



US 20160144247A1

(19) **United States**

(12) **Patent Application Publication**  
**Chen et al.**

(10) **Pub. No.: US 2016/0144247 A1**

(43) **Pub. Date: May 26, 2016**

(54) **GOLF CLUB HEADS WITH CAVITIES AND RELATED METHODS**

**Publication Classification**

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

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(52) **U.S. Cl.**  
CPC ..... *A63B 53/047* (2013.01)

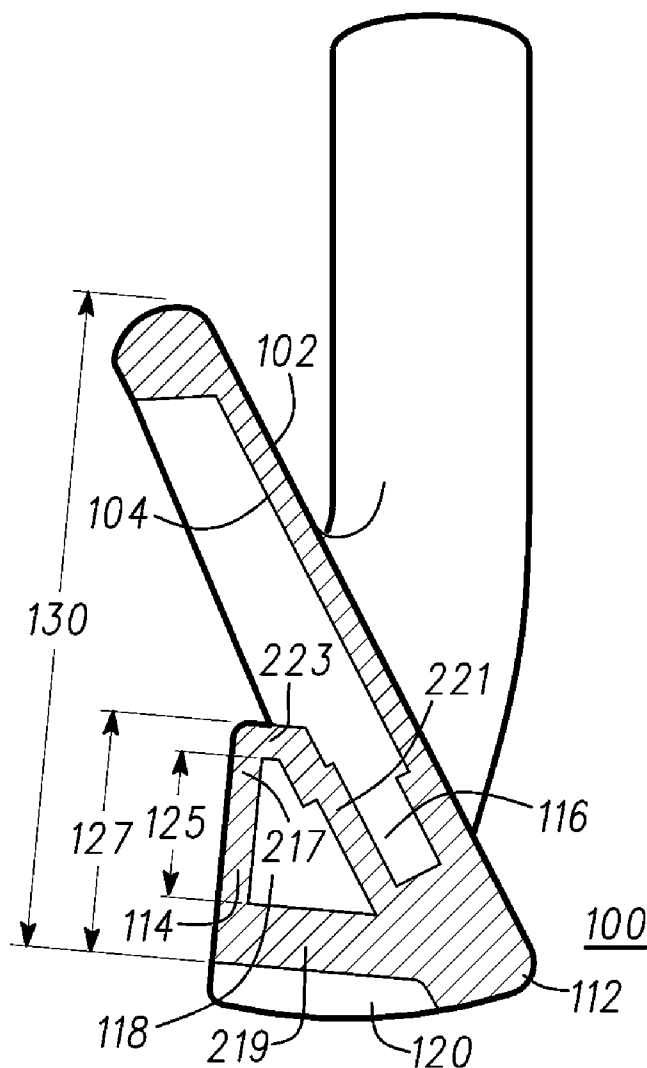
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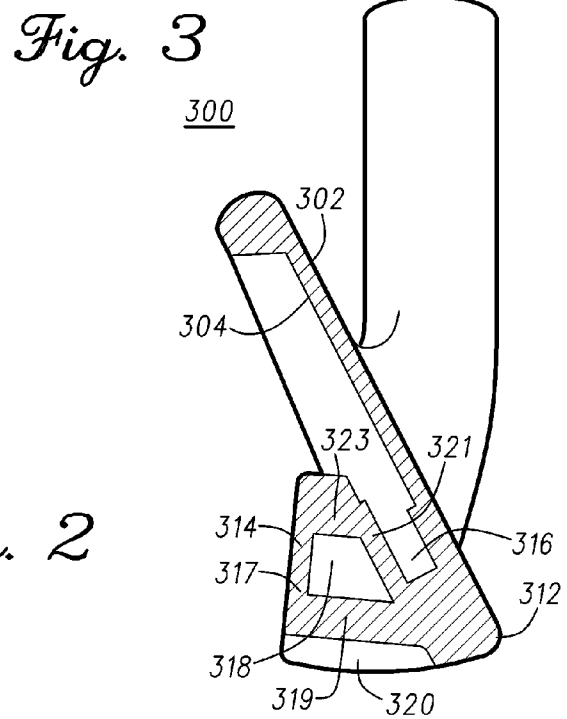
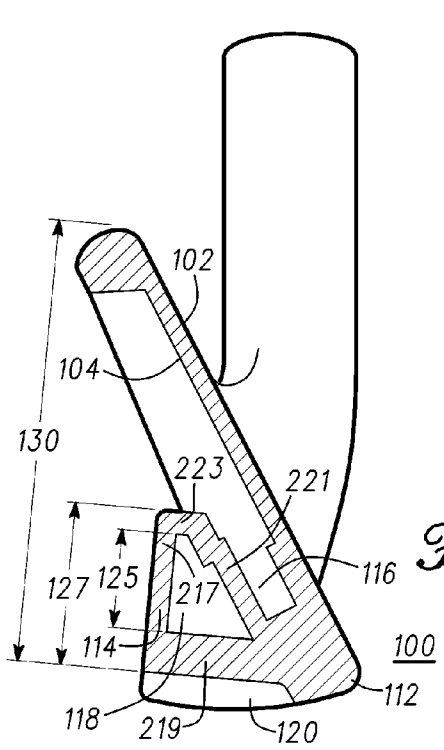
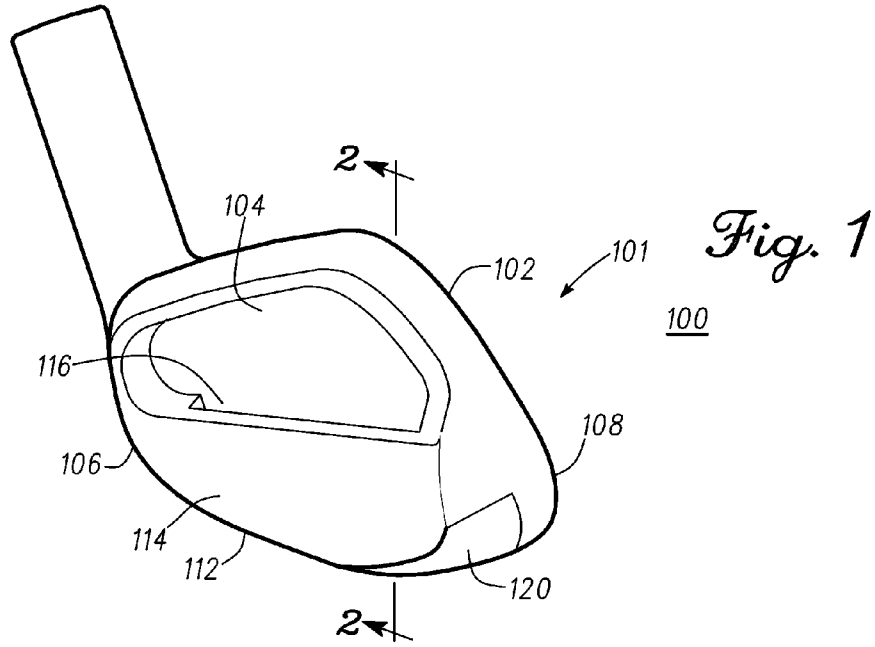
(57) **ABSTRACT**

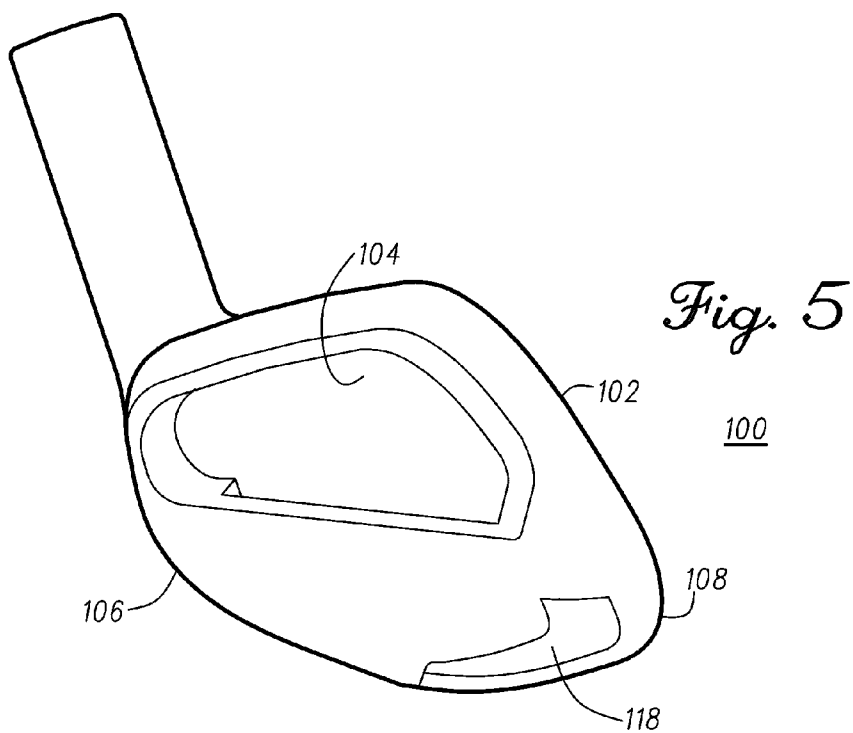
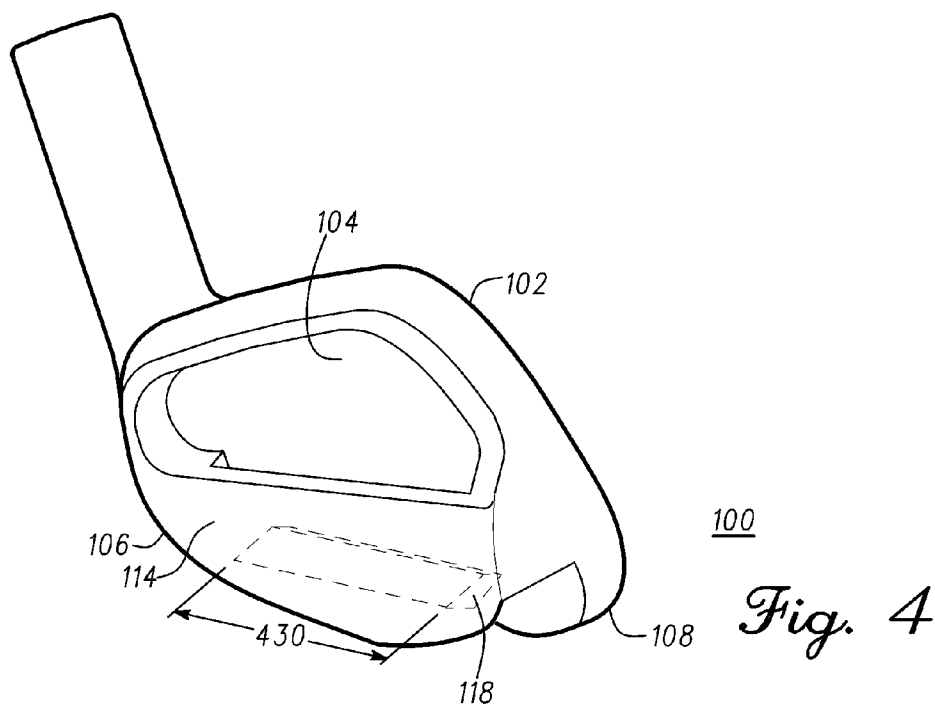
Embodiments of golf club heads with cavities and methods to manufacture golf club heads with cavities are generally described herein. In some embodiments, a golf club head comprises a body. The body comprises a strikeface, a backside of the strikeface, a heel region, a toe region opposite the heel region, a sole, a first cavity at the backside of the strikeface, a rear portion opposite the strikeface, and a second cavity at the rear portion. In many embodiments, the golf club head further comprises a cap closing off the second cavity. Other embodiments may be described and claimed.

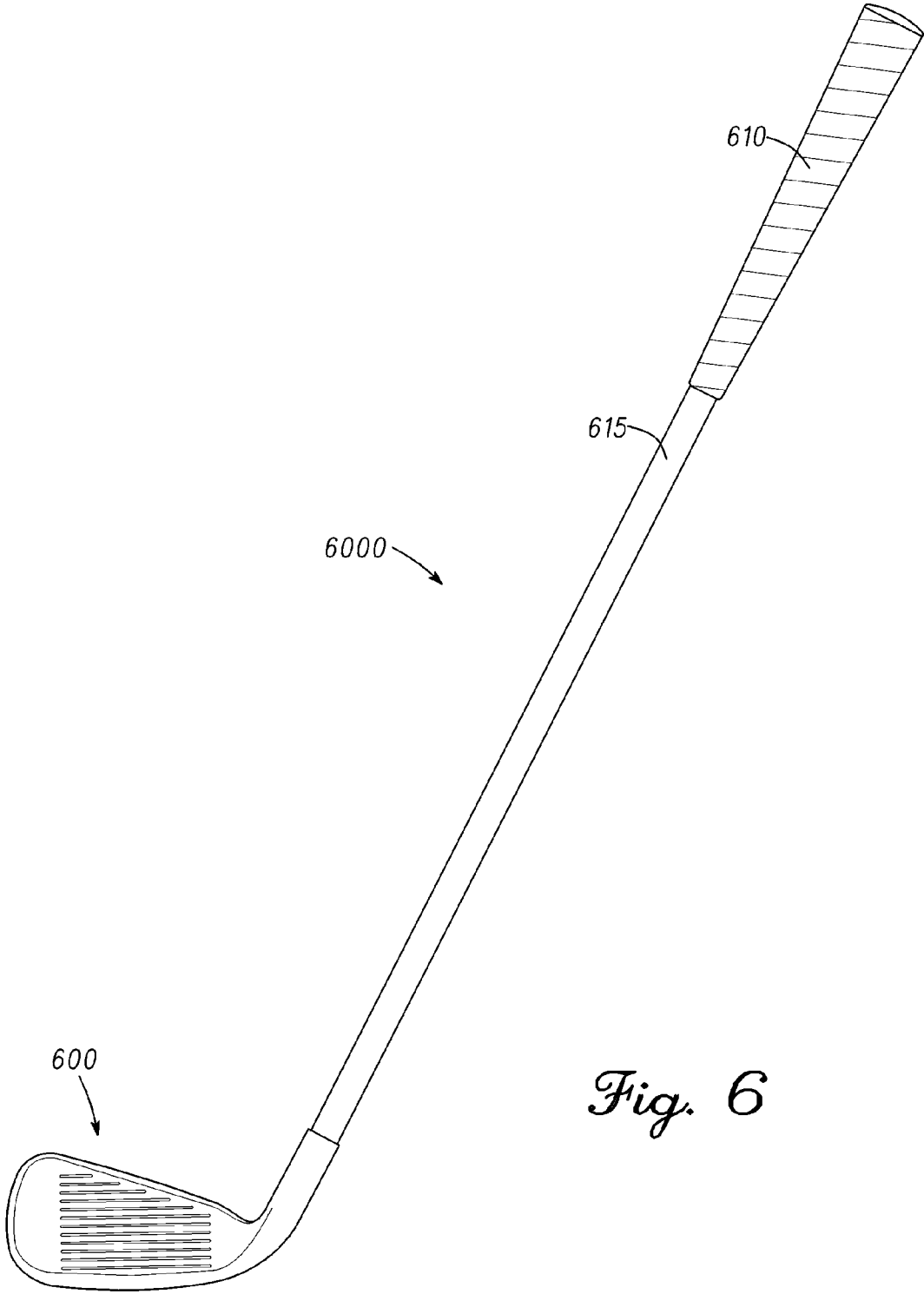
(21) Appl. No.: **14/555,025**

(22) Filed: **Nov. 26, 2014**









*Fig. 6*

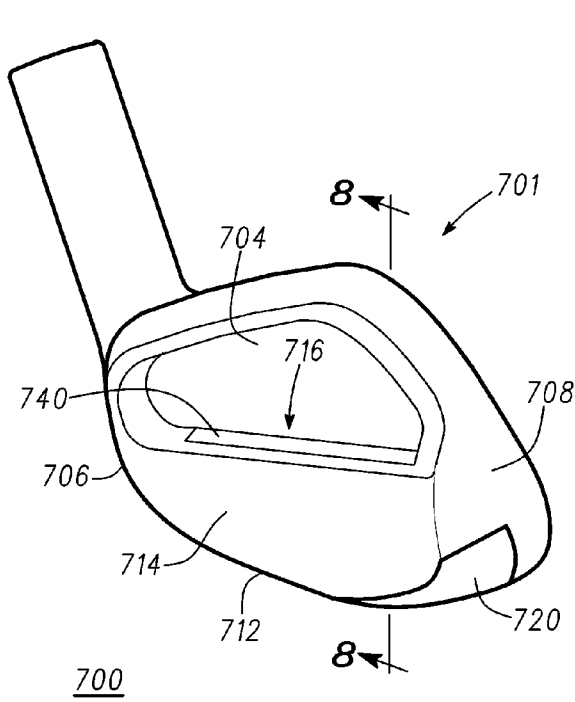


Fig. 7

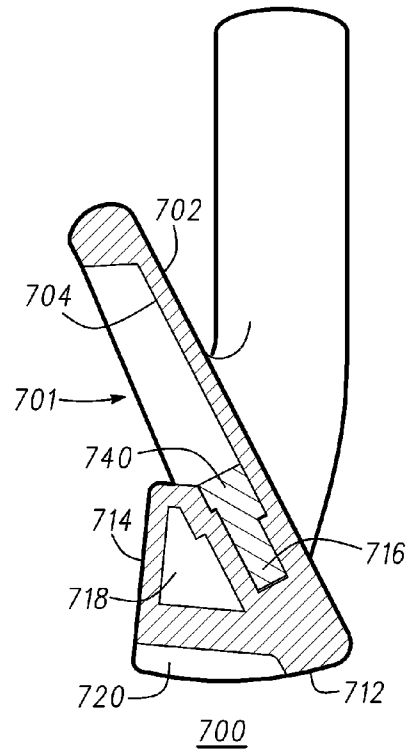


Fig. 8

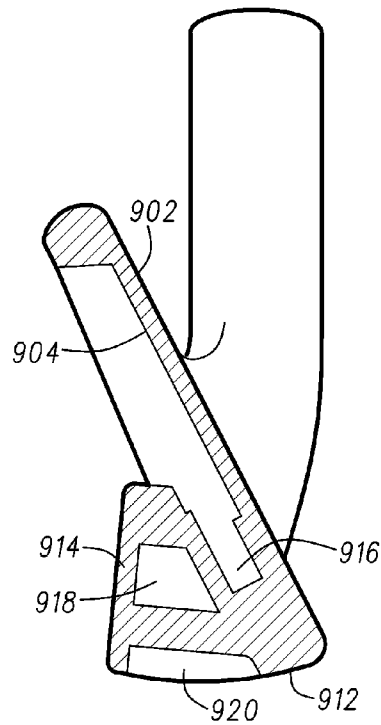
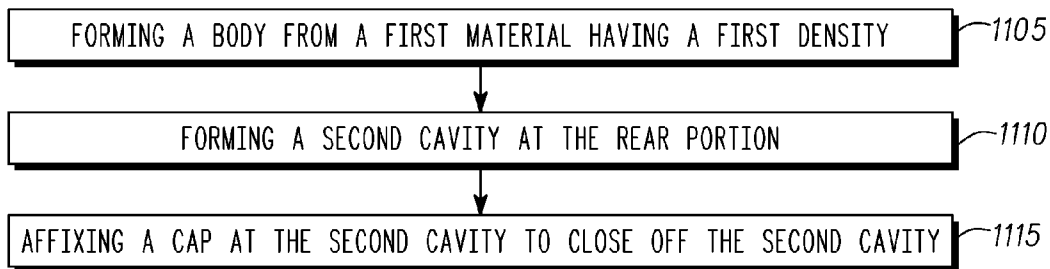
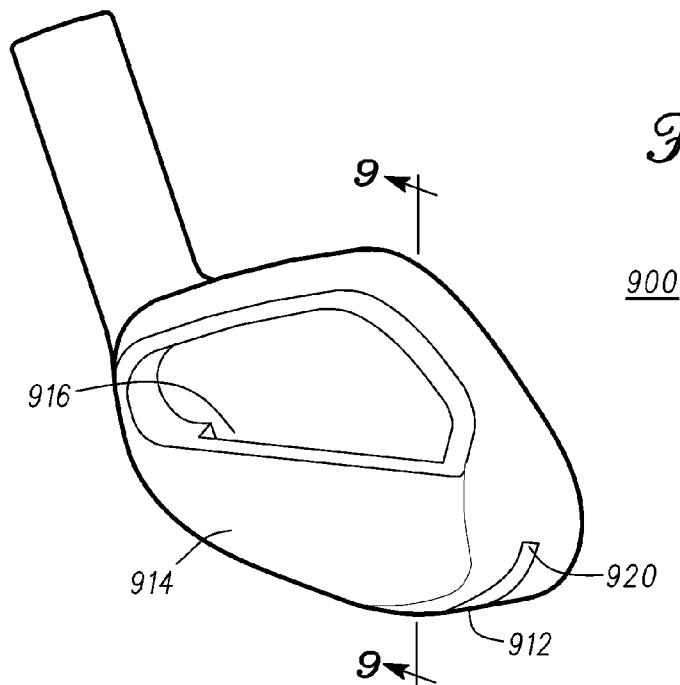


Fig. 9



1100

Fig. 11

**GOLF CLUB HEADS WITH CAVITIES AND RELATED METHODS**

**TECHNICAL FIELD**

[0001] This disclosure relates generally to golf clubs, and relates more particularly to golf club heads with cavities.

**BACKGROUND**

[0002] Golf club manufacturers have designed golf club heads to accommodate the preferences of an individual user as well as the individual user's golfing ability. Some golf club manufactures have designed golf club heads to accommodate the preferences of an individual user, such as an individual user's preference on the golf club head's look and feel. Some individual users may prefer a heavy look, such as a muscle-back iron. Golf club manufacturers have designed golf club heads to accommodate the preferences of an individual user while designing golf club heads with enhanced weight distribution and/or a lower center of gravity.

**BRIEF DESCRIPTION OF THE DRAWINGS**

[0003] To facilitate further description of the embodiments, the following drawings are provided in which:

[0004] FIG. 1 depicts back, toe-side perspective view of a golf club head according to an embodiment;

[0005] FIG. 2 depicts the golf club head of FIG. 1 along the cross-sectional line 2-2 in FIG. 1;

[0006] FIG. 3 depicts a golf club head similar to the golf club head of FIG. 1 along the cross-sectional line 2-2 in FIG. 1, according to another embodiment;

[0007] FIG. 4 depicts a back, toe-side perspective, x-ray view of the golf club head of FIG. 1;

[0008] FIG. 5 depicts a back, toe-side perspective view of the golf club head of FIG. 1 according to another embodiment;

[0009] FIG. 6. depicts a front view of a golf club according to an embodiment;

[0010] FIG. 7 depicts a back, toe-side perspective view of a golf club head according to an embodiment;

[0011] FIG. 8 depicts the golf club head of FIG. 7 along the cross-sectional line 7-7 in FIG. 7;

[0012] FIG. 9 depicts the golf club head of FIG. 10 along a similar cross-sectional line 9-9 in FIG. 10, according to an embodiment;

[0013] FIG. 10 depicts a back, toe-side perspective view of a golf club head, according to an embodiment; and

[0014] FIG. 11 depicts a method of manufacturing a golf club head according to an embodiment of a method.

[0015] For simplicity and clarity of illustration, the drawing figures illustrate the general manner of construction, and descriptions and details of well-known features and techniques may be omitted to avoid unnecessarily obscuring the golf clubs and their methods of manufacture. Additionally, elements in the drawing figures are not necessarily drawn to scale. For example, the dimensions of some of the elements in the figures may be exaggerated relative to other elements to help improve understanding of embodiments of the golf club heads with cavities and related methods. The same reference numerals in different figures denote the same elements.

[0016] The terms "first," "second," "third," "fourth," and the like in the description and in the claims, if any, are used for distinguishing between similar elements and not necessarily for describing a particular sequential or chronological order.

It is to be understood that the terms so used are interchangeable under appropriate circumstances such that the embodiments of golf club heads with cavities and related methods herein are, for example, capable of operation in sequences other than those illustrated or otherwise described herein. Furthermore, the terms "contain," "include," and "have," and any variations thereof, are intended to cover a non-exclusive inclusion, such that a process, method, article, or apparatus that comprises a list of elements is not necessarily limited to those elements, but may include other elements not expressly listed or inherent to such process, method, article, or apparatus.

[0017] The terms "left," "right," "front," "back," "top," "bottom," "side," "under," "over," and the like in the description and in the claims, if any, are used for descriptive purposes and not necessarily for describing permanent relative positions. It is to be understood that the terms so used are interchangeable under appropriate circumstances such that the embodiments of golf clubs and methods of manufacture described herein are, for example, capable of operation in other orientations than those illustrated or otherwise described herein.

[0018] The terms "couple," "coupled," "couples," "coupling" and the like as used herein, is defined as directly or indirectly connected in a physical, mechanical, or other manner. Two or more mechanical elements may be mechanically coupled together, but not electrically or otherwise coupled together. Coupling may be for any length of time, e.g., permanent or only for an instant.

[0019] "Mechanical coupling" and the like should be broadly understood and include mechanical coupling of all types.

[0020] The absence of the word "removably," "removable," and the like near the word "coupled," and the like does not mean that the coupling, etc. in question is or is not removable.

**DESCRIPTION OF EXAMPLES OF EMBODIMENTS**

[0021] Various embodiments include a golf club head comprising a body. The body comprises a strikeface, a backside of the strikeface, a heel region, a toe region opposite the heel region, a sole, and a rear portion opposite the strikeface. In many embodiments, the body further comprises a first cavity at the backside of the strikeface and a second cavity at the rear portion. In some embodiments, the golf club head also comprises a cap closing off the second cavity.

[0022] Some embodiments include a golf club comprising a shaft, a grip and a golf club head. The golf club head comprises a body. The body comprises a strikeface, a backside of the strikeface, a heel region, a toe region opposite the heel region, a sole, and a rear portion opposite the strikeface. In many embodiments, the body further comprises a first cavity at the backside of the strikeface and a second cavity at the rear portion. In some embodiments, the golf club head also comprises a cap closing off the second cavity.

[0023] Other embodiments include a method for manufacturing a golf club head. In many embodiments the method comprises forming a body from a first material having a first density. The body having a strikeface, a backside of the strikeface, a heel region, a toe region opposite the heel region, a sole, a first cavity at the backside of the strikeface, and a rear portion opposite the strikeface. In some embodiments, the

method can also comprise forming a second cavity at the rear portion and affixing a cap at the second cavity to close off the second cavity.

**[0024]** Turning to the drawings, FIG. 1 illustrates a back, toe-side perspective view of a golf club head **100** according to an embodiment. Golf club head **100** is merely exemplary and is not limited to the embodiments presented herein. Golf club head **100** can be employed in many different embodiments or examples not specifically depicted or described herein.

**[0025]** In some embodiments, golf club head **100** can be an iron-type golf club head. In other embodiments, golf club head **100** can be another type of golf club head (e.g., a driver-type club head, a fairway wood-type club head, a hybrid-type club head, a wood-type club head, a wedge-type club head, or a putter-type club head.) In some embodiments, golf club head **100** comprises a body **101**. In many embodiments, body **101** comprises a strikeface **102**, a backside **104** of strikeface **102**, a heel region **106**, a toe region **108** opposite heel region **106**, and a sole **112** at the bottom of body **101**. Body **101** can further comprise a first cavity **116** at backside **104**. Further, body **101** can comprise a rear portion **114** opposite strikeface **102**. First cavity **116** can be between backside **104** and rear portion **114**. In some embodiments, golf club head **100** can comprise a hosel, which in other embodiments can be omitted. In many embodiments, rear portion **114** can be designed to look similar to a traditional muscleback iron golf club head. For example, many muscleback irons have a full back or full rear portion of a golf club head. Muscleback irons differ from non-muscleback irons in which the rear or back of the golf club head has been hollowed out to at least partially remove the muscleback, full back and/or rear portion. In some embodiments, rear portion **114** can be designed to provide a heavy or thick look to the golf club head.

**[0026]** Some users may prefer a heavy look to a golf club head, such as a muscleback golf club head. However, in many instances, a muscleback golf club head may not provide an enhanced weight distribution and/or a lower center of gravity. For instance, muscleback irons with wide soles can add weight high and in the middle of the golf club head. Also, many muscleback golf clubs may have a greater loss of distance compared to non-muscleback golf clubs. Additionally, many muscleback golf clubs have a lower moment of inertia, or forgiveness, than a non-muscleback golf club. For users who prefer the heavy look to a golf club head, but would like an enhanced weight distribution, higher moment of inertia and/or a lower center of gravity, a second cavity within the rear portion or muscleback portion of the golf club head can be designed.

**[0027]** In some embodiments, the higher moment of inertia can be at least partially due to perimeter weighting. In other embodiments, the higher moment of inertia can be at least partially due to a second cavity in body **101**. For example, in many embodiments, body **101** further comprises a second cavity **118** (FIG. 2) at or within rear portion **114**. In some embodiments, second cavity **118** can be designed to enhance weight distribution of golf club head **100**, while maintaining a heavy or muscleback look of rear portion **114**. In some embodiments, second cavity **118** can be hollow, thereby reducing the mass and/or weight of rear portion **114**. In other embodiments, second cavity **118** can be at least partially hollow. In other embodiments, second cavity **118** can comprise a filler material in all or a portion of second cavity **118**. In embodiments wherein second cavity **118** comprises the

filler material, the filler material can be less dense than the material(s) used for other parts of body **101** (i.e., the club head density).

**[0028]** In some embodiments, second cavity **118** can comprise an opening at least partially at toe region **108**. In some embodiments, second cavity **118** can comprise an opening at least partially at sole **112**. In some embodiments, second cavity **118** can comprise an opening at least partially at heel region **106**. In many embodiments, and as shown in FIG. 1, second cavity **118** comprises an opening at least partially at toe region **108** and at least partially at sole **112** and does not comprise an opening at heel region **106**. In some embodiments, second cavity **118** can be open to first cavity **116** to form one larger cavity. In some embodiments, wherein second cavity **118** is open to first cavity **116**, the one larger cavity can comprise at least two distinct regions. In other embodiments, wherein second cavity **118** is open to first cavity **116**, the one larger cavity can comprise a single region.

**[0029]** In some embodiments, second cavity **118** can be formed by removing an inner rear portion material from rear portion **114**. The inner rear portion material can be removed from an opening in rear portion **114**. In many embodiments, the inner rear portion material can be removed from an opening at toe region **108**. In some embodiments, the inner rear portion material can be removed from an opening at sole **112** and/or an opening at heel region **106**. In some embodiments, second cavity **118** can be formed by using a pull piece to remove the inner rear portion to create second cavity **118**. In some embodiments, approximately 8 grams (g) to approximately 30 g of material from the inner rear portion material can be removed to form second cavity **118**. In some embodiments, approximately 10 g to approximately 15 g of the inner rear portion material can be removed to form second cavity **118**.

**[0030]** In many embodiments, mass removed and/or missing from second cavity **118** can be redistributed as perimeter weighting in golf club head **100**. For example, in various embodiments, golf club head **100** can further comprise a cap **120** (FIG. 1) closing off second cavity **118**. Cap **120** can provide perimeter weighting for golf club head **100**. In other embodiments, such as FIG. 5, (which illustrates a back, toe-side perspective view of golf club head **100** of FIG. 1 according to an embodiment) golf club head **100** may not comprise a cap closing off second cavity **118**, and second cavity **118** can be at least partially open to the environment.

**[0031]** In FIG. 1, cap **120** is shown at least partially at toe region **108** and at least partially at sole **112** of golf club head **100**. In other embodiments, cap **120** can be located at least partially in sole **112**, at least partially in toe region **108**, and/or at least partially in the back of rear portion **114**. In some embodiments, cap **120** can close off second cavity **118** and can cover the cavity **118** opening in body **101**. In embodiments wherein there is an opening in heel region **106**, cap **120** can be at least partially located in heel region **106**. In other embodiments when there is an opening in sole region **112**, cap **120** can be at least partially located in sole region **112**. In some embodiments, cap **120** can be at least partially located in rear portion **114**. In embodiments wherein second cavity **118** comprises an opening in heel region **106**, cap **120** in heel region **106** can be lightweight or have a cap density that is less dense than the golf club head density of body **101**. In embodiments wherein second cavity **118** comprises an opening in toe region **108**, the cap density of cap **120** can be higher than a club head density of body **101**. In some embodiments, cap



**120** can comprise tungsten. In some embodiments, cap **120** can comprise steel. In some embodiments, cap **120** can be welded to body **101**. In other embodiments, cap **120** can be bonded and/or adhered to body **101**. In some examples, cap **120** can be bonded or adhered using an adhesive.

**[0032]** In some embodiments, cap **120** can weigh approximately 3 g to approximately 30 g. In many embodiments, when cap **120** is at least partially located at toe region **108**, cap **120** can move the center of gravity (cg) lower and toward toe region **108**. In embodiments when cap **120** is at least partially located in toe region **108**, cap **120** can raise the moment of inertia of body **101** and golf club head **100**.

**[0033]** In many embodiments, cap **120** can be substantially flush with body **101**. In some embodiments, cap **120** can be substantially flush with rear portion **114** such that rear portion **114** can appear substantially solid. In other embodiments, cap **120** can comprise an indication, such as a different coloring or marking, to indicate that rear portion **114** is at least partially hollow, comprises perimeter weighting, and/or is not substantially solid. In other embodiments, cap **120** can at least partially protrude from body **101**. In other embodiments, cap **120** can be substantially within body **101**.

**[0034]** As shown in FIG. 1, cap **120** can be partially at toe region **108** and partially at sole **112**. In other embodiments, such as cap **920** of FIG. 9 and FIG. 10, cap **920** can be at least partially within sole **112** and not visible from the back of rear portion **914**. In many embodiments, cap **920** can be similar to cap **120** of FIG. 1. FIG. 9 shows a golf club head **900** along the line 9-9 of FIG. 10. FIG. 10 shows a back, toe-side perspective view of golf club head **900**, according to an embodiment. In many embodiments, golf club head **900** comprises cap **920** within sole **912** and not at the back of rear portion **914**.

**[0035]** Returning to FIG. 1, in some embodiments, first cavity **116** can be substantially parallel to strikeface **102**. In some embodiments, first cavity **116** can be forward of rear portion **114**, as shown in FIG. 2. FIG. 2 illustrates golf club head **100** of FIG. 1 along the cross-sectional line 2-2 of FIG. 1. In some embodiments, second cavity **118** can be substantially parallel to strikeface **102**.

**[0036]** In some embodiments, first cavity **116** can be configured to receive an insert. For example, FIG. 8 illustrates an insert **740**. FIG. 8 shows golf club head **700** along the cross-sectional line 7-7 of golf club head **700** in FIG. 7. FIG. 7 illustrates a back, toe-side perspective view of golf club head **700**, according to an embodiment. As shown in FIGS. 7 and 8, Golf club head **700** comprises a body **701**. In many embodiments, body **701** of FIGS. 7 and 8 can be similar to body **101** of FIG. 1. Body **701** can comprise a strikeface **702**, a backside **704** of strikeface **702**, a heel region **706**, a toe region **708** opposite heel region **706**, a sole **712**, a first cavity **716** at backside **704**, a rear portion **714** opposite strikeface **702**, a second cavity **718** (FIG. 8), and a cap **720** closing off second cavity **718**. In some embodiments, first cavity **716** can be hollow. While in many embodiments, body **701** can further comprise insert **740** (as shown in FIG. 8) at least partially within first cavity **716**. In some embodiments, insert **740** can comprise a custom tuning port weight and/or a filler insert. In some embodiments, an insert material of insert **740** can be more dense than a body material of body **701**. In other embodiments, the insert material of insert **740** can be the same density or less dense than the golf club head material density of body **701**.

**[0037]** Returning to FIG. 2, rear portion **114** can have a rear portion height **127**. In many embodiments and as shown in

FIG. 2, rear portion height **127** can be measured from the bottom of rear portion **114** (or from a top of cap **120**) to a maximum height of rear portion **114** in a direction substantially perpendicular to ground when golf club head **100** is at address. Also as shown in FIG. 2, strikeface **102** can have a strikeface height **130**. Strikeface height **130** can be measured from the bottom of rear portion **114** (or from a top of cap **120**) to the top of strikeface **102** in a direction substantially perpendicular to ground when golf club head **100** is at address. As measured, strikeface height **130** can be substantially parallel to rear portion height **127**. In many embodiments, rear portion height **127** can be approximately one-fourth to approximately one-half of strikeface height **130**. In other embodiments, rear portion height **127** can be approximately one-half to approximately three-fourths of strikeface height **130**. In some embodiments, rear portion height **127** can be equal to approximately one-half of strikeface height **130**.

**[0038]** In various embodiments, second cavity **118** can comprise a second cavity height **125**. In some embodiments, second cavity height **125** can be approximately 0.20 inch (in.) to approximately 0.28 inch in height. In some embodiments, second cavity **118** can comprise a second cavity length **430** (shown in FIG. 4). In some embodiments, second cavity length **430** can be approximately 1.7 inches to 2.1 inches in length. In many embodiments, second cavity **118** can also comprise a volume of second cavity **118**. In some embodiments, the volume of second cavity **118** can be approximately 0.08 in<sup>3</sup> to approximately 0.10 in<sup>3</sup>.

**[0039]** In some embodiments, second cavity **118** can be contoured to follow the shape of rear portion **114**. In many embodiments, one or more of the wall(s) of second cavity **118** can at least partially follow the shape of rear portion **114**. For example, FIG. 2 shows walls **217**, **219**, **221**, and **223** of second cavity **118** as being substantially parallel to the walls of rear portion **114**. In other embodiments, second cavity **118** can only partially follow only one or more wall(s) of rear portion **114** and can have a different shape. For example, second cavity **318** (FIG. 3) can partially follow one or more wall(s) of rear portion **314** and have a trapezoid cross section shape as shown in FIG. 3.

**[0040]** FIG. 3 illustrates a golf club head **300** similar to the golf club head of FIG. 1 along cross-sectional line 2-2 of FIG. 1, according to another embodiment. Golf club head **300** comprises a strikeface **302**, a backside **304** of the strikeface, a first cavity **316**, and a sole **312**. In this embodiment, second cavity walls **317** and **319** substantially follow the walls of rear portion **314**, while second cavity walls **321** and **323** partially follow only one or more of the walls of rear portion **114**. In other embodiments, second cavity **318** can have a substantially triangular, rectangular, square, or circular cross section. In some embodiments, the cross section of second cavity **318** can change throughout rear portion **314**. For example, at the heel region, the cross section of second cavity **318** can be larger in area than the cross section of second cavity **318** at the toe region. In other examples, the cross section of second cavity **318** at the heel region can be smaller in area than the cross section of second cavity **318** at the toe region. Second cavity **318** can be covered by a cap **320**.

**[0041]** In some embodiments, returning to FIG. 2, wall(s) **217**, **219**, **221**, and/or **223** surrounding second cavity **118** can be substantially thin. For example, in some embodiments wall(s) **217**, **219**, **221**, and/or **223** can be approximately 0.001

in. to approximately 0.400 in. In some embodiments, wall(s) 217, 219, 221, and/or 223 can be approximately 0.040 in. to approximately 0.150 in.

[0042] FIG. 4 illustrates another back, toe-side perspective, x-ray view of club head 100 of FIG. 1. In FIG. 4, second cavity 118 is shown as dashed lines within rear portion 114. In some embodiments, second cavity 118 can extend from heel region 106 to toe region 108. In other embodiments, second cavity can extend from the middle of rear portion 114 to toe region 108. In some embodiments, second cavity can extend from the middle of rear portion 114 to heel region 106. In other embodiments, second cavity can be located only at toe region 108. Second cavity 118 can be substantially parallel to strikeface 102. In other embodiments, only one wall of second cavity 118 can be substantially parallel to strikeface 102. In some embodiments, second cavity 118 is not substantially parallel to strikeface 102. In many embodiments, second cavity 118 can be substantially hollow and/or empty. In other embodiments, second cavity 118 can comprise a weight or other filler material.

[0043] Some embodiments include a fully assembled golf club, such as a golf club 6000 as shown in FIG. 6. FIG. 6 shows a front view of a golf club 6000 according to an embodiment. In some embodiments, golf club 6000 can comprise a shaft 615, a grip 610 at one end of shaft 615, and a golf club head 600 coupled to shaft 615 at an opposite end of shaft 615. In many embodiments, golf club head 600 can be similar to golf club head 100 (FIG. 1), golf club head 300 (FIG. 3), golf club head 700 (FIG. 7), and/or golf club head 900 (FIG. 10). In some embodiments, golf club 6000 is an iron-type golf club. In other embodiments, golf club 6000 can be another type of golf club head (e.g., a driver-type club head, a fairway wood-type club head, a hybrid-type club head, a wood-type club head, a wedge-type club head, or a putter-type club head.)

[0044] Various embodiments include a method 1100 for manufacturing a golf club head as shown in FIG. 11. FIG. 11 depicts a method of manufacturing a golf club head according to an embodiment. In some embodiments, method 1100 can be used to manufacture a golf club head similar to golf club head 100 (FIG. 1), golf club head 300 (FIG. 3), golf club head 700 (FIG. 7), and/or golf club head 900 (FIG. 10).

[0045] In many embodiments, method 1100 comprises forming a body from a first material having a first density (block 1105). In some embodiments, forming a body from a first material can comprise forging the body. In other embodiments, forming a body from a first material can comprise casting the body. In some embodiments, method 1100 can comprise manufacturing a golf club head for an iron-type club head. In many embodiments, method 1100 can comprise forming a strikeface, a backside of the strike face, a heel region, a toe region opposite the heel region, a sole, and a first cavity at the backside of the strikeface for the body formed in block 1105.

[0046] In many embodiments, method 1100 can further comprise forming a rear portion opposite the strikeface in the body formed in block 1105. In many embodiments, and similar to as described above and shown in FIG. 2, the rear portion can have a rear portion height. In many embodiments, the rear portion height can be measured from the bottom of the rear portion to a maximum height of the rear portion. Additionally, as shown in FIG. 2, strikeface 102 can comprise a strikeface height which can be measured from the bottom of rear portion 114 to the top of strikeface. As shown in FIG. 2, as measured,

strikeface height 130 can be substantially parallel to rear portion height 127. In many embodiments, forming the second cavity in block 1110 of method 1100 can comprise forming the rear portion height to be approximately one-fourth to approximately one-half of the strikeface height. In other embodiments, forming the second cavity in block 1110 can comprise forming the rear portion height to be approximately one-half to approximately three-fourths of the strikeface height. In some embodiments, forming the second cavity in block 1110 of method 1100 can comprise forming the rear portion height to be equal to approximately one-half of the strikeface height.

[0047] In some embodiments, method 1100 can comprise configuring the first cavity to receive an insert, while in other embodiments first cavity can be configured to be hollow and/or to not receive an insert. For example, method 1100 can comprise forming body 701, as shown in FIG. 7, and configuring first cavity 716 to receive insert 740. In some embodiments, an insert material of insert 740 can be more dense than a body material of body 701. In other embodiments, the insert material of insert 740 can be the same density or less dense than the body material of body 701. In some embodiments, a length of the first cavity can be substantially parallel to the strikeface, as shown by first cavity 116 of FIG. 1. In some embodiments, the first cavity can be forward of the rear portion, such as shown in golf club head 100 of FIG. 2.

[0048] In many embodiments, method 1100 can also comprise forming a second cavity at the rear portion (block 1110) and affixing a cap at the second cavity to close off the second cavity (block 1115). In some embodiments, block 1110 of forming the second cavity at the rear portion can further comprise removing an inner rear portion material from the rear portion. In many embodiments, the inner rear portion can be removed from an opening in the toe region. In some embodiments, the inner rear portion can be removed from an opening in the sole and/or an opening in the heel. In some embodiments, the second cavity at the rear portion formed in block 1110 can be formed by using a pull piece to create the second cavity. In some embodiments, block 1110 comprises removing approximately 8 g to approximately 30 g of material from the rear portion. In some embodiments, block 1110 comprises removing approximately 10 g to approximately 15 g from the rear portion.

[0049] Forming the second cavity in block 1110 can further comprise extending the second cavity from the heel region to the toe region. For example, as shown in FIG. 4, second cavity 118 can be formed to extend from heel region 106 to toe region 108. In other embodiments, forming the second cavity can comprise extending the second cavity from the middle of the rear portion to the toe region. In some embodiments, forming the second cavity can comprise extending the second cavity from the middle of the rear portion to the heel region. In other embodiments, forming the second cavity can comprise forming second cavity at the toe region. In some embodiments, block 1110 of method 1100 can further comprise forming the second cavity to be substantially parallel to the strikeface. For example, as shown in FIG. 4, second cavity 118 can be substantially parallel to strikeface 102. In other embodiments, block 1110 can comprise forming the second cavity wherein only one wall of the second cavity can be substantially parallel to the strikeface. In some embodiments, the second cavity is not formed to be substantially parallel to the strikeface. In many embodiments, block 1110 of method 1100 can comprise forming the second cavity to be hollow

and/or empty. In other embodiments, block **1110** method **1100** can comprise forming the second cavity so that the second cavity can comprise a weight and/or other filler material.

**[0050]** In some embodiments, forming the second cavity in block **1110** of method **1100** can comprise forming the second cavity to have a second cavity height. In various embodiments, forming the second cavity in block **1110** can comprise forming the second cavity height to be approximately 0.20 inch to approximately 0.28 inch in height.

**[0051]** In some embodiments, forming the second cavity in block **1110** of method **1100** can comprise forming a second cavity length, such as second cavity length **430** as shown in FIG. 4, to be approximately 1.7 inch to approximately 2.1 inch in length. In many embodiments, forming the second cavity in block **1110** of method **1100** can comprise forming the second cavity to have a second cavity volume of approximately 0.08 in<sup>3</sup> to approximately 0.10 in<sup>3</sup>. In some embodiments, forming the second cavity in block **1110** can comprise removing approximately 3 g to approximately 30 g from the rear portion. In other embodiments, forming the second cavity in block **110** can comprise removing approximately 3 g to approximately 11 g from the rear portion. In some embodiments, forming the second cavity in block **1110** comprises forming the second cavity to be hollow.

**[0052]** In many embodiments, forming the second cavity in block **1110** comprises forming the second cavity only at the rear portion. For example, second cavity **118** of FIG. 2 can be formed at rear portion **114**. In many embodiments, forming the second cavity in block **1110** of method **1100** can comprise contouring the second cavity to follow the shape of the rear portion, such as, in some examples, second cavity **118** of FIG. 2. In other embodiments, forming the second cavity in block **1110** can comprise forming the second cavity to comprise a different cross-sectional shape, such as a trapezoidal shape as shown in second cavity **318** of FIG. 3.

**[0053]** In other embodiments, forming the second cavity in block **1110** can comprise forming the second cavity to comprise a substantially triangular, rectangular, square, or circular cross-section in at least a portion of the second cavity. In some embodiments, the cross-section of the second cavity can change throughout the rear portion. In other embodiments, the cross-section of the second cavity can remain the same throughout the rear portion of the golf club head. For example, the second cavity formed in block **1110** can have a cross-sectional area at the heel region larger than the cross section of the second cavity at the toe region. In other examples, the cross-sectional area of second cavity formed in block **1110** at the heel region can be smaller than the cross-sectional area at the toe region.

**[0054]** In some embodiments, the one or more of the walls surrounding the second cavity (such as wall(s) **217**, **219**, **221**, and/or **223** in FIG. 2) can be formed to be substantially thin. For example, in some embodiments, wall(s) **217**, **219**, **221**, and/or **223** of FIG. 2, can be formed to be approximately 0.001 in. to approximately 0.400 in. in thickness. In some embodiments, wall(s) **217**, **219**, **221**, and/or **223** can be formed to be approximately 0.040 in to approximately 0.150 in. in thickness.

**[0055]** In some embodiments, method **1100** can further comprise affixing a cap at the second cavity to close off the second cavity (block **1115**). In many embodiments, affixing the cap at the second cavity comprises affixing the cap at least partially at the toe region of the golf club head. For example,

FIG. 1 shows cap **120** affixed at least partially at toe region **108** of golf club head **100**. In other embodiments, affixing the cap at the second region can comprise affixing the cap at least partially at the sole of the golf club head, at least partially at the toe region, and/or at least partially at the heel region of the golf club head. In some embodiments, affixing the cap at the second region can comprise affixing the cap at least partially at the rear portion. In some embodiments, the cap can weigh approximately 3 g to approximately 30 g. In some embodiments, the cap can weigh approximately 3 g to approximately 25 g.

**[0056]** In many embodiments, the cap comprises a cap density of the cap that is higher than a club head density of the body. In other embodiments, the cap comprises a cap density of the cap that is the same or lower than the club head density of the body. In some embodiments, the cap can comprise tungsten. In some embodiments, the cap can comprise steel. In many embodiments, cap **120** can be affixed so that it is substantially flush with the body of the golf club head. For example, as shown in FIG. 1, cap **120** is substantially flush with body **101** of golf club head **100**. In other embodiments, the cap can at least partially protrude from the body.

**[0057]** The golf club heads with cavities and related methods discussed herein may be implemented in a variety of embodiments, and the foregoing discussion of these embodiments does not necessarily represent a complete description of all possible embodiments. Rather, the detailed description of the drawings, and the drawings themselves, disclose at least one preferred embodiment of systems and methods for fitting golf club head weight, and may disclose alternative embodiments of golf club heads with cavities and related methods.

**[0058]** All elements claimed in any particular claim are essential to golf club heads with cavities and related methods claimed in that particular claim. Consequently, replacement of one or more claimed elements constitutes reconstruction and not repair. Additionally, benefits, other advantages, and solutions to problems have been described with regard to specific embodiments. The benefits, advantages, solutions to problems, and any element or elements that may cause any benefit, advantage, or solution to occur or become more pronounced, however, are not to be construed as critical, required, or essential features or elements of any or all of the claims.

**[0059]** As the rules to golf may change from time to time (e.g., new regulations may be adopted or old rules may be eliminated or modified by golf standard organizations and/or governing bodies such as the United States Golf Association (USGA), the Royal and Ancient Golf Club of St. Andrews (R&A), etc.), golf equipment related to the apparatus, methods, and articles of manufacture described herein may be conforming or non-conforming to the rules of golf at any particular time. Accordingly, golf equipment related to the apparatus, methods, and articles of manufacture described herein may be advertised, offered for sale, and/or sold as conforming or non-conforming golf equipment. The apparatus, methods, and articles of manufacture described herein are not limited in this regard.

**[0060]** Moreover, embodiments and limitations disclosed herein are not dedicated to the public under the doctrine of dedication if the embodiments and/or limitations: (1) are not expressly claimed in the claims; and (2) are or are potentially equivalents of express elements and/or limitations in the claims under the doctrine of equivalents.

1. A golf club head comprising:  
 a body comprising:  
 a strikeface;  
 a backside of the strikeface;  
 a heel region;  
 a toe region opposite the heel region;  
 a sole;  
 a first cavity at the backside of the strikeface;  
 a rear portion opposite the strikeface;  
 and  
 a second cavity at the rear portion;  
 and  
 a cap at least partially at the sole and closing off the second cavity, the cap comprising a cap density higher than a body density of the body;  
 wherein:  
 at least a portion of the second cavity is hollow when the cap closes off the second cavity.
2. The golf club head of claim 1, wherein:  
 the first cavity is configured to receive an insert.
3. The golf club head of claim 1, wherein:  
 a length of the first cavity is substantially parallel to the strikeface and forward of the rear portion.
4. The golf club head of claim 1, wherein:  
 the second cavity extends from the heel to the toe and is substantially parallel to the strikeface.
5. The golf club head of claim 1, wherein:  
 the cap is at least partially at the toe region of the golf club head.
6. The golf club head of claim 1, wherein:  
 a rear portion height of the rear portion is equal to approximately  $\frac{1}{4}$  to approximately  $\frac{1}{2}$  of a strikeface height of the strikeface;  
 and  
 the second cavity is located only at the rear portion.
7. The golf club head of claim 1, wherein:  
 the cap weighs approximately 3 g to approximately 30 g.
8. The golf club head of claim 1, wherein:  
 the cap comprises a cap material comprising tungsten.
9. The golf club head of claim 1, wherein:  
 the cap is substantially flush with the body.
10. The golf club head of claim 1, wherein:  
 the golf club head is an iron-type club head;  
 and  
 at least a portion of the first cavity is located between the strikeface and the second cavity.
11. A golf club comprising:  
 a shaft;  
 a grip;  
 and  
 a golf club head comprising:  
 a body comprising:  
 a strikeface;  
 a backside of the strikeface;  
 a heel region;  
 a toe region opposite the heel region;  
 a sole;  
 a first cavity at the backside of the strikeface;  
 a rear portion opposite the strikeface;  
 and  
 a second cavity at the rear portion; and  
 a cap at least partially at the sole and closing off the second cavity, the cap comprising a cap density higher than a body density of the body;
- wherein:  
 at least a portion of the second cavity is hollow when the cap closes off the second cavity.
12. The golf club of claim 11, wherein:  
 the first cavity is configured to receive an insert.
13. The golf club of claim 11, wherein:  
 a length of the first cavity is substantially parallel to the strikeface and forward of the rear portion.
14. The golf club of claim 11, wherein:  
 the second cavity extends from the heel to the toe and is substantially parallel to the strikeface.
15. The golf club of claim 11, wherein:  
 the cap is at least partially at the toe region of the golf club head.
16. The golf club of claim 11, wherein:  
 a rear portion height of the rear portion is equal to approximately  $\frac{1}{4}$  to approximately  $\frac{1}{2}$  of a strikeface height of the strikeface;  
 and  
 the second cavity is located only at the rear portion.
17. The golf club of claim 11, wherein:  
 the cap weighs approximately 3 g to approximately 30 g.
18. The golf club of claim 11, wherein:  
 the cap comprises a cap material comprising tungsten.
19. The golf club of claim 11, wherein:  
 the cap is substantially flush with the body.
20. The golf club of claim 11, wherein:  
 the golf club head is an iron-type club head;  
 and  
 at least a portion of the first cavity is located between the strikeface and the second cavity.
21. A method for manufacturing a golf club head, comprising:  
 forming a body from a first material having a first density, the body having:  
 a strikeface;  
 a backside of the strikeface;  
 a heel region;  
 a toe region opposite the heel region;  
 a sole;  
 a first cavity at the backside of the strikeface;  
 and  
 a rear portion opposite the strikeface;  
 forming a second cavity at the rear portion;  
 and  
 affixing a cap at the second cavity and at least partially at the sole to close off the second cavity  
 wherein:  
 at least a portion of the second cavity is hollow when the cap closes off the second cavity; and  
 the cap comprises a cap density higher than a body density of the body.
22. The method for manufacturing the golf club head of claim 21, wherein:  
 forming the second cavity further comprises:  
 removing an inner rear portion material from the rear portion, wherein the inner rear portion material is removed from an opening in the toe.
23. The method for manufacturing the golf club head of claim 22, wherein:  
 removing the inner rear portion material from the rear portion comprises removing approximately 8 g to approximately 15 g from the rear portion.

24. The method for manufacturing the golf club head of claim 21, wherein:

the first cavity is configured to receive an insert.

25. The method for manufacturing the golf club head of claim 21, wherein:

a length of the first cavity is substantially parallel to the strikeface and forward of the rear portion.

26. The method for manufacturing the golf club head of claim 21, wherein:

forming the second cavity further comprises extending the second cavity from the heel to the toe;

and

the second cavity is substantially parallel to the strikeface.

27. The method for manufacturing the golf club head of claim 21, wherein:

the cap is at least partially at the toe region of the golf club head.

28. The method for manufacturing the golf club head of claim 21, wherein:

a rear portion height of the rear portion is equal to approximately  $\frac{1}{4}$  to approximately  $\frac{1}{2}$  of a strikeface height of the strikeface;

and

the second cavity is located only at the rear portion.

29. The method for manufacturing the golf club head of claim 21, wherein:

the cap weighs approximately 3 g to approximately 30 g.

30. The method for manufacturing the golf club head of claim 21, wherein:

the cap comprises a cap material comprising tungsten.

31. The method for manufacturing the golf club head of claim 21, wherein:

the cap is substantially flush with the body.

32. The method for manufacturing the golf club head of claim 21, wherein:

the golf club head is an iron-type club head;

and

at least a portion of the first cavity is located between the strikeface and the second cavity.

33. The golf club head of claim 4, wherein:

a length of the second cavity is approximately 1.7 inches to approximately 2.1 inches, measured from the heel to the toe.

34. The golf club of claim 14, wherein:

a length of the second cavity is approximately 1.7 inches to approximately 2.1 inches, measured from the heel to the toe.

35. The method for manufacturing the golf club head of claim 26, wherein:

a length of the second cavity is approximately 1.7 inches to approximately 2.1 inches, measured from the heel to the toe.

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