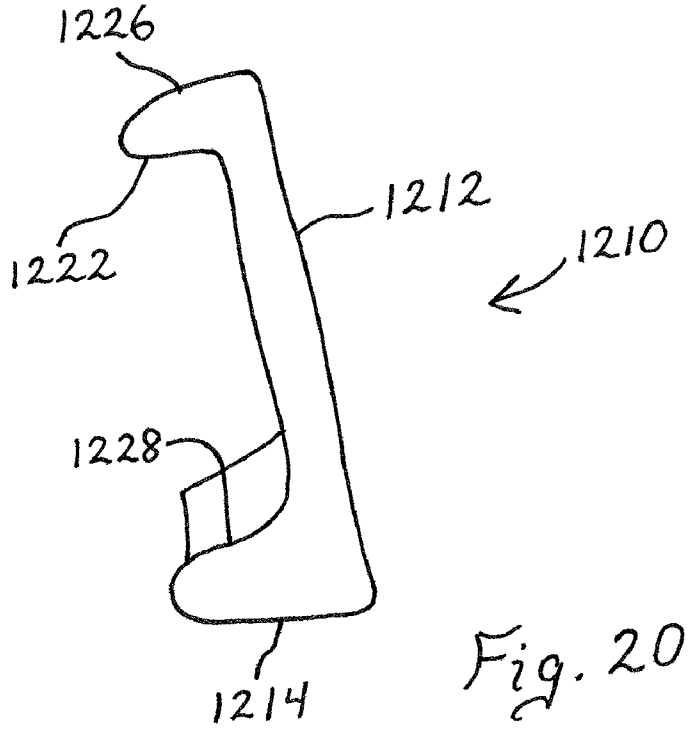
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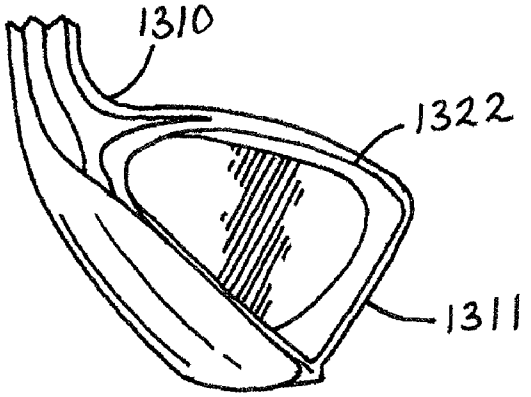

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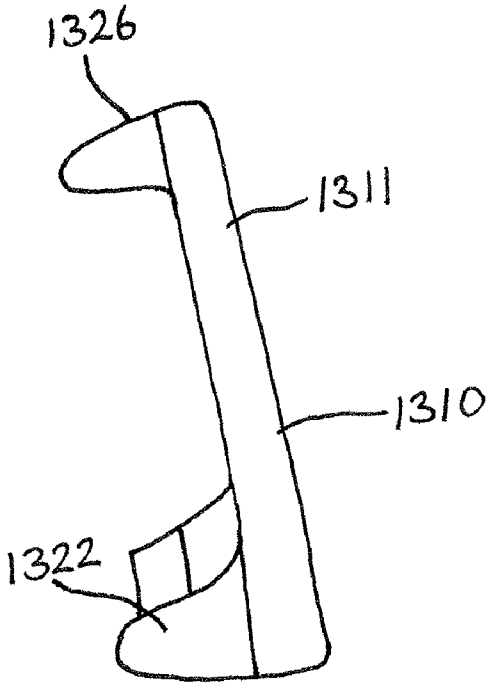

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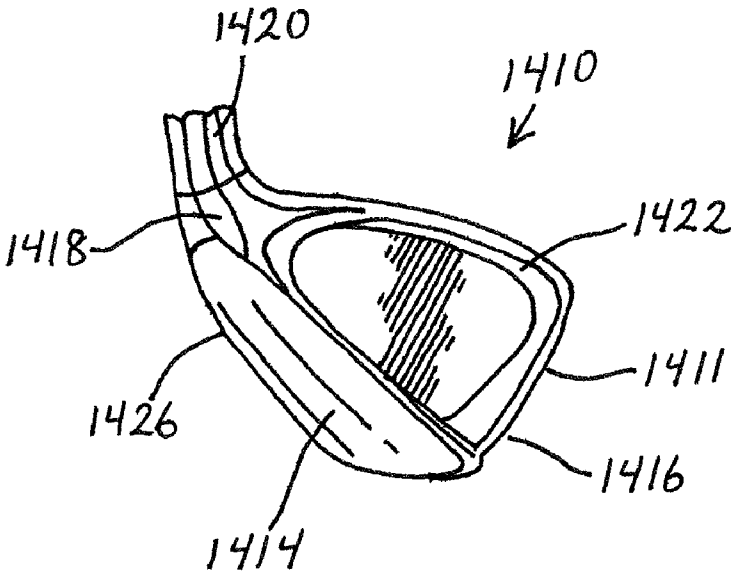
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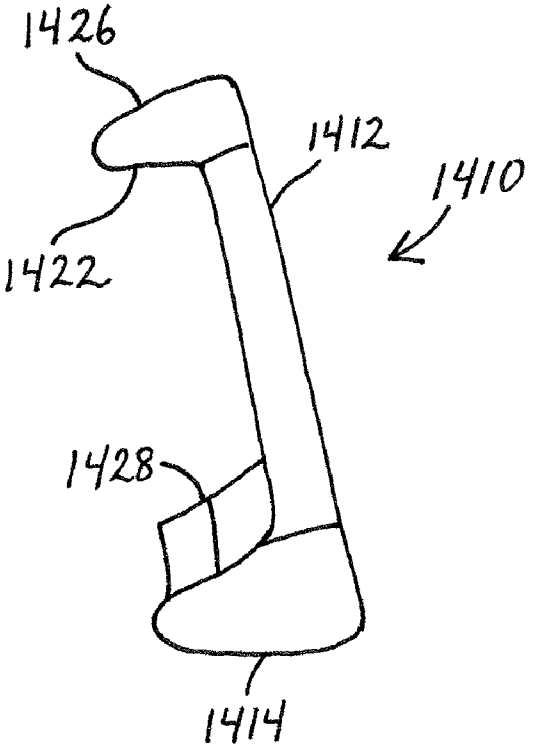
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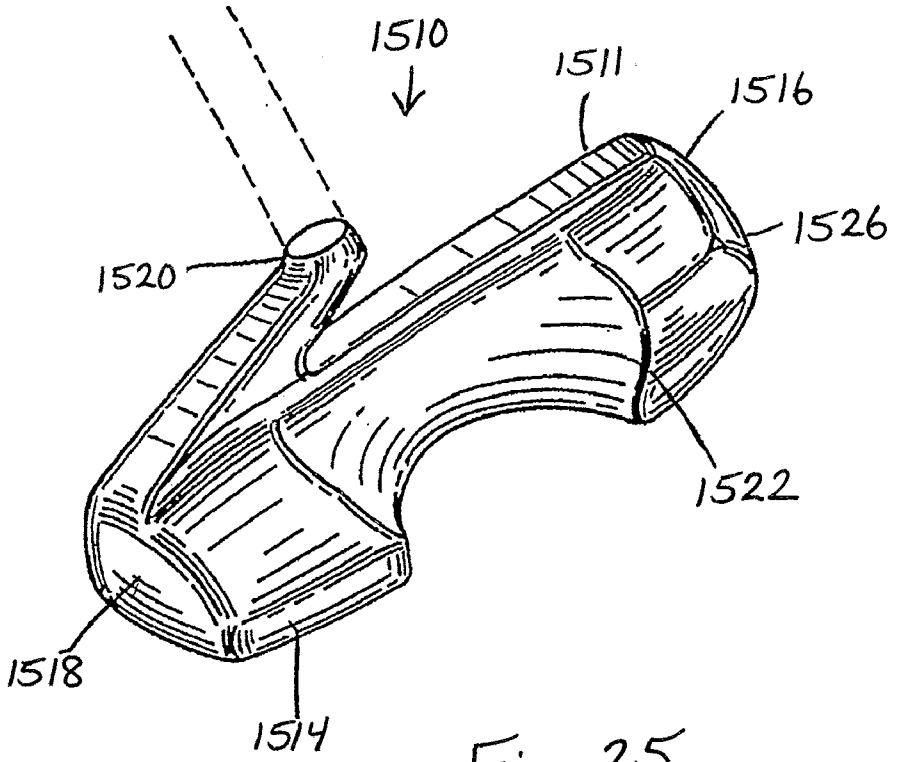
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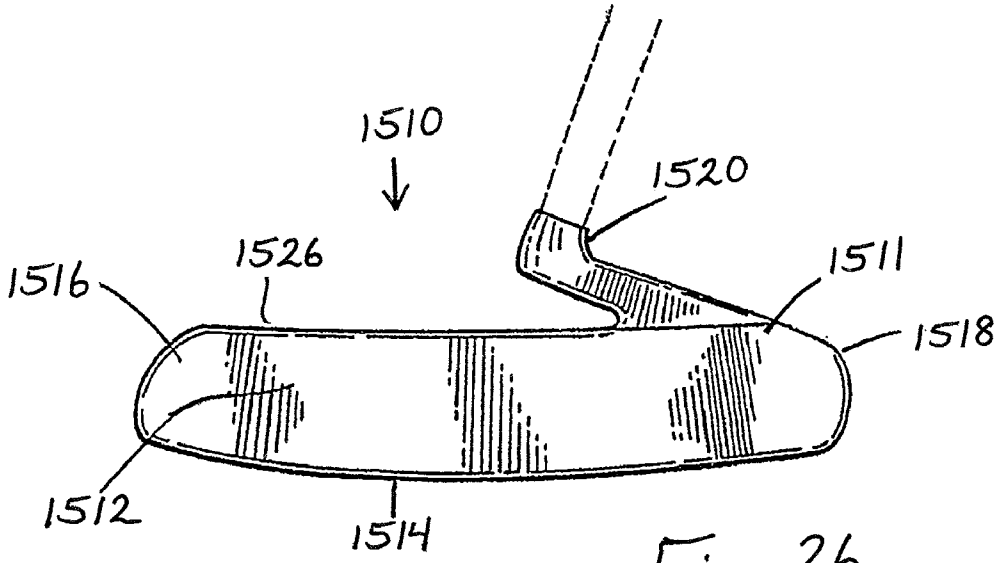
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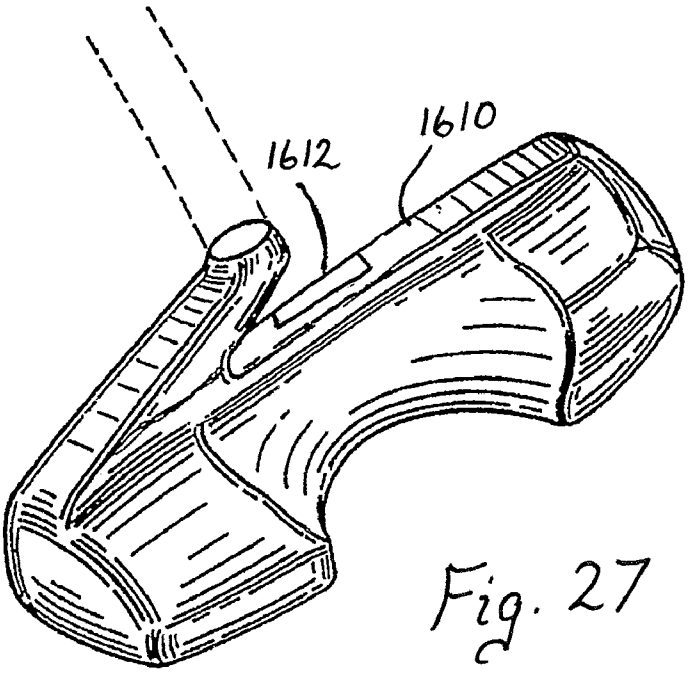
Fig. 26



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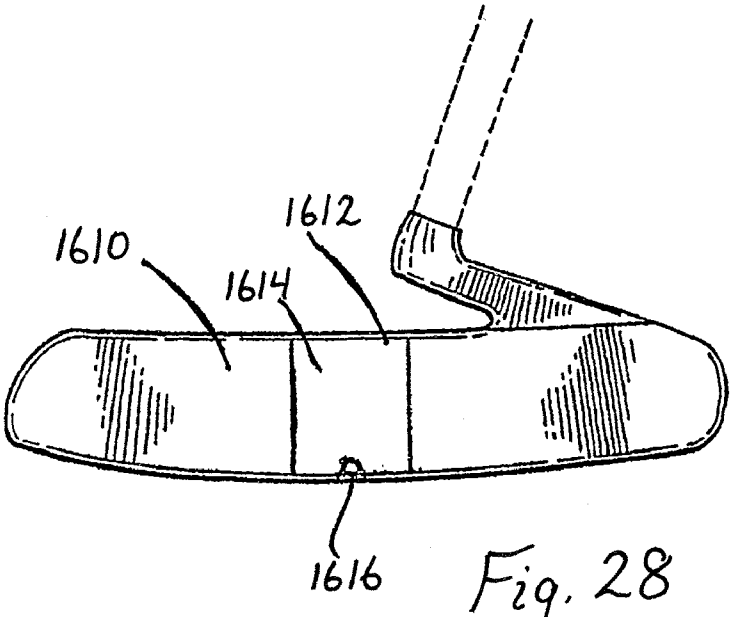

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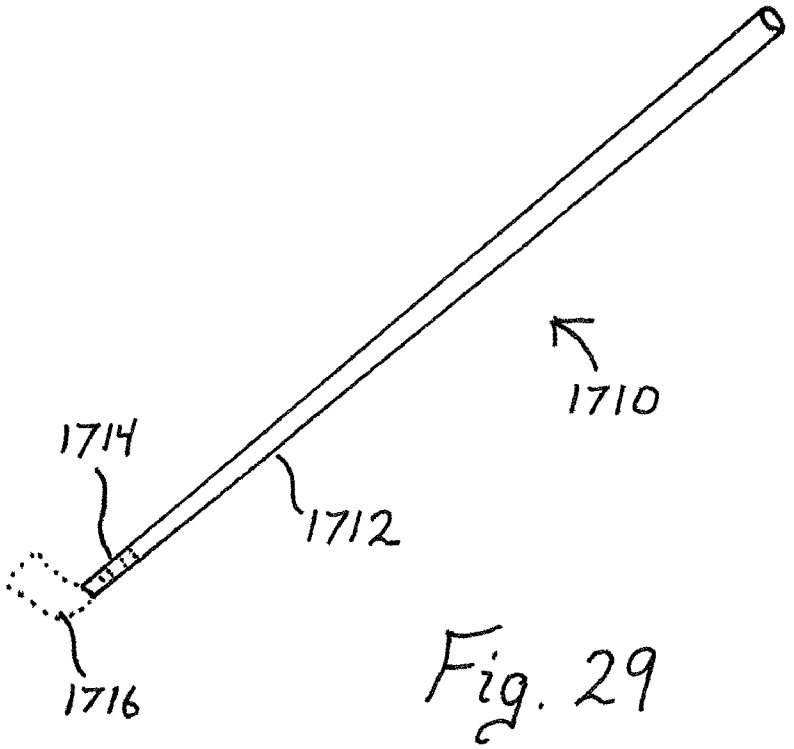

Fig. 29

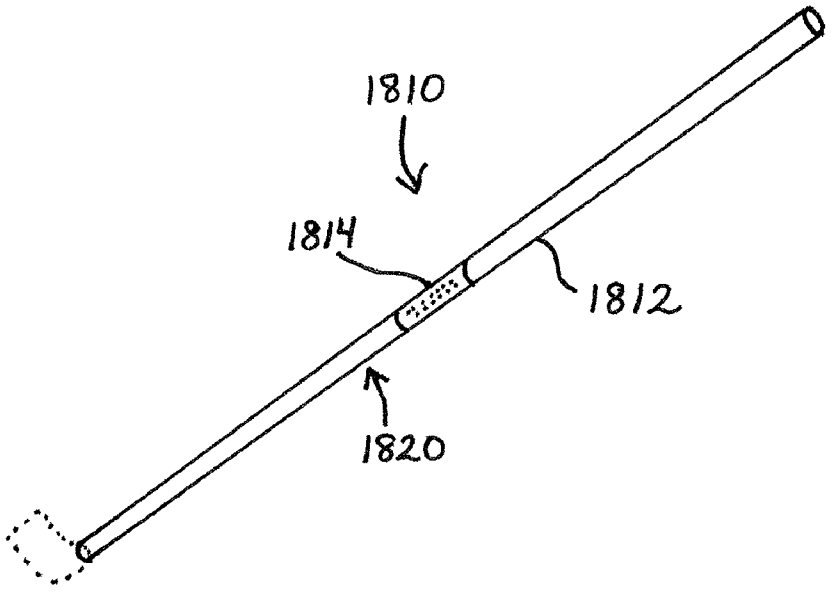

Fig. 30

GOLF CLUB HEAD AND GOLF CLUB SHAFT

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application is a divisional of U.S. patent application Ser. No. 11/509,706, filed Aug. 25, 2006, entitled "GOLF CLUB HEAD AND GOLF CLUB SHAFT", which is currently pending, which claims the benefit of U.S. Provisional Patent Application Ser. No. 60/710,875, entitled "GOLF CLUB HEAD", filed Aug. 25, 2005.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] This invention relates to a golf club head. More particularly, the invention relates to a golf club head composed of a transparent, lightweight material offering enhanced mass positioning within a golf club head. The invention also relates to a golf club shaft offering improved performance and functionality.

[0004] 2. Description of the Prior Art

[0005] Golf club manufacturers are consistently attempting to design golf clubs that are easier to hit and offer golfers greater forgiveness when the ball is not struck directly upon the sweet spot of the striking face. As those skilled in the art will certainly appreciate, many designs have been developed and proposed for assisting golfers in learning and mastering the very difficult game of golf.

[0006] Much of the focus of the golf club heads is on ways to shift the weight within the golf club head in a manner which improves the striking characteristics of the club.

[0007] As such, a need exists for an improved golf club head which provides for greater versatility in shifting mass about a golf club head in a manner improving the striking characteristics of the golf club head.

SUMMARY OF THE INVENTION

[0008] It is, therefore, an object of the present invention to provide a golf club head including a club head body. The club head body includes a striking face, a soleplate, a crown, a toe, a heel and a hosel. The club head body includes a body shell composed of the striking face, soleplate, crown, toe and heel, wherein the body shell has a mass of no more than approximately 150 g and a volume of at least approximately 70 cc, and the club head body has a mass of at least approximately 180 g.

[0009] It is also an object of the present invention to provide a golf club head including a club head body. The club head body includes a striking face, a soleplate, a toe, a heel and a hosel. The club head body includes a body shell composed of the striking face, soleplate, toe and heel, wherein at least a portion of the body shell is composed of a material having a density of less than approximately 2.5 g/cm^3 and a tensile strength of at least approximately 465 $MPa/(g/cm^3)$.

[0010] It is another object of the present invention to provide a golf club shaft which includes an elongated shaft body, wherein at least a portion of the shaft body is composed of a transparent material allowing for viewing of the internal structure of the shaft.

[0011] Other objects and advantages of the present invention will become apparent from the following detailed description when viewed in conjunction with the accompanying drawings, which set forth certain embodiments of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] FIG. **1** is a bottom perspective view of a driver type golf club head in accordance with the present invention.

[0013] FIG. **2** is a front plan view of the golf club head shown in FIG. **1**.

[0014] FIG. **3** is a cross-sectional view of the golf club head along the lines III-III in FIG. **2**.

[0015] FIG. **4** is a front plan view of a driver type golf club head in accordance with an alternate embodiment.

[0016] FIG. **5** is a front plan view of a driver type golf club head in accordance with yet another embodiment of the present invention.

[0017] FIG. **6** is a front plan view of a driver type golf club head in accordance with a further embodiment of the present invention.

[0018] FIG. **7** is a bottom perspective view of a fairway wood type golf club head in accordance with the present invention.

[0019] FIG. **8** is a front plan view of the golf club head shown in FIG. **7**.

[0020] FIG. **9** is a cross-sectional view along the lines IX-IX as shown in FIG. **8**.

[0021] FIG. **10** is a front plan view of a fairway wood type golf club head in accordance with an alternate embodiment.

[0022] FIG. **11** is a front plan view of a fairway wood type golf club head in accordance with still another embodiment of the present invention.

[0023] FIG. **12** is a front plan view of a fairway wood type golf club head in accordance with still another embodiment of the present invention.

[0024] FIG. **13** is a bottom perspective view of a hybrid type golf club head in accordance with the present invention.

[0025] FIG. **14** is a front plan view of the golf club head shown in FIG. **13**.

[0026] FIG. **15** is a cross sectional view along the lines XV-XV in FIG. **14**.

[0027] FIG. **16** is a front plan view of a hybrid type golf club head in accordance with an alternate embodiment.

[0028] FIG. **17** is a front plan view of a hybrid type golf club head in accordance with another embodiment.

[0029] FIG. **18** is a front plan view of a hybrid type golf club head in accordance with still another embodiment.

[0030] FIG. **19** is a rear perspective view of an iron type golf club head in accordance with the present invention.

[0031] FIG. **20** is a cross-sectional view of the iron type golf club head shown in FIG. **19**.

[0032] FIG. **21** is an alternate embodiment of an iron type golf club head.

[0033] FIG. **22** is a cross-sectional view of the iron type golf club head shown in FIG. **21**.

[0034] FIG. **23** is a rear perspective view of an iron type golf club head in accordance with an alternate embodiment.

[0035] FIG. **24** is a cross-sectional view of the iron type golf club head shown FIG. **23**.

[0036] FIG. **25** is a rear perspective view of a putter type golf club head.

[0037] FIG. **26** is a front plan view of the putter type golf club head shown in FIG. **25**.

[0038] FIG. **27** is a rear perspective view of a putter type golf club head.

[0039] FIG. **28** is a front plan view of the putter type golf club head shown in FIG. **27**.

[0040] FIGS. **29** and **30** are side views of golf club shafts in accordance with the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0041] The detailed embodiments of the present invention are disclosed herein. It should be understood, however, that the disclosed embodiments are merely exemplary of the invention, which may be embodied in various forms. Therefore, the details disclosed herein are not to be interpreted as limiting, but as a basis for the claims and for teaching one skilled in the art how to make and/or use the invention.

[0042] With reference to FIGS. **1**, **2** and **3**, a golf club head is shown. The golf club head **10** includes a club head body **11**. The club head body **11** includes a striking face **12**, a soleplate **14**, a crown **16**, a toe **18**, a heel **20**, a skirt **21**, or other structure, used in connecting the crown **16** to the soleplate **14**, and a hosel **22** to which a golf club shaft **24** is secured, as well as any weight member(s) **28** which might be incorporated into the club head body **11**. The club head body **11** includes a body shell **26** composed of the striking face **12**, soleplate **14**, crown **16**, toe **18**, heel **20** and skirt **21**. That is, the body shell **26** may generally be considered the structure used in striking a golf ball and, as will be discussed below in greater detail, may have various weighting member(s) **28** secured thereto in an effort to optimize the striking characteristics of the golf club head **10**. While the present metal wood type golf club head, and those which follow, are disclosed as including a skirt, those skilled in the art will appreciate that the club heads constructed without a skirt will still be considered to fall within the spirit of the present invention.

[0043] In accordance with a preferred embodiment, the golf club head **10** is that of a metal wood type driver, that is, a metal wood driver type golf club head having a striking face **12** with a loft of approximately 7 degrees to approximately 13 degrees. The golf club head **10**, and in particular, the club head body **11**, has a volume of at least approximately 300 cc and, considering current weight standards applied to golf club heads, has a mass of approximately 180 g to approximately 250 g, preferably approximately 180 g to approximately 220 g, and preferably approximately 200 g.

[0044] Although a driver type golf club head is disclosed herein in accordance with a preferred embodiment of the present invention, the concepts underlying the present invention may be applied to a variety of golf club head types, for example, fairway woods, hybrids, irons, etc., without departing from the spirit of the present invention. As discussed below in detail, when these various golf club head types are employed in the spirit of the present invention, the volume and weighting of these golf club heads are varied to suit their differing constructions and the manner in which the weight distribution is manipulated is similar.

[0045] In accordance with a preferred embodiment of the present invention, at least a portion of the body shell **26** is composed of a transparent sheet made from minute carbon nanotubes. The nanotubes are tiny carbon tubes, too small to see with the naked eye, and are woven into an aerogel sheet of a predetermined size; in fact, trillions of tubes are woven into aerogel sheets about 5 cm wide and 1 m long, which then may be used in the manufacture of golf club heads in accordance with the present invention. In accordance with a preferred embodiment, multiple aerogel sheets are layered to produce the densified, highly oriented carbon nanotube sheet material exhibiting desirable characteristics for use in the manufacture of golf club heads. This carbon nanotube sheet material preferably has a thickness of 50 nm and a density of 0.5 g/cm^3. In accordance with a preferred embodiment, the carbon nanotube sheet material offers a density of less than approximately 2.5 g/cm^3, preferably less than approximately 2.0 g/cm^3, and a tensile strength of at least approximately 465 $MPa/(g/cm^3)$. Specifics regarding the manufacture and composition of the transparent carbon nanotube sheet material are disclosed by Mei et al. in Science Magazine. Mei Zhang, Shaoli Fang, Anvar A. Zakhidov, Sergey B. Lee, Ali E. Aliev, Christopher D. Williams, Ken R. Atkinson, and Ray H. Baughman, "Strong, Transparent, Multifunctional, Carbon Nanotube Sheets", Science 19 Aug. 2005; 309:1215-1219, which is incorporated herein by reference. Additional information concerning carbon nanotube fabrication is disclosed in U.S. Patent Application Publication Nos. 2002/0113335 to Lobovsky et al., entitled "Spinning, Processing, and Applications of Carbon Nanotube Filaments, Ribbons and Yarns", 2003/0165648 to Lobovsky et al., entitled "Composite Material Comprising Oriented Carbon Nanotubes in a Carbon Matrix and Process for Preparing Same", 2004/0096389 to Lobovsky et al., entitled "Spinning, Processing, and Applications of Carbon Nanotube Filaments, Ribbons and Yarns", and 2005/0074569 to Lobovsky et al., entitled "Composite Material Comprising Oriented Carbon Nanotubes in a Carbon Matrix and Process for Preparing Same", which are also incorporated herein by reference.

[0046] As those skilled in the art will certainly appreciate, the carbon nanotube sheet material is a strong and lightweight material. With this in mind, use of the carbon nanotube sheet material offers a great reduction in the weight of the golf club head without sacrificing strength. Although carbon nanotube sheet material is disclosed for use in accordance with various embodiments disclosed herein, those skilled in the art will appreciate other materials offering similar weight and strength characteristics may be employed without departing from the spirit of the present invention.

[0047] Implementation of the carbon nanotube sheet material reduces the mass of the body shell **26** to approximately no more than 150 g. Since the body shell **26** has a mass of no more than 150 g, weight member(s) **28** are attached to the body shell **26** in a manner bringing the golf club head **10** up to a mass commensurate with that of a conventional metal wood driver type golf club head. As such, at least approximately 30 g to 100 g of weight member(s) **28** are available for selective positioning within (or to the outer surface of) the club head body **11** in a manner optimizing the golf club head **10** for specific golf swings.

[0048] As those skilled in the art will certainly appreciate, the extra weight member(s) **28** may be positioned at a variety of locations depending upon the swing characteristics of the golfer. For example, the majority of the weight member(s) **28** could be placed on the center of the soleplate **14** to pull the center of gravity as low as possible or they could be positioned around the outer skirt of the golf club head to maximize the moment of inertia. One could also position the weight member(s) on the soleplate, but position it all the way back to increase launch angle while keeping the backspin relatively low (High Launch/Low Spin) or position it all the way forward to control launch angle, lower spin and also lower the amount of gear effect spin caused by off-center hits.

[0049] As mentioned above, at least a portion of the body shell **26** is composed of the carbon nanotube sheet material described above. In accordance with a preferred embodiment of the present invention as shown in FIGS. **1** to **3**, the crown **16** is composed of the carbon nanotube sheet material while the remainder of the body shell **26** of the golf club head **10** is composed of a metal, for example, a titanium alloy (although those skilled in the art will appreciate that a variety of materials may be used without departing from the spirit of the invention). Similarly, the striking face, soleplate, toe, heel and/or hosel, or combinations thereof, may be formed from the carbon nanotube sheet material. For example, and with reference to FIG. **4**, it is contemplated, the soleplate **114** might be manufactured from the carbon nanotube sheet material in an effort to provide for enhanced club head strength, while the striking face **112**, crown **116**, toe **118**, heel **120** and skirt **121** are composed of traditional golf club head materials. Similarly, the carbon nanotube sheet material might be incorporated into an insert for the striking face **212** (see FIG. **5**), while the soleplate **214**, crown **216**, toe **218**, heel **220** and skirt **221** are composed of traditional golf club head materials. While a body shell partially composed of the carbon nanotube sheet material is disclosed above, it is further contemplated the entire body shell **326**, that is, the striking face **312**, soleplate **314**, crown **316**, toe **318**, heel **320** and skirt **321** may be composed of the carbon nanotube sheet material described above (see FIG. **6**).

[0050] By exposing the interior of the club head body, one may view the internal structure thereof. As such, it is contemplated the golf club head may be provided with an internal adjustment structure which a user can view as he or she adjusts working components of the golf club head. For example, the implementation of a transparent carbon nanotube sheet material body shell allows for the possibility of a weight adjustment system that requires internal viewing for verification of proper weight positioning or support structure adjustment which similarly requires internal viewing for verification of the proper weight position.

[0051] Similarly, the golf club head might be provided with an internal indicator providing golfers with an impression indicative of where on the striking face the prior ball was struck. Such an internal indicator is secured along the rear surface of the striking face and one may look through the transparent crown to view the impression provided by the indicator.

[0052] In addition to use of the present invention in the construction of driver type golf club heads, the concepts underlying the present invention may similarly be applied to fairway wood type golf club heads **410**, that is, metal wood type golf club heads having a striking face **412** with a loft of approximately 13 degrees to approximately 24 degrees. Referring to FIGS. **7**, **8** and **9**, and as with the driver type golf club head embodiment, the golf club head **410** includes a club head body **411** composed of a striking face **412**, a soleplate **414**, a crown **416**, a toe **418**, a heel **420**, a skirt **421**, or other structure, used in connecting the crown **416** to the soleplate **414**, and a hosel **422** to which a golf club shaft **424** is secured, as well as any weight member(s) **428** which might be incorporated into the club head body **411**. The club head body **411** includes a body shell **426** composed of the striking face **412**, soleplate **414**, crown **416**, toe **418**, heel **420** and skirt **421**. That is, the body shell **426** may generally be considered the structure used in striking a golf ball and, as will be discussed below in greater detail, may have various weighting member (s) **428** secured thereto in an effort to optimize the striking characteristics of the golf club head **410**.

[0053] In accordance with a preferred embodiment, the fairway wood type golf club head **410**, in particular, the club head body **411**, has a volume of approximately 100 cc to approximately 250 cc, and a mass of approximately 205 g to approximately 245 g. As with the driver type golf club head discussed above, at least a portion of the body shell **426** is composed of the carbon nanotube sheet material.

[0054] Implementation of the carbon nanotube sheet material reduces the mass of the body shell **426** to approximately no more than 150 g. Since the body shell **426** has a mass of no more than 150 g, weight member(s) **428** are attached to the body shell **426** in a manner bringing the golf club head **410** up to a mass commensurate with that of a conventional metal wood fairway type golf club head. As such, at least approximately 55 g to 95 g of weight member(s) **428** are available for selective positioning within (or to the outer surface of) the club head body **411** in a manner optimizing the golf club head **410** for specific golf swings.

[0055] As those skilled in the art will certainly appreciate, the extra weight member(s) **428** may be positioned at a variety of locations depending upon the swing characteristics of the golfer. For example, the majority of the weight member(s) **428** could be placed on the center of the soleplate **414** to pull the center of gravity as low as possible or they could be positioned around the outer skirt of the golf club head to maximize the moment of inertia. One could also position the weight member(s) on the soleplate, but position it all the way back to increase launch angle while keeping the backspin relatively low (High Launch/Low Spin) or position it all the way forward to control launch angle, lower spin and also lower the amount of gear effect spin caused by off-center hits.

[0056] As with the driver type golf club head embodiment, at least a portion of the body shell **426** is composed of the carbon nanotube sheet material described above. In accordance with a preferred embodiment of the present invention as shown in FIGS. **7** to **9**, the crown **416** is composed of the carbon nanotube sheet material while the remainder of the body shell **426** of the golf club head **410** is composed of a metal, for example, a titanium alloy (although those skilled in the art will appreciate that a variety of materials may be used without departing from the spirit of the invention). Similarly, the striking face, soleplate, toe, heel and/or hosel, or combinations thereof, may be formed from the transparent material. For example, and with reference to FIG. **10**, it is contemplated, the soleplate **514** might be manufactured from the carbon nanotube sheet material in an effort to provide for enhanced club head strength, while the striking face **512**, crown **516**, toe **518**, heel **520** and skirt **521** are composed of traditional golf club head materials. Similarly, the carbon nanotube sheet material might be incorporated into an insert for the striking face **612** (see FIG. **11**), while the soleplate **614**, crown **616**, toe **618**, heel **620** and skirt **621** are composed of traditional golf club head materials. While a body shell partially composed of the carbon nanotube sheet material is disclosed above, it is further contemplated the entire body shell **726**, that is, the striking face **712**, soleplate **714**, crown **716**, toe **718**, heel **720** and skirt **721** may be composed of the carbon nanotube sheet material described above (see FIG. **12**).

[0057] The concepts underlying the present invention may similarly be applied to hybrid, or I-wood, type golf club heads **810** as shown in FIGS. **13**, **14** and **15**. The golf club head **810**

includes a club head body **811** having a striking face **812**, a soleplate **814**, a crown **816**, a toe **818**, a heel **820**, a skirt **821**, or other structure, used in connecting the crown **816** to the soleplate **814**, and a hosel **822** to which a golf club shaft **824** is secured, as well as any weight member(s) **828** which might be incorporated into the club head body **811**. The club head body **811** includes a body shell **826** composed of the striking face **812**, soleplate **814**, crown **816**, toe **818**, heel **820** and skirt **821**. That is, the body shell **826** may generally be considered the structure used in striking a golf ball and, as will be discussed below in greater detail, may have various weighting member(s) **828** secured thereto in an effort to optimize the striking characteristics of the golf club head **810**.

[0058] In accordance with a preferred embodiment, the hybrid golf club head **810**, in particular, the club head body **811**, has a volume of approximately 70 cc to approximately 150 cc, and a mass of approximately 210 g to approximately 260 g. As with the driver type golf club head discussed above, at least a portion of the body shell **826** is composed of the carbon nanotube sheet material.

[0059] Implementation of the carbon nanotube sheet material reduces the mass of the body shell **826** to approximately no more than 150 g. Since the body shell **826** has a mass of no more than 150 g, weight member(s) **828** are attached to the body shell **826** in a manner bringing the golf club head **810** up to a mass commensurate with that of a conventional hybrid type golf club head. As such, at least approximately 60 g to 110 g of weight member(s) **828** are available for selective positioning within (or to the outer surface of) the golf club head **810** in a manner optimizing the golf club head **810** for specific golf swings.

[0060] As those skilled in the art will certainly appreciate, the extra weight member(s) may be positioned at a variety of locations depending upon the swing characteristics of the golfer. For example, the majority of the weight member(s) **828** could be placed on the center of the soleplate **814** to pull the center of gravity as low as possible or they could be positioned around the outer skirt of the golf club head to maximize the moment of inertia. One could also position the weight member(s) on the soleplate, but position it all the way back to increase launch angle while keeping the backspin relatively low (High Launch/Low Spin) or position it all the way forward to control launch angle, lower spin and also lower the amount of gear effect spin caused by off-center hits.

[0061] As with the driver type golf club head embodiment, at least a portion of the body shell **826** is composed of the carbon nanotube sheet material described above. In accordance with a preferred embodiment of the present invention as shown in FIGS. **1** to **3**, the crown **816** is composed of the carbon nanotube sheet material while the remainder of the body shell **826** is composed of a metal, for example, a titanium alloy (although those skilled in the art will appreciate that a variety of materials may be used without departing from the spirit of the invention). Similarly, the striking face, soleplate, toe, and/or heel, or combinations thereof, may be formed from the carbon nanotube sheet material. For example, and with reference to FIG. **16**, it is contemplated, the soleplate **914** might be manufactured from the carbon nanotube sheet material in an effort to provide for enhanced golf club head strength, while the striking face **912**, crown **916**, toe **918**, heel **920** and skirt **921** are composed of traditional golf club head materials. Similarly, the carbon nanotube sheet material might be incorporated into an insert for the striking face **1012** (see FIG. **17**), while the soleplate **1014**, crown **1016**, toe **1018**, heel **1020** and skirt **1021** are composed of traditional golf club head materials. While a body shell partially composed of the carbon nanotube sheet material is disclosed above, it is further contemplated the entire body shell **1126**, that is, the striking face **1112**, soleplate **1114**, crown **1116**, toe **1118**, heel **1120** and skirt **1121** may be composed of the carbon nanotube sheet material described above (see FIG. **18**).

[0062] In addition to utilization of the transparent carbon nanotube sheet material in the manufacture of metal wood type golf club heads, and with reference to FIGS. **19** and **20**, the carbon nanotube sheet material described above is also utilized in the manufacture of iron type golf club heads **1210**, for example, a cavity back golf club head. In particular, the iron type golf club head **1210** includes a club head body **1211** having a striking face **1212**, soleplate **1214**, toe **1216**, heel **1218**, rear cavity border **1222**, and hosel **1220** shaped and dimensioned for receiving a golf club shaft, as well as any weight member(s) **1228** which might be incorporated into the club head body **1211**. The club head body **1211** includes body shell **1226** composed of the striking face **1212**, soleplate **1214**, toe **1216** and heel **1218** and rear cavity border **1220**. That is, the body shell **1226** may generally be considered the structure used in striking a golf ball and, as will be discussed below in greater detail, may have various weighting member (s) **1228** secured thereto in an effort to optimize the striking characteristics of the golf club. In accordance with a preferred embodiment of the present invention, the entire iron club head shell **1226** is manufactured from the carbon nanotube sheet material and provides a substantially see-through golf club head **1210** previously unknown in the prior art.

[0063] The golf club head **1210**, in particular, the club head body **1211**, is that of an iron type golf club head and has a volume ranging from approximately 70 cc to approximately 230 cc, and mass of approximately 215 g to approximately 310 g. As those skilled in the art will appreciate, the volume and mass of iron type golf club heads vary substantially depending upon the specific iron being used. For example, a 3 iron might have a mass of up to approximately 215 g, while a sand wedge will have a mass up to approximately 310 g.

[0064] In accordance with this embodiment, the entire body shell **1226** is composed of the carbon nanotube sheet material. Because the carbon nanotube sheet material is a lightweight material, a great reduction in the mass is achieved without sacrificing strength. Although use of carbon nanotube sheet material is disclosed in accordance with a preferred embodiment of the present invention, other materials offering similar mass and strength characteristics may be employed without departing from the spirit of the present invention.

[0065] Since the mass of the body shell **1226** is substantially reduced, the weight reduction may be applied to other portions of the golf club head **1210** in an effort to improve the striking characteristics of the golf club head **1210**. For example, long irons (for example, the 3-iron to the 6-iron) take advantage of the weight reduction by adding this weight to the lower portion of the rear cavity border in an effort to further help individuals get the ball into the air when using these clubs. Similarly, short irons (for example, the 7-iron to the sand wedge) take advantage of the weight reduction by adding this weight to the upper portion of the rear cavity border in an effort to further control the trajectory of a ball being struck by these clubs. Although a specific redistribution is contemplated in accordance with a preferred embodiment, those skilled in the art will certainly appreciate, the extra

weight member(s) may be positioned at a variety of locations depending upon the swing characteristics of the golfer.

[0066] In particular, implementation of the carbon nanotube sheet material in accordance with the present embodiment reduces the mass of a traditional stainless steel golf club head body by at least approximately 150.5 g-217 g. That is, the body shell **1226** would have a mass of approximately 64.5 g to approximately 93 g with the extra 150.5 g-217 g available for redistribution within the club head **1210** via weight member(s) **1228**. This weight may be redistributed to enhance the striking characteristics as discussed above, bringing the golf club head **1210** up to a weight commensurate with that of a conventional iron type golf club head.

[0067] In accordance with an alternate embodiment of the present invention, and with reference to FIGS. **21** and **22**, the rear cavity border **1322** of the golf club head **1310** is manufactured from the carbon nanotube sheet material, while the remainder of the body shell **1326** of the club head body **1311** is manufactured from traditional materials. This would provide golfers with the look of a blade type iron with the actual body of a cavity back golf club head. As those skilled in the art will certainly appreciate, this would result in less weight savings in the body shell.

[0068] With reference to yet a further embodiment of an iron type golf club head in accordance with the spirit of the present invention as disclosed in FIGS. **23** and **24**, the iron golf club head **1410** includes a club head body **1411** having a striking face **1412**, soleplate **1414**, toe **1416**, heel **1418**, rear cavity border **1422**, and a hosel **1420** shaped and dimensioned for receiving a golf club shaft, as well as any weight member (s) **1428** which might be incorporated into the club head body **1411**. The club head body **1411** includes body shell **1426** composed of the striking face **1412**, soleplate **1414**, toe **1416** and heel **1418** and rear cavity border **1420**. That is, the body shell **1426** may generally be considered the structure used in striking a golf ball and, as will be discussed below in greater detail, may have various weighting member(s) **1428** secured thereto in an effort to optimize the striking characteristics of the golf club.

[0069] As mentioned above, the golf club head **1410**, in particular, the club head body **1411**, is that of an iron type golf club head and has a volume ranging from approximately 70 cc to approximately 230 cc, and mass of approximately 215 g to approximately 310 g. As those skilled in the art will appreciate, the volume and mass of iron type golf club heads vary substantially depending upon the specific iron being used. For example, a 3 iron might have a mass of up to approximately 215 g, while a sand wedge will have a mass up to approximately 310 g.

[0070] In accordance with this embodiment, the striking face **1412** is composed of the carbon nanotube sheet material and the remainder of the body shell **1426** is composed of traditional golf club head materials (for example, titanium or stainless steel). Because the carbon nanotube sheet material from which the striking face **1412** is composed is a lightweight material, a great reduction in the mass is achieved without sacrificing strength. Although carbon nanotube sheet material is disclosed in accordance with a preferred embodiment of the present invention, other materials offering similar mass and strength characteristics may be employed without departing from the spirit of the present invention.

[0071] Since the mass of the striking face **1412** is substantially reduced, the weight reduction may be applied to other portions of the golf club head **1410** in an effort to improve the striking characteristics of the golf club head **1410**. For example, long irons (for example, the 3-iron to the 6-iron) take advantage of the weight reduction in the striking face by adding this weight to the lower portion of the rear cavity border in an effort to further help individuals get the ball into the air when using these clubs. Similarly, short irons (for example, the 7-iron to the sand wedge) take advantage of the weight reduction in the striking face by adding this weight to the upper portion of the rear cavity border in an effort to further control the trajectory of a ball being struck by these clubs. Although a specific redistribution is contemplated in accordance with a preferred embodiment, those skilled in the art will certainly appreciate, the extra weight member(s) may be positioned at a variety of locations depending upon the swing characteristics of the golfer.

[0072] In particular, implementation of the carbon nanotube sheet material sheet reduces the mass of a traditional stainless steel striking face by at least approximately 20 g. That is, the body shell **1426** would have a mass of approximately 195 g to approximately 290 g with the extra 20 g available for restribution within the club head **1410** via weight member(s) **1428**. This weight may be redistributed to enhance the striking characteristics as discussed above, bringing the golf club head **1410** up to a weight commensurate with that of a conventional iron type golf club head.

[0073] While three embodiments for an iron type golf club head are presented above, those skilled in the art will appreciate the carbon nanotube sheet material may be used in other combinations to create a desired look and feel to the golf club head. For example, the carbon nanotube sheet material might be incorporated into an insert for the striking face or the soleplate might be formed of the carbon nanotube sheet material.

[0074] Referring to FIGS. **25** and **26**, it is further contemplated the carbon nanotube sheet material may be utilized in the manufacture of a putter type club head **1510**. In particular, the putter type club head **1510** includes a putter club head body **1511** having a striking face **1512**, a soleplate **1514**, a toe **1516**, a heel **1518**, a rear cavity border **1522**, and a hosel **1520** shaped and dimensioned for receiving a golf club shaft, as well as any weight members (not shown) which might be incorporated into the putter type club head body **11**. The putter club head body **1511** includes a body shell **1526** composed of the striking face **1512**, soleplate **1514**, toe **1516**, heel **1518**, hosel **1520** and rear cavity border **1522**. As with the prior embodiments, and with reference to FIGS. **25** and **26**, the putter type club head **1510** may be manufactured entirely from the carbon nanotube sheet material.

[0075] However, and with reference to FIGS. **27** and **28**, the carbon nanotube sheet material may be combined with traditional putter materials so as to improve the aesthetic appearance of the putter type club head **1610** and enhance the functionality thereof. For example, the striking face **1612** may be provided with an insert **1614** composed of the carbon nanotube sheet material. The insert **1614** would allow the user to more accurately align the striking face **1612** with the ball through the provision of alignment markings **1616** formed for viewing through the carbon nanotube sheet material which, as discussed above, is transparent.

[0076] As those skilled in the art will certainly appreciate, a variety of embodiments for golf club head constructions are disclosed above within the spirit of the present invention. As those skilled in the art will also appreciate, the various components make up these golf club heads may be assembled

using conventional club manufacturing techniques, as such, they may be integrally molded or coupled together via adhesives, welding, brazing, etc.

[0077] In addition to utilization of the carbon nanotube sheet material described above in the manufacture of golf club heads, the carbon nanotube sheet material may also be utilized in the construction of golf club shafts for supporting the golf club head. It is contemplated the shafts may be formed partially from the carbon nanotube sheet material, for example, adjacent the butt end, distal end or central portion, or the entire shaft may be constructed of the carbon nanotube sheet material.

[0078] Because of the weight reduction through the implementation of the carbon nanotube sheet material into the construction of the golf club shaft, tremendous weight manipulation is possible. In fact, the carbon nanotube sheet material is very strong, light and transparent, so weight and strength may be moved to wherever a designer deems necessary. In addition, because the carbon nanotube sheet material is transparent, the weight or strength mechanisms inside the shaft may be made visible.

[0079] For example, where a steel shaft might weigh 100 grams, a shaft incorporating carbon nanotube sheet material as discussed above might weigh 30 grams, leaving approximately 70 grams to move around the shaft in creating desired effects.

[0080] In accordance with a preferred embodiment, and with reference to FIG. **29**, the shaft **1710** includes a shaft body **1712** constructed entirely from carbon nanotube sheet material. The shaft body **1712** is constructed with similar shape and dimensions as conventional steel and/or graphite shafts. However, and considering the fact the shaft body **1712** is transparent, a visible weight **1714** is placed within the shaft body **1712** at a location adjacent the connection point for the hosel **1716** and the shaft **1710**. The weight **1714** is colored and visible through the shaft body **1712**. Because the weight **1714** is readily visible, and in accordance with a preferred embodiment, different weights are used for different flex and swing characteristics. The different weights **1714** are, therefore, color coded to provide the golfer with a ready visual indicator as to the weight used and, therefore, specific swing and flex characteristics offered by the shaft **1710**.

[0081] Similarly, and in accordance with an alternate embodiment of the present invention as shown in FIG. **30**, the weight **1814** may be positioned adjacent the kick point (or flex point) **1820** of the shaft **1810** and color-coded for swing speeds. As those skilled in the art will appreciate, the kick point is the point at which the shaft bend is greatest as it is swung. A shaft with a lower kick point generally results in a higher trajectory as a result of the greater flexibility nearer the golf club head, while a higher kick makes the shaft feel stiffer and commonly results in a lower ball trajectory.

[0082] More particularly, and with reference to FIG. **30**, the shaft **1810** includes a shaft body **1812** constructed entirely from carbon nanotube sheet material. The shaft body **1812** is constructed with similar shape and dimensions as conventional steel and/or graphite shafts. However, and considering the fact the shaft body **1812** is transparent, a visible weight **1814** is placed within the shaft body **1812** at a location adjacent the kick point **1820** of the shaft **1810**. The weight **1814** is colored and visible through the shaft body **1812**. Because the weight **1814** is readily visible, and in accordance with a preferred embodiment, different weights are used for different flex and swing characteristics. The different weights **1814** are, therefore, color coded to provide the golfer with a ready visual indicator as to the weight **1814** used and, therefore, specific swing and flex characteristics offered by the shaft **1810**.

[0083] In view of the great strength characteristics offered by the carbon nanotube sheet material, it is contemplated the shafts and heads may be configured to provide for a releasable connection system allowing for selective connection of various golf club heads with a shaft.

[0084] While the preferred embodiments have been shown and described, it will be understood that there is no intent to limit the invention by such disclosure, but rather, is intended to cover all modifications and alternate constructions falling within the spirit and scope of the invention.

1-35. (canceled)

36. A golf club, comprising:

an elongated shaft body, wherein at least a portion of the shaft body is composed of a transparent material composed of carbon nanotubes woven into a sheet of a predetermined size allowing for viewing of the internal structure of the shaft;

a weight member positioned within the shaft body and visible through the transparent material; and

a golf club head secured to an end of the shaft body.

37. The golf club shaft according to claim **36**, wherein the weight member is positioned adjacent a distal end of the shaft body where the shaft body is shaped and dimensioned for attachment to a hosel of a golf club head.

38. The golf club shaft according to claim **36**, wherein the weight member is positioned within the shaft body adjacent the kick point of the shaft body.

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