



US 20030045371A1

(19) **United States**

(12) **Patent Application Publication**

(10) **Pub. No.: US 2003/0045371 A1**

Wood et al.

(43) **Pub. Date:**

Mar. 6, 2003

(54) **GOLF CLUB HEAD**

(21) **Appl. No.: 09/940,856**

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(22) **Filed: Aug. 29, 2001**

Publication Classification

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(51) **Int. Cl.⁷ A63B 53/04**

(52) **U.S. Cl. 473/328**

(57) **ABSTRACT**

A golf club head having a hollow metal body with a conical indentation in a sole of the metal body.

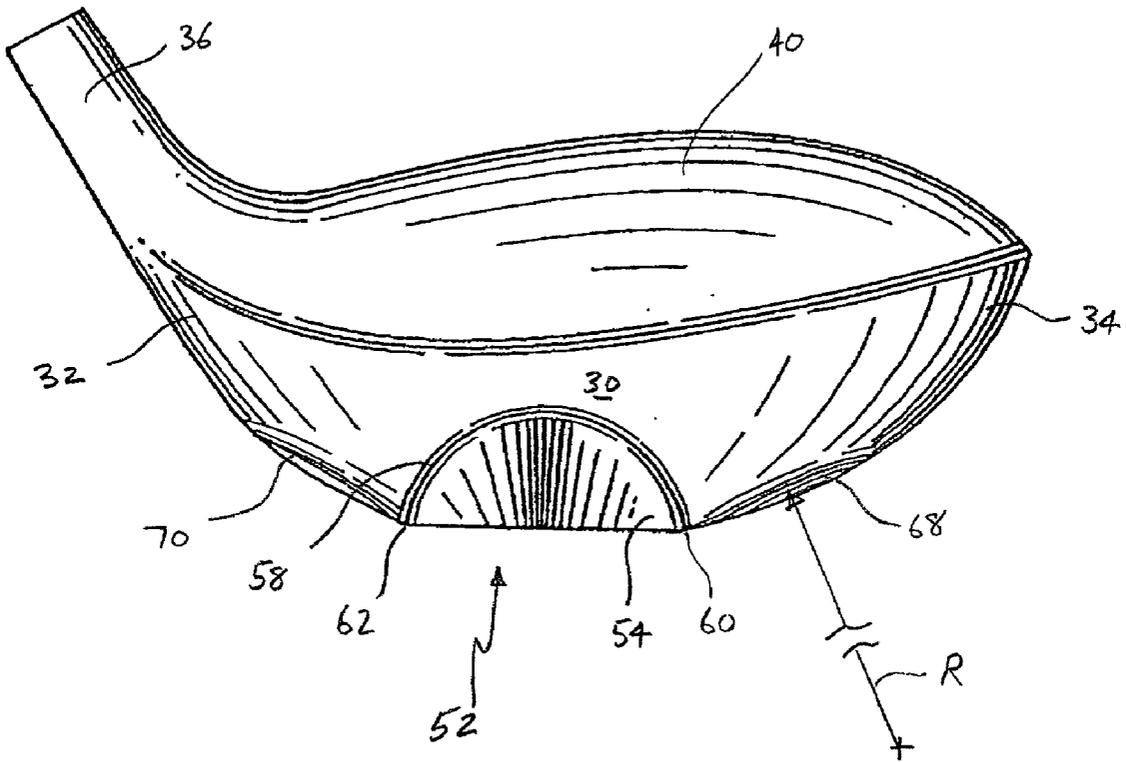


FIG. 1

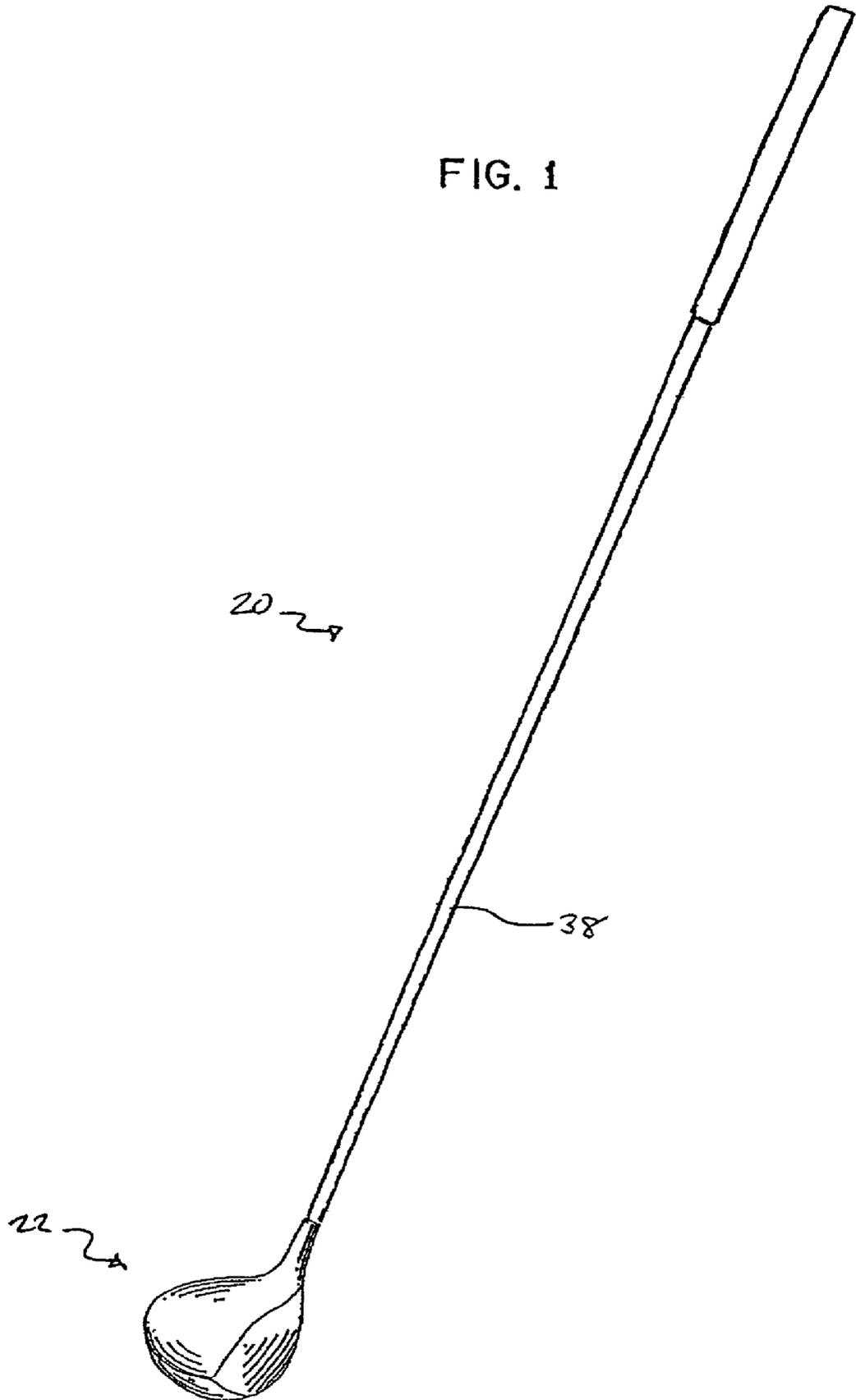


FIG. 2

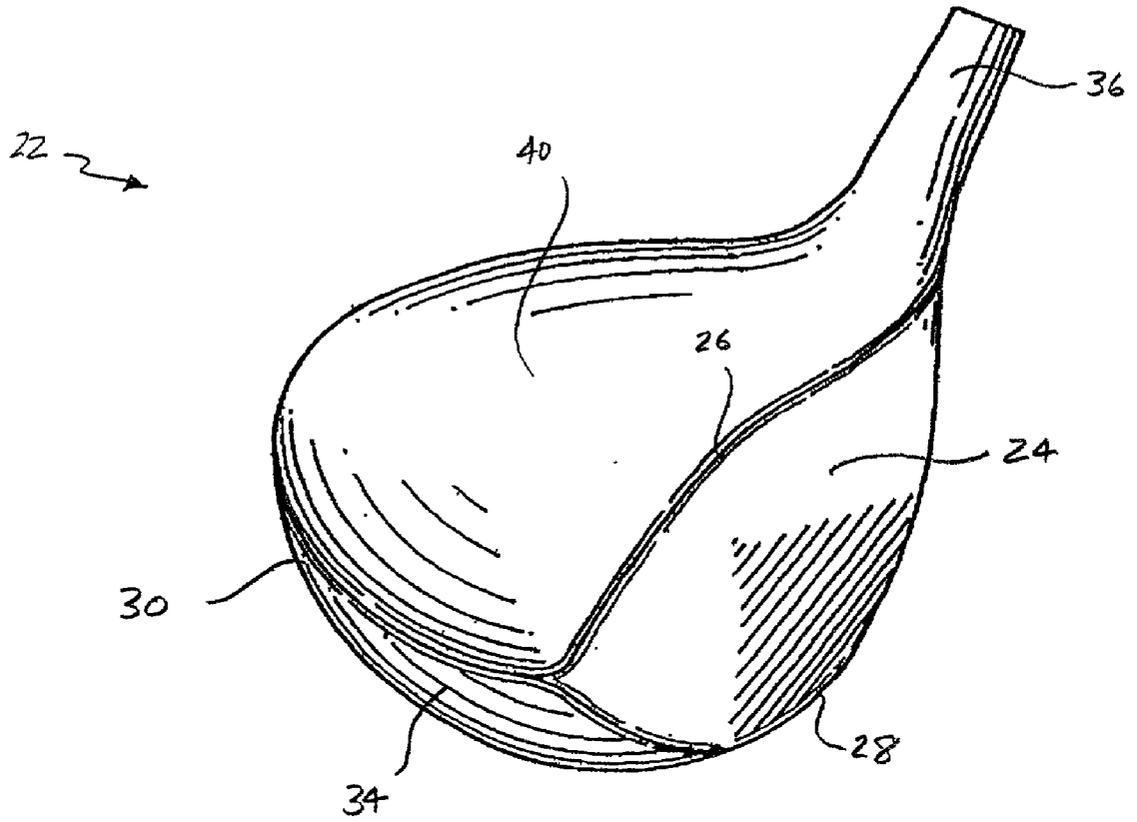


FIG. 3

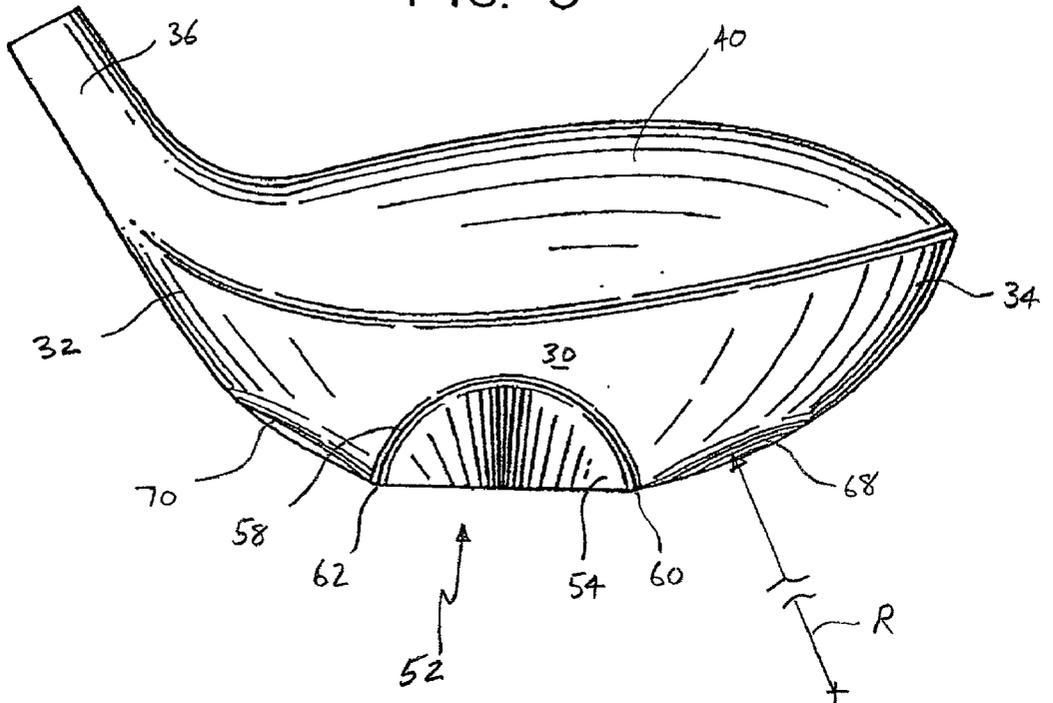


FIG. 4

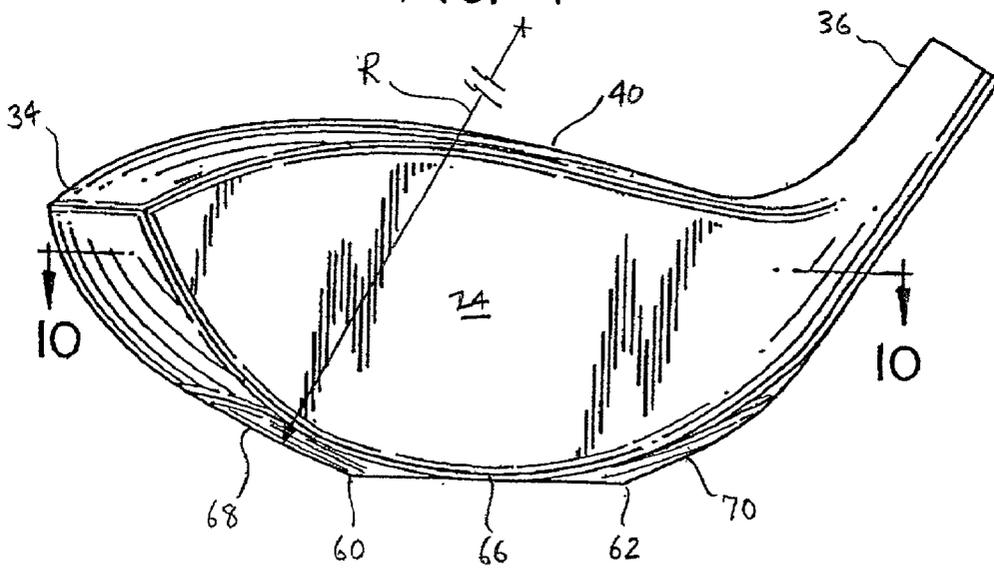


FIG. 5

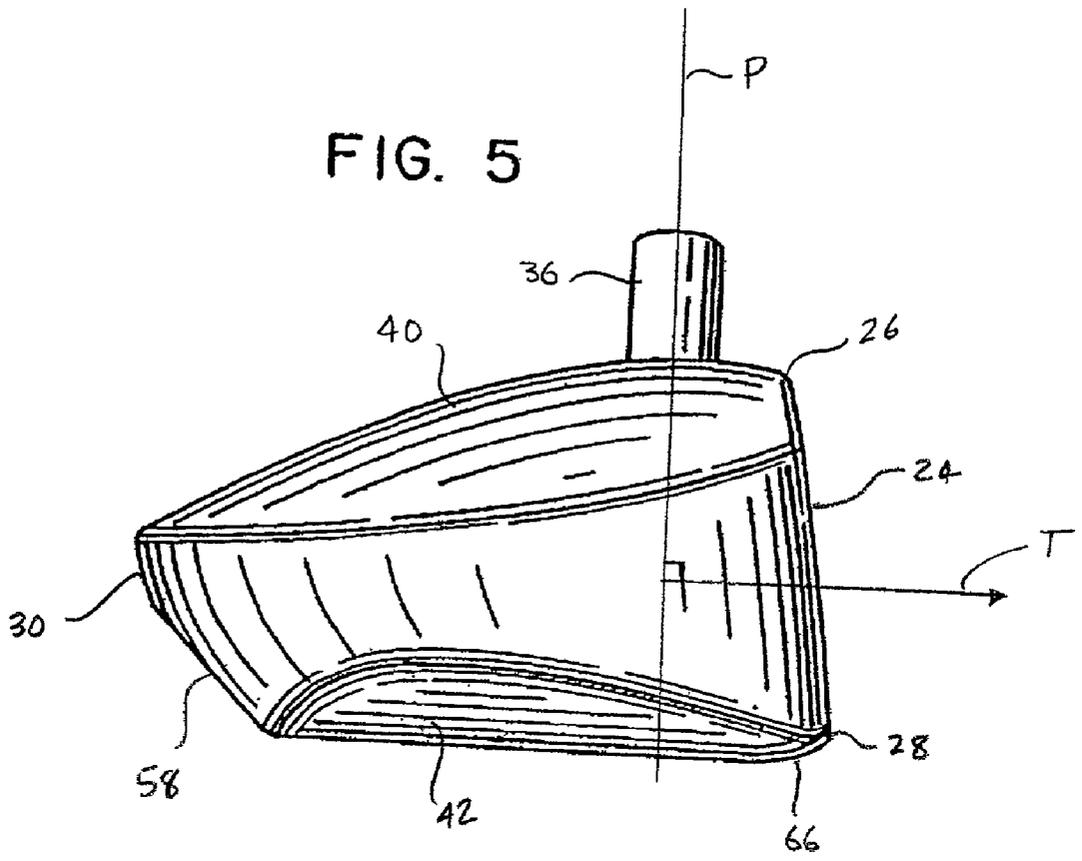
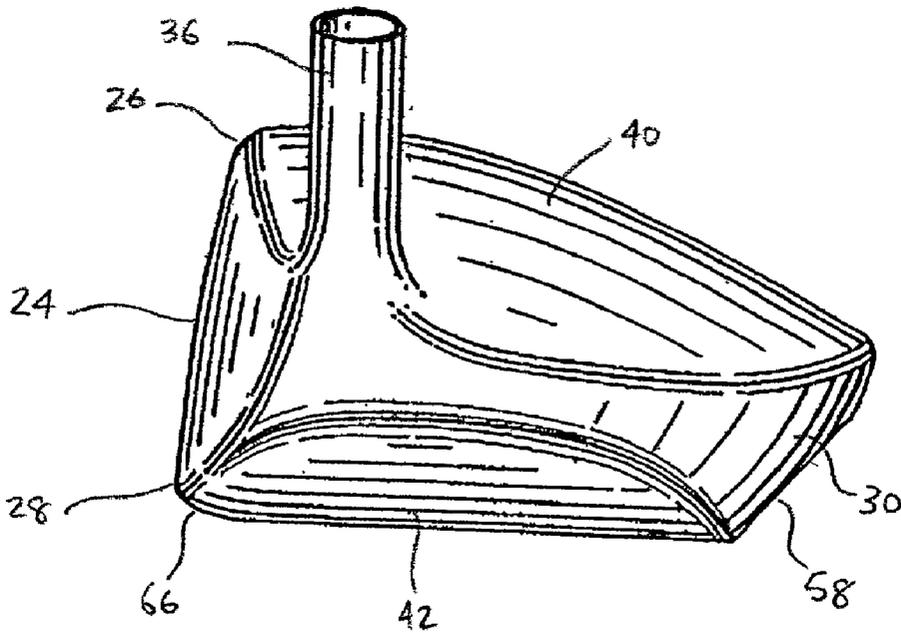


FIG. 6



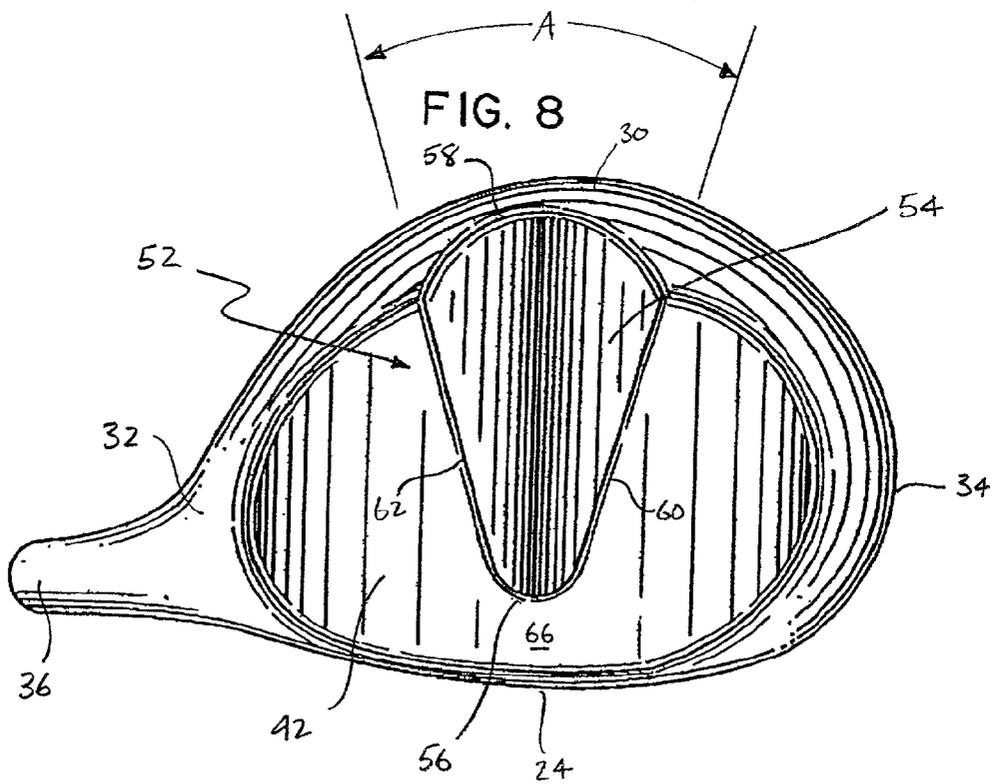
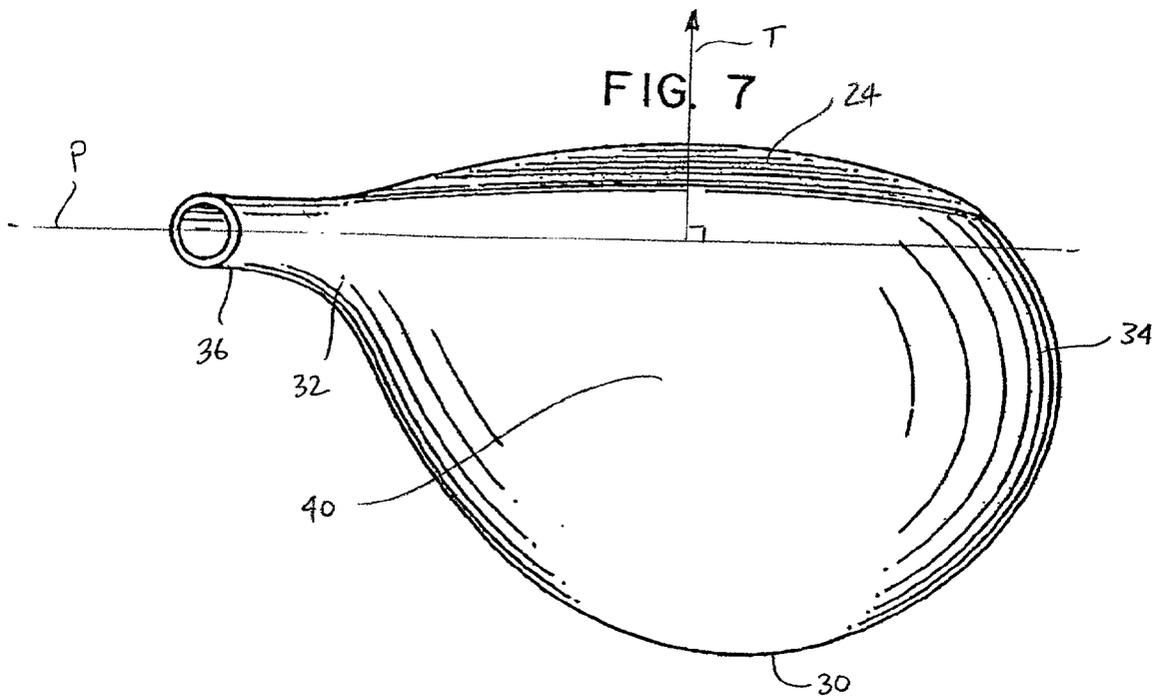
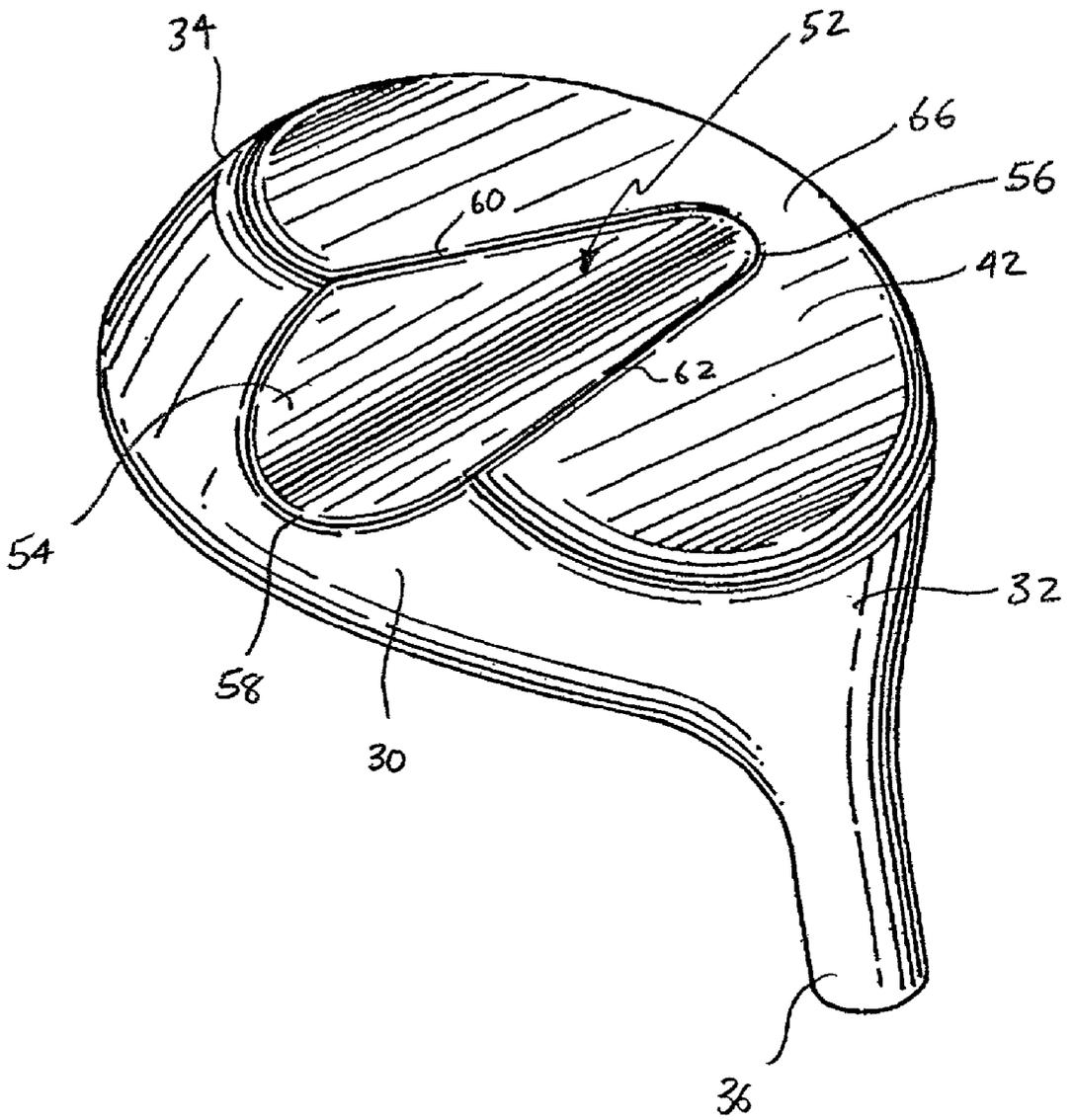
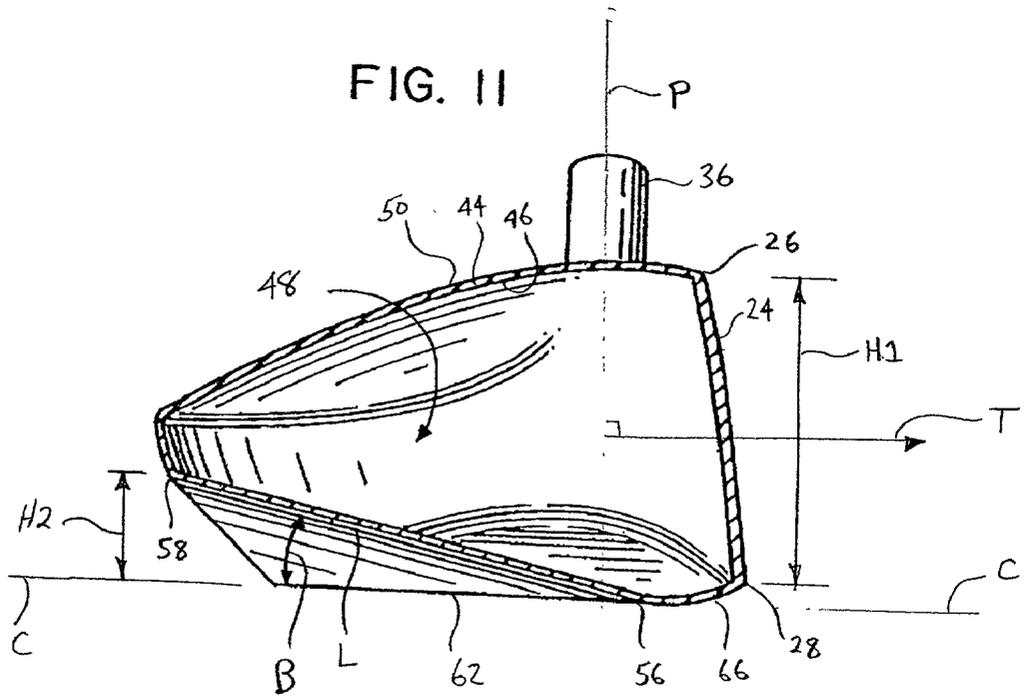
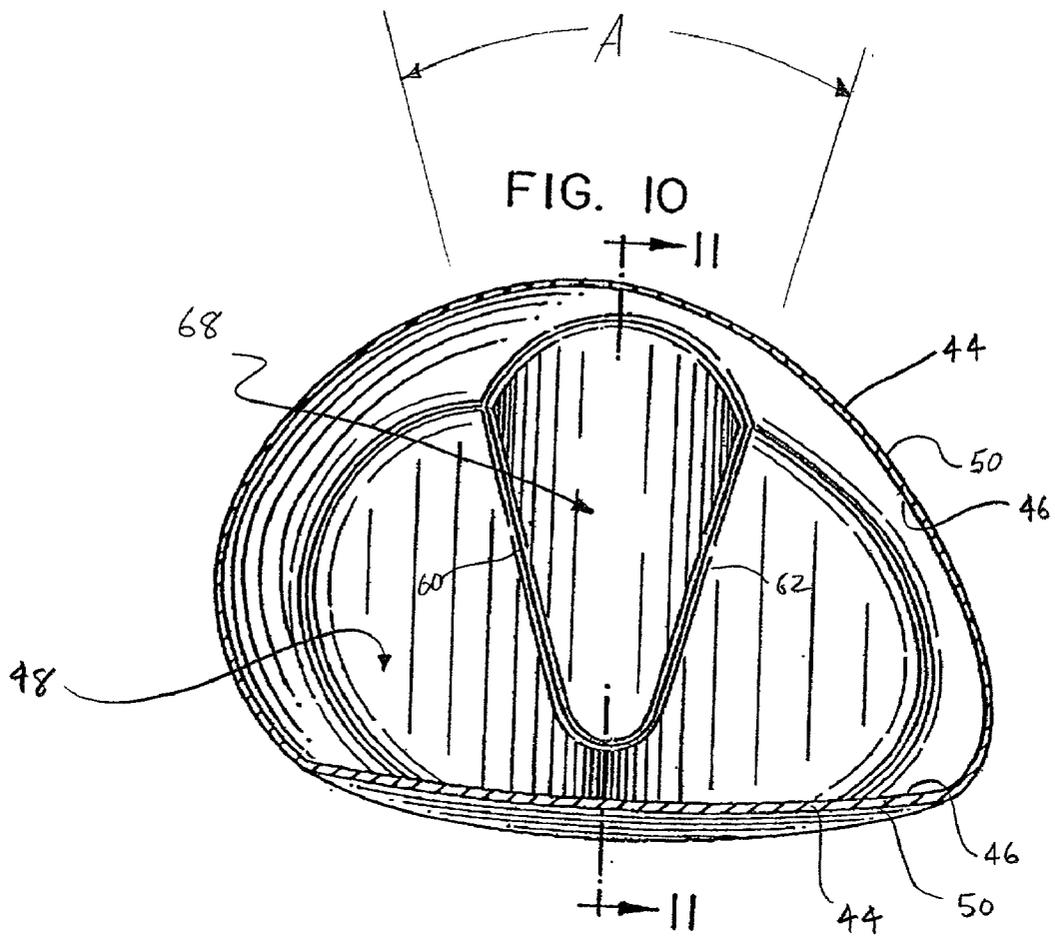


FIG. 9





GOLF CLUB HEAD

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention relates to golf club heads and, more particularly, to metal golf club heads having a conical indentation in a sole of the head.

[0003] 2. Description of the Related Art

[0004] Many conventional metal wood heads attempt to distribute the weight of the head about the perimeter of the head while maintaining the center of gravity at a desirable location. To achieve this result, some metal wood heads include weighted inserts or other configurations that are particularly difficult to manufacture. Because many of these conventional metal wood heads have a large perimeter or are oversized, they tend to drag on the turf during play, making it particularly difficult to follow through unclean shots or hit clean shots from the rough.

SUMMARY OF THE INVENTION

[0005] Generally speaking, embodiments of the present invention strive to provide a hollow, metal golf club head that is believed to decrease backspin.

[0006] Embodiments of the present invention strive to provide a hollow, metal golf club head that is believed to have decreased resistance as compared to some conventional club heads when the sole of the club contacts the turf.

[0007] Other advantages associated with the present invention will become more readily apparent to those skilled in the art from the following detailed description. As will be realized, the invention is capable of other and different embodiments, and its several details are capable of modification in various obvious aspects, all without departing from the invention. Accordingly, the drawings and the description are to be regarded as illustrative in nature, and not limitative.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] FIG. 1 is a perspective view of a golf club in accordance with one embodiment of the present invention;

[0009] FIG. 2 is a front perspective view of the golf club head of the golf club illustrated in FIG. 1.

[0010] FIG. 3 is a back elevational view of the golf club head illustrated in FIG. 2.

[0011] FIG. 4 is a front elevational view of the golf club head illustrated in FIG. 2.

[0012] FIG. 5 is a left side elevational view of the golf club head illustrated in FIG. 2.

[0013] FIG. 6 is a right side elevational view of the golf club head illustrated in FIG. 2.

[0014] FIG. 7 is a top plan view of the golf club head illustrated in FIG. 2.

[0015] FIG. 8 is a bottom plan view of the golf club head illustrated in FIG. 2.

[0016] FIG. 9 is a bottom perspective view of the golf club head illustrated in FIG. 2.

[0017] FIG. 10 is a cross-sectional view of the golf club head illustrated in FIG. 2 taken along the line 10-10 in FIG. 4.

[0018] FIG. 11 is a cross-sectional view of the golf club head illustrated in FIG. 2 taken along the line 11-11 in FIG. 10.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0019] FIGS. 1-11 illustrate one embodiment of a golf club 20 having a golf club head 22 in accordance with the present invention. As illustrated in the figures, the golf club head 22 includes a front strike face 24 that strikes a golf ball when a golfer swings the club 20. The strike face 24 includes a top portion 26 and a bottom portion 28. The golf club head 22 also includes a backside 30 located opposite from the front strike face 24 and that defines the trailing edge of the club head 22 when a golfer swings the club 20. The golf club head 22 also includes a heel 32, a toe 34 located opposite from the heel, and a hosel 36 that receives a shaft 38 of the golf club 20. The golf club head 22 further includes a crown 40 that defines the top of the golf club head, and a sole 42 located opposite from the crown. The sole 42 adjoins the bottom portion 28 of the front strike face 24 and extends rearward in a direction toward the backside 30 until it adjoins the backside, and also extends in a direction toward the heel 34 and toe 36 as illustrated in FIGS. 8 and 9.

[0020] As illustrated in FIGS. 10 and 11, the golf club head 22 has a hollow body defined by a metallic wall 44, which defines the perimeter of the golf club head 22. In this manner the golf club head 22 is perimeter weighted. The metallic wall 44 includes an interior surface 46 that faces an interior 48 of the golf club head 22. The metallic wall 44 also include an exterior surface 50 that faces an exterior of the golf club head 22. In the preferred embodiment, the interior 48 of the golf club head 22 is empty, having no material therein except for a gas, such as air. However, in alternative embodiments of the golf club head 22, the interior 48 may be filled with a substance such as foam and/or may include reinforcement bars or ridges therein.

[0021] As is illustrated in FIGS. 3 and 8-11, the golf club head 22 also includes a conical indentation 52 recessed in the sole 42. The conical indentation 52 has a curvilinearly contoured surface 54 defined by the exterior surface 50 of the metallic wall 44, which is shaped similar to the interior surface of a right circular cone cut through its center axis by a plane. Hence, the conical indentation 52 has a V-shaped perimeter having two opposing straight edges 60, 62 that are located at an angle A with respect to each other. The angle A is preferably between 20-60 degrees. In the illustrated embodiment, the golf club head 22 is a driver having an angle A of approximately 40 degrees. The angle A may also change depending upon the loft of the club. For example, in one embodiment the golf club head 22 is a fairway wood having an angle A of approximately 30 degrees. Because the angle A is preferably between 20-60 degrees and the curvilinearly contoured surface 54 is shaped similar to the interior surface of a right circular cone cut through its center axis by a plane, a straight line passing through the true vertex and true directrix of the curvilinearly contoured surface 54 is preferably at an angle between 10-30 degrees with respect to the true center axis of the curvilinearly contoured surface. In

an alternative embodiment of the golf club head 22, the perimeter of the conical indentation 52 resembles a parabola pointing toward the front strike face 24.

[0022] As is illustrated in FIG. 8, the conical indentation 52 has a curved apex 56 that is located rearward of the front strike face 24 and that points toward the front strike face. In an alternative embodiment, the apex 56 forms a point. The apex 56 is preferably spaced rearward from the front strike face 24 approximately 0.25-1.0 inches so as to provide a section 66 that will slide across the turf rather than dig into the turf during a swing. In the illustrated embodiment, the most forward point of the apex 56 is spaced from the front strike surface approximately 0.5 inches. As is illustrated in FIG. 9, the section 66 of the sole 42 located between the apex 56 and the front face 24 is preferably curved in a direction from the heel 32 to the toe 34, having a radius of curvature between 2-8 inches, more preferably between 3-4 inches. As is best illustrated in FIGS. 5 and 6, the section 66 also curves from the apex 56 toward the bottom portion 28 such that the section 66 is slightly above the common plane C (described further below). In an alternative embodiment, the section 66 of the sole 42 located between the apex 56 and the front strike face 24 is planar.

[0023] In the preferred embodiment, the conical indentation 52 extends rearward of the apex 56 toward and into the backside 30 such that the curvilinearly contoured surface 54 intersects the backside. Because the backside 30 has a curved periphery, the intersection between the backside and the conical indentation 52 defines an elliptical edge 58 where the indentation 52 terminates. In an alternative embodiment of the golf club head 22, the conical indentation 52 terminates before reaching the backside 30 such that the indentation 52 is located only in the sole 42.

[0024] As is illustrated in FIGS. 5, 7, and 11, a vertical plane P that contains the axis of the hosel 36 of the golf club head 22 is approximately perpendicular to an ideal driving line T, which is a horizontal imaginary line that passes through the geometric center of the front strike face 24 and is oriented toward the vertical intangible axis of a targeted hole. The plane P and the driving line T correspond to the ideal position of the golf club head 22 when a golfer aims the club 20 to hit a ball. As is illustrated in FIG. 11, the front strike face 24 has a vertical face height H1 located between the bottom portion 28 and the top portion 26 as measured along the vertical plane P. Additionally, a most rearward portion of the conical indentation 52 has a vertical indentation height H2 located between the apex 56 and the most rearward portion of the edge 58 as measured along the vertical plane P. As is illustrated in FIG. 3, the conical indentation 52 extends up into the interior 48 of the golf club head 22. Hence, the vertical indentation height H2 is a percentage of the vertical face height H1, preferably between 20% and 95% of the vertical face height H1, and more preferably between 30% and 95% of the vertical face height. In the illustrated embodiment, the vertical indentation height H2 is approximately 38% of the vertical face height H1. In an alternative embodiment, the vertical indentation height H2 is approximately 50% of the vertical face height H1. In another embodiment, the vertical indentation height H2 is equal to or greater than the vertical face height H1. As will be appreciated, the vertical indentation height H2 can vary in accordance with the loft of the club head. This orientation of the conical indentation 52 can also be

described in another manner. As illustrated in FIG. 11, the conical indentation 52 includes an imaginary line L extending between the most rearward portion of the edge 58 and the most forward portion of the apex 56. This imaginary line L is preferably at an angle B with respect to a common plane C containing the opposed rail edges 60, 62. The angle B is preferably between 5-60 degrees, and more preferably between 10-50 degrees. In the illustrated embodiment, the angle B is approximately 10 degrees. In an alternative embodiment, the angle B is approximately 13 degrees. In another embodiment, the angle B is approximately 15 degrees. Hence, as described above, the portion of the wall 44 defining the conical indentation 52 extends up from the common plane C into the interior 48 of the golf club head 22.

[0025] Because the metallic wall 44 defines the conical indentation 52, as illustrated in FIG. 10, the conical indentation defines a cone-shaped protrusion 68 from the interior surface 46 of the sole 42 when viewed from the interior 48. Because the portion of the metallic wall 44 defining conical indentation 52 extends up into the interior 48 of the golf club head 22, the inclusion of the conical indentation in the sole 42 moves the perimeter weight of this portion of the metallic wall up into the interior, rearward portion of the club head. As compared to an entirely flat sole, the inclusion of the conical indentation 52 increases the surface area of the metallic wall 44 in an area rearward of the front face 42 and in an area within the interior 48. This tends to move the center of gravity of the golf club head 22 to a location more above the common plane C and further back from the front strike face 24 as compared to some conventional designs, which is believed to: (1) reduce back spin; (2) reduce twisting of the club head on off-center hits; and (3) help launch struck balls at a higher angle.

[0026] As described above and as illustrated in FIGS. 3, 4, and 11, the opposing edges 60, 62 are located in a common plane C. The common plane C is approximately parallel with the ideal driving line T, approximately perpendicular with the vertical plane P, and approximately tangent to the lower most portion of the section 66. In the preferred embodiment, a remainder of the sole 42 surrounding the conical indentation 52 and located rearward of the apex 56 slopes away from the conical-shaped indentation such that the opposing edges 60, 62 define a V-shaped rail located directly adjacent the conical indentation. That is, the remainder of the sole 42 surrounding the conical indentation 52 and located rearward of the apex 56 is not located in the common plane C, but is rather located above the common plane C. Hence, the opposing edges 60, 62 define the lowermost portion of the golf club head 22. In an embodiment in which the golf club head 22 is a fairway wood, it is believed that this V-shaped rail helps reduce drag on a shot and helps the sole 42 slice down through the rough. It is also believed that this V-shaped rail helps straighten the club head 22 when the club head is not swung straight into the ball.

[0027] The aforementioned remainder of the sole 42 can slope away from the opposing edges in any variety of manners. In the illustrated embodiment, each portion 68, 70 of the sole adjacent the edges 60, 62 slopes away from the respective edge by each following a separate radius of curvature R that gradually changes along the length of each edge 62, 64. More particularly and in reference to FIG. 4, the portion 68 of the sole adjacent the edge 60 follows a concave radius of curvature R so as to slope away from the

edge 60 near the apex side of the edge. This radius of curvature R gradually increases along the length of the edge 60 until it eventually turns flat and then eventually turns slightly convex at the tail end of the edge 60 adjacent the backside 30 as illustrated in FIG. 3. The opposite portion 70 of the sole 42 adjacent the edge 62 is similarly sloped. In an alternative embodiments, the aforementioned remainder of the rail slopes away from the edges 60, 62 by following one or more planar angles, symmetric contours, and/or or asymmetric contours. In yet a further embodiment, an entirety or only a portion of the aforementioned remainder of the sole 42 does not slope away from the conical indentation 52, but is rather within the common plane C.

[0028] In an embodiment of the golf club head 22 in which the loft is that of a driver, the golf club head 22 is preferably fabricated from three forged casings that are welded to each other to define the golf club head 22. In an embodiment of the golf club head 22 in which the loft is that of a fairway wood, the head is preferably fabricated from a forged casing that defines the face and a cast casing that defines the remainder of the club head. These two casings are welded to each other to define the golf club head 22. In each of these embodiments, the portion of the metallic wall 44 that define the conical indentation 52 is located entirely within one casing. In the preferred embodiment, the metallic wall 44 is a titanium alloy and/or a stainless steel. However, the metallic wall 44 may be other materials, such as aluminum alloys and magnesium alloys.

[0029] The principles, preferred embodiments, and modes of operation of the present invention have been described in the foregoing description. However, the invention which is intended to be protected is not to be construed as limited to the particular embodiments disclosed. Further, the embodiments described herein are to be regarded as illustrative rather than restrictive. Variations and changes may be made by others, and equivalents employed, without departing from the spirit of the present invention. Accordingly, it is expressly intended that all such variations, changes and equivalents which fall within the spirit and scope of the present invention as defined in the claims be embraced thereby.

What is claimed is:

1. A golf club head comprising:

- a hollow metal body defined by a metallic wall having an interior surface that faces an interior of said hollow metal body and an exterior surface that faces an exterior of said hollow metal body, said metallic wall defining:
- a front strike face having a top portion and a bottom portion;
- a backside located opposite from said front strike face;
- a sole adjoining said bottom portion of said front striking face and extending rearward until it adjoins said backside; and
- a portion at which said interior surface and said exterior surface are curvilinearly contoured to define a conical indentation in said sole and in said back side as viewed from the exterior of said hollow metal body, said conical indentation including an apex located rearward of said front strike face and pointing toward said front

strike face, a remainder of said sole surrounding said conical indentation and located rearward of said apex sloping away from said conical indentation to define a V-shaped rail directly adjacent said conical-shaped indentation.

2. The golf club head of claim 1, said hollow metal body including a hosel having an axis extending approximately along a vertical plane positioned perpendicular to a driving line, said front strike face having a vertical face height located between said bottom portion and said top portion as measured along said vertical plane, a most rearward portion of said conical-shaped indentation having a vertical indentation height located between said apex and said most rearward portion as measured along said vertical plane, said vertical indentation height being at least 20% of said vertical face height.

3. The golf club head of claim 2, said vertical indentation height being between 20% and 95% of said vertical face height.

4. The golf club head of claim 1, said apex being a predetermined distance rearward of said front striking face, said predetermined distance being between 0.25-1.0 inches.

5. The golf club head of claim 4, said predetermined distance being approximately 0.5 inches.

6. The golf club head of claim 1, a section of said sole located between said apex and said striking face having a curvature.

7. The golf club head of claim 1, said V-shaped rail having opposed rail edges that are at a predetermined angle with respect to each other, said angle being between 20-50 degrees.

8. The golf club head of claim 7, said angle being approximately 40 degrees.

9. The golf club head of claim 1, said conical indentation having a base edge located opposite from said apex, said base being elliptical.

10. The golf club head of claim 9, said base edge being located entirely rearward of said sole.

11. The golf club head of claim 1, said V-shaped rail having opposed rail edges that are in a common plane.

12. The golf club head of claim 11, said hollow metal body including a hosel having an axis extending approximately along a vertical plane positioned perpendicular to a driving line, said common plane being a plane approximately perpendicular to said vertical plane.

13. The golf club head of claim 11, said conical indentation including an imaginary line extending between a first point and a second point, said first point being located at a most rearward portion of said conical-shaped indentation, said second point being located at a most forward portion of said apex, said imaginary line being at an angle with respect to said common plane, said angle being between 5-60 degrees.

14. The golf club head of claim 13, said angle being between 10-50 degrees.

15. The golf club head of claim 14, said angle being approximately 10 degrees.

16. The golf club head of claim 1, at least a portion of said hollow metal body being fabricated from a forged titanium alloy casing.

17. The golf club head of claim 16, said portion including the strike face.

18. The golf club head of claim 1, said hollow metal body being fabricated from at least two preformed casings.

19. The golf club head of claim 18, only one of said preformed casings including an entirety of said conical-shaped indentation.

20. The golf club head of claim 18 said at least two preformed casings being welded together.

21. The golf club head of claim 18, said hollow metal body being fabricated from at least three preformed casings.

22. A golf club head comprising:

a hollow body having a periphery defined by a metallic wall, said metallic wall defining a heel, a toe located opposite from said heel, a front strike face having a top portion and a bottom portion, a backside located opposite from said front striking face, a sole adjoining said bottom portion of said front strike face and extending rearward until it adjoins said backside, and an indentation in said sole, said indentation having a conical surface therein and a V-shaped perimeter that points toward said strike face, said conical surface intersecting said backside to define an elliptical edge.

23. The golf club head of claim 22, an apex of said V-shaped perimeter being spaced from said strike face by a section of said sole.

24. The golf club head of claim 23, said hollow metal body including a hosel extending along a vertical plane positioned perpendicular to a driving line, said V-shaped perimeter being located within a common plane, said common plane being a plane approximately perpendicular to said vertical plane.

25. The golf club head of claim 24, a portion of said sole located rearward of said V-shaped perimeter sloping upward and away from said V-shaped perimeter to define a V-shaped rail.

26. A golf club head comprising:

a hollow metal body defined by a metallic wall having an interior surface that faces an interior of said enclosed body and an exterior surface that faces an exterior of said enclosed body, said metallic wall defining:

a strike face having a top portion and a bottom portion; a backside located opposite from said strike face;

a sole adjoining said bottom portion of said strike face and extending rearward to said backside,

a crown located opposite from said sole;

a heel;

a toe located opposite from said heel; and

a portion at which said interior surface and said exterior surface are curvilinearly contoured to define a cone-shaped protrusion from said sole as viewed from the interior of said hollow metal body, said cone-shaped protrusion including an apex located rearward of said strike face and pointing toward said strike face.

27. A golf club head comprising:

a hollow metal body having a conical indentation in a sole of said hollow metal body, said sole sloping away from a periphery of said conical indentation such that two opposing edges of said conical indentation define a lowermost portion of said golf club head when said golf club head is oriented such that a vertical plane that contains an axis of a hosel of said golf club head is located approximately perpendicular to an ideal driving line.

28. The golf club head of claim 27, said two opposing edges being located within a common plane.

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