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(71) Demandeur/Applicant:
KARSTEN MANUFACTURING CORPORATION, US

(72) Inventeurs/Inventors:
JERTSON, MARTY R., US;
COLE, ERIC V., US

(74) Agent: SMART & BIGGAR

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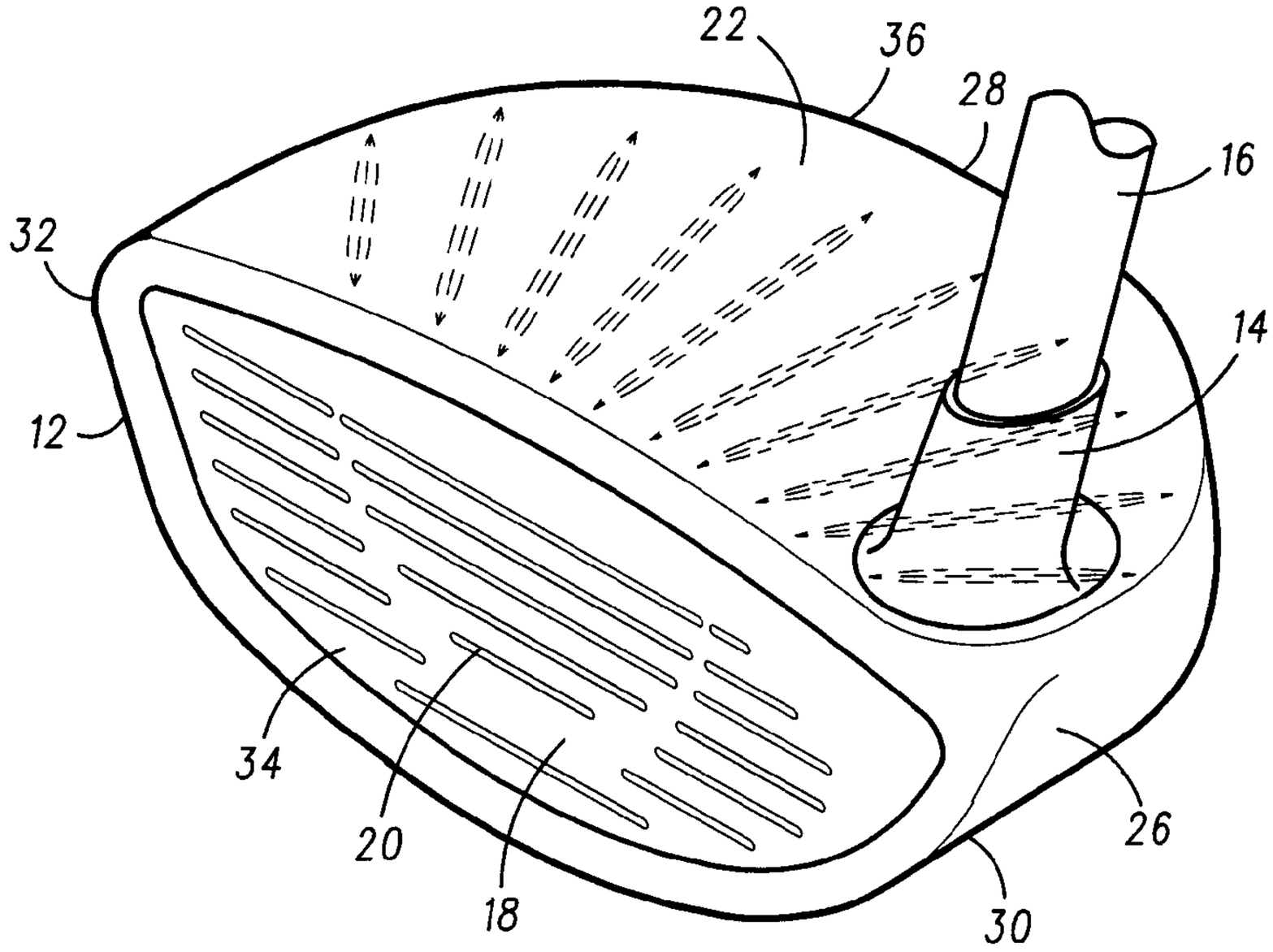

(57) Abrégé/Abstract:
Golf club heads with ribs are described herein. Other embodiments and related methods are also disclosed herein.

GOLF CLUB HEADS WITH RIBS AND RELATED METHODS

ABSTRACT

Golf club heads with ribs are described herein. Other embodiments and related methods are also disclosed herein.

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Inventors: Marty R. Jertson (Phoenix, AZ)
Eric V. Cole (Phoenix, AZ)
Assignee: Karsten Manufacturing Corporation (Phoenix, AZ)

GOLF CLUB HEADS WITH RIBS AND RELATED METHODS

CLAIM OF PRIORITY

[001] This application is a continuation-in-part of U.S. Patent Application No. 12/541,817, filed on August 14, 2009, which is a continuation-in-part of U.S. Patent Application No. 12/430,821, filed on April 27, 2009, now U.S. Pat. No. 7,874,935, which is a continuation of U.S. Patent Application No. 12/047,957, filed on March 13, 2008, now U.S. Pat. No. 7,563,177, which is a continuation of U.S. Patent Application No. 11/496,216, filed on July 31, 2006, now U.S. Patent No. 7,396,298. The contents of the disclosures listed above are incorporated herein by reference.

TECHNICAL FIELD

[002] The present invention generally relates to golf equipment and, more particularly, to golf club heads.

BACKGROUND

[003] Modern wood-type golf club heads are now almost exclusively made of metal rather than the persimmon wood that gave the clubs their name. These club heads are generally constructed as a hollow metal shell with a relatively thick face to withstand the ball impact and a relatively thick sole to withstand grazing impact with the ground as well as lowering the center of gravity of the club head. The remainder of the club head is manufactured as thin as possible so as to allow the maximum amount of material to be

dedicated to the face and sole portions. Although the crown and skirt of a modern club head are quite thin, they still must be sufficiently rigid in the direction of the maximum stress in order to provide support for the face of the club head.

[004] Ribs have commonly been employed in the crowns of club heads to enable the crowns to be as lightweight as possible while still providing sufficient stiffness in the fore and aft direction. U.S. Pat. No. 4,214,754 to Zebelean discloses a hollow club head with a crown that includes parallel ribs running perpendicular to the face of the club head that extend internally and bridge the thin transition with the crown. Similarly, U.S. Pat. No. 6,595,871 to Sano discloses a hollow club head with a separately attached face and a crown that includes a plurality of parallel ribs extending perpendicular to the face. U.S. Pat. No. 5,067,715 to Schmidt et al discloses a hollow club head that includes a crown with a plurality of parallel ribs that merge into and run perpendicularly to the club head face as well as a plurality of ribs that merge into and run perpendicularly to a rear wall of the club head.

[005] The prior art fails to recognize that a club head having a crown with parallel ribs that uniformly reinforce the face of the club head is not an efficient structure since the club head face is not uniformly loaded but is subjected to essentially a point impact near its center.

BRIEF DESCRIPTION OF THE DRAWINGS

[006] FIG. 1 is a front perspective view of a golf club head incorporating features of the present invention;

[007] FIG. 2 is a cross-sectional view of the club head of FIG. 1 viewed from below;

[008] FIG. 3 is a partial cross-sectional view of the club head of FIG. 1 viewed from the front;

[009] FIG. 4 is a top view of a golf club head, according to a second embodiment;

[010] FIG. 5 is a full cross-sectional view of the club head of FIG. 4 viewed from the front;

[011] FIG. 6. is a top view of a golf club head, according to a third embodiment;

[012] FIG. 7 is a full cross-sectional view of the club head of FIG. 6 viewed from the side;

[013] FIG. 8 is a top view of a golf club head, according to a fourth embodiment;

[014] FIG. 9 is a full cross-sectional view of the club head of FIG. 8 viewed from the side;

[015] FIG. 10 is a top view of a golf club head, according to a fifth embodiment;

[016] FIG. 11 is a full cross-sectional view of the club head of FIG. 10 viewed from the front;

[017] FIG. 12 is a top view of a golf club head, according to a sixth embodiment;

[018] FIG. 13 is a full cross-sectional view of the club head of FIG. 12 viewed from the front;

[019] FIG. 14 is a partial front cross-sectional view of a golf club head according to another embodiment;

[020] FIG. 15 is a top cross-sectional view of the golf club head of FIG. 14 with respect to line XV-XV of FIG. 14;

[021] FIG. 16 illustrates a flowchart of a method for providing a golf club head in accordance with examples and embodiments of the present disclosure; and

[021a] FIG. 17 is a top cross-sectional view of a golf club head according to another embodiment.

DESCRIPTION

[022] In a first example, a golf club head can comprise a body and a plurality of ribs protruded from a rib surface of the body. The body can comprise having a heel end, a toe end, a sole, a front surface, and a rear surface. The plurality of ribs can comprise a first rib with a first longitudinal axis, a second rib with a second longitudinal axis, a third rib with a third longitudinal axis. The first, second, and third longitudinal axes can intersect at a common point external to the body.

[023] In a second example, a golf club head can comprise a body and a plurality of ribs protruded from a rib surface of the body. The body can comprise a heel end, a toe end, a crown, a sole, a front surface, and a rear surface. The plurality of ribs can be generally straight and non-intersecting, and/or may comprise a first rib closest to the heel end of the body and a second rib closest to the toe end of the body. The plurality of ribs also may be arranged in a substantially radial pattern to form a fan-like shape between the first and second ribs.

[024] In a third example, a method can comprise (a) providing a body of a golf club head with a heel end, a toe end, a sole, a front surface, and a rear surface, and (b)

providing a plurality of ribs protruded from a rib surface of the body. The plurality of ribs can comprise a first rib with a first longitudinal axis extending through a common point, a second rib with a second longitudinal axis extending through the common point, and a third rib with a third longitudinal axis extending through the common point, wherein the common point can be external to the body.

[025] Other examples and embodiments are further disclosed herein. Such examples and embodiments may be found in the figures, in the claims, and/or in the present description.

[026] With reference to FIGS. 1-3, golf club 10 comprises a club head 12, a hosel 14 and a shaft 16. Club head 12 is composed of a hollow body 18, typically made of stainless steel, titanium or other material having a high shear modulus of elasticity and high strength-to-weight ratio. Hollow body 18 comprises a front wall or face 20 adapted for impacting a golf ball. Hollow body 18 further comprises a top wall or crown 22, a bottom wall or sole 24, and a side wall or skirt 26 that connects the face 20 to crown 22 and sole 24. Club head 12 further includes a heel end 30 and a toe end 32. Skirt 26 wraps around the club head 12 between the heel and toe ends 30, 32 to form a rear wall 28. Golf club head 12 can be a golf club head for a driver type club, a fairway wood, or a hybrid club.

[027] Crown 22 comprises a thin walled structure preferably cast as part of hollow body 18. Crown 22 is preferably titanium having a relatively thin thickness dimension of 0.076 centimeters (cm) ± 0.013 cm. Crown 22 is reinforced with a plurality of ribs 34 extending downward from lower surface 36 of crown 22. Each rib 34 extends from a first end proximal, but spaced from, the front wall 20 to a second end proximal, but

spaced from, the rear wall 28. The ribs 34 are spaced apart by a greater amount, preferably 20 percent greater, at their second ends than at their first ends. Adjacent ribs 34 diverge from their first ends toward their second ends by an angle of at least 5 degrees. Ribs 34 comprise narrow, elongate, generally straight, metallic, shock wave distributing elements with a height dimension of 0.051 cm. ± 0.013 cm and width dimension of 0.178 cm ± 0.013 cm. Ribs 34 are generally convex downward when viewed in cross-section and blend smoothly into lower surface 36 of crown 22. It will be understood that crown 22 is free of ribs extending transversely between the ribs 34.

[028] The lower surface 36 of the crown 22 has a forward portion and a rearward portion as defined by a midline lying generally parallel to the front wall 20 one-half the distance between a forwardmost point on the front wall 20 and a rearwardmost point on the rear wall 28. The first ends of the ribs 34 terminate in the forward portion of the crown 22 and the second ends of the ribs 34 terminate in the rearward portion of the crown 22.

[029] As shown most clearly in FIG. 2, ribs 34 are arrayed in a pattern such that the longitudinal axes 38 of the ribs 34 radiate from and intersect at a point 40 in space located forward of front wall 20. Point 40 is preferably located within the middle one third (W/3) of the width of front wall 20 and is preferably located substantially in front of the center line of front wall 20. Note that because club head 12 is a three dimensional body, as used herein, point 40 refers to a single point when viewed in plan view as in FIG. 2. Alternatively, point 40 can be thought of as a vertical line consisting of the locus of intersections of vertical planes passing through the center lines of the ribs 34.

[030] Ribs 34 originate at a first location proximal the intersection 42 of the rear surface 44 of front wall 20 and lower surface 36 of crown 22 and extend to a second location proximal rear wall 28. In the illustrative embodiment, at least half, and preferably all of the ribs 34 extend from front wall 20 past the mid-point (L/2) of club head 12 and are not interconnected by any transverse ribs. Accordingly, each rib 34 acts independently of the other ribs 34 interconnected only by the intervening thin section of crown 22 therebetween. Preferably, point 40 is also no more than L/2 forward of front wall 20. This results in a pattern of ten ribs 34 subtending an angle of approximately 60 degrees or an angular divergence of from 4 to 8 degrees, preferably about 6 degrees of divergence between adjacent ribs 34.

[031] The surprising result of this arrangement of ribs 34 is that although an array of perpendicular ribs 0.051 cm high by 0.178 cm wide results in only a 9% reduction in maximum stress as compared with unreinforced crown region, ribs 34 arranged in a radial fan pattern in accordance with the present invention reduce maximum stress in the crown region by almost 36%. Although not wishing to be held to any particular theory of operation, it is believed that because the face 20 itself deforms non-uniformly extending outward from the point of impact, the loads are transferred to the crown region in a similar non-uniform manner radiating outward from the point of impact. Therefore, arranging the ribs 34 in a radial pattern extending out from near the point of impact yields a crown 22 that more efficiently supports the face 20 during impact.

[032] In addition to straight linear ribs with substantially constant widths and heights as demonstrated in the example of FIGs. 1-3, it is possible to have alternate embodiments of

a golf club head with ribs. For example, the ribs can be curved or the heights and/or widths of the ribs can be varied.

[033] As an example, FIG. 4 illustrates another embodiment of a golf club head. FIG. 5 illustrates a cross-sectional view of the embodiment of FIG. 4 taken at the lines labeled "5." Golf club head 412 (FIG. 4) includes a hollow body 418 (FIG. 4) with a front wall 420 (FIG. 4), a crown 422 (FIG. 4), a sole 524 (FIG. 5), a side wall 526 (FIG. 5) connecting crown 422 and sole 524, a heel end 430 (FIG. 4), a toe end 432 (FIG. 4), and a rear side 428 (FIG. 4) that is opposite of front wall 420. In addition, golf club head 412 can also include ribs 440 (FIG. 4) that extend downwardly from the lower surface of crown 422. In the example of the embodiment illustrated in FIG. 4, ribs 440 comprise ribs 441, 442, 443, 444, 445, and 446 that have a first end that is proximal to front wall 420 and a second end that is proximal to rear side 428.

[034] In some examples, one or more of ribs 440 can be curved. As an example, each of ribs 441, 442, 443, 444, 445, and 446 are curved in the example of FIG. 4. In other examples, however, some of ribs 440 may not be curved. For example, rib 441 can be linear. When ribs 440 are curved, the length of ribs 440 can be increased. A longer rib allows for more of the rib to absorb the vibration.

[035] Each of ribs 440 of FIG. 4 are curved. In some examples, ribs 440 can be curved in different directions. For example, ribs 441, 442, and 443 can be curved in one direction, while ribs 444, 445, and 446 can be curved in the opposite direction. Ribs 441, 442, and 443 are curved convexly with respect to toe end 432. Therefore, the first end and second end of ribs 441, 442, and 443 are curved away from toe 432 end towards heel end 430. On the other hand, ribs 444, 445, and 446 are curved convexly with respect to

heel end 430. Therefore, the first end and second end of ribs 444, 445, and 446 are curved away from heel end 430 towards toe end 432. In one example, at least two of ribs 440 would intersect if extended forwardly in a linear or curved fashion toward front wall 420. For example, the linear extension of rib 442 would intersect with the linear extension of rib 444 near front wall 420 or, in a different embodiment, in front of front wall 420. It should be noted that there may be alternate curve arrangements for ribs 440. For example, more ribs of ribs 440 may curve towards one direction than the other, or all the ribs may curve in the same direction. In addition, there may be less or more than six ribs 440.

[036] Each of ribs 440 can have a radius of curvature. A radius of curvature is the radius of the circle that is created by an extrapolation of the rib. In some examples, each of ribs 440 has a different radius of curvature. In other examples, some of the radii can be approximately equal to each other.

[037] In the example of golf club head 412 illustrated in FIG. 4, rib 441 has the largest radius of curvature. The radius of curvature of the subsequent ribs decreases the closer the rib is to heel end 430 or toe end 432 relative to rib 441. For example, the radius of curvature of rib 442 is less than that of rib 441, and the radius of curvature of rib 443 is less than that of rib 442. Furthermore, the radius of curvature of rib 444 is less than that of rib 441; the radius of curvature of rib 445 is less than that of rib 444; and the radius of curvature of rib 446 is less than that of rib 445. In other examples the radii of curvature of ribs 440 can increase the closer the rib is to heel end 430 or toe end 432 relative to rib 441. In yet other examples, the radii of curvature of ribs 440 can have no relation to the rib's position relative to rib 441.

[038] In the same or other examples, the radii of curvature for the ribs can be symmetric with each other according to their position relative to rib 441. For example, the radius of curvature of rib 442 can be approximately equal to the radius of curvature of rib 444, and the radius of curvature of rib 443 can be approximately equal to the radius of curvature of rib 445. In other examples, the radii of curvature for ribs 440 are asymmetric with each other.

[039] Each of ribs 440 has a width dimension. In the example of FIG. 4, each of ribs 440 has a width that is approximately equal to the other ribs. In other examples, ribs 440 can have widths that are not equal to every other rib. In some examples, each of ribs 440 has a tapering first end and a tapering second end. In other examples, there is no tapering of the first end and/or the second end.

[040] In addition, each of ribs 440 has a height dimension. The height dimension is a measure of the distance that a rib extends from crown 422 into hollow body 418. In the example of FIG. 5, each of ribs 440 has a height that is approximately equal to the heights of each of the other ribs. In other examples, ribs 440 can have heights that are not equal to the other ribs.

[041] Each of ribs 440 has a length dimension also. The length dimension is a measure of the (curved) distance between a rib's first end and its second end. In the example of FIG. 4, the ribs towards the midpoint between toe end 432 and heel end 430 have the greatest length. In addition, the length of a rib decreases the closer the rib is to toe end 432 or heel end 430. As an example, rib 441 has the greatest length; the length of rib 442 is greater than that of rib 443; the length of rib 444 is greater than that of rib 445; and the

length of rib 445 is greater than that of rib 446. In other examples, all of ribs 440 have an approximately equal length.

[042] FIGs. 6 illustrates another embodiment of a golf club head. FIG. 7 illustrates a cross-sectional view of the embodiment of FIG. 6 taken at the lines labeled "7." Golf club head 612 (FIG. 6) includes a hollow body 618 (FIG. 6) with a front wall 620 (FIG. 6), a crown 622 (FIG. 6), a sole 724 (FIG. 7), a side wall 726 (FIG. 7) connecting crown 622 and sole 624, a heel end 630 (FIG. 6), a toe end 632 (FIG. 6), and a rear side 628 (FIG. 6). In addition, golf club head 612 can also include ribs 640 (FIG. 6) that extend downwardly from the lower surface of crown 622. In the example of the embodiment illustrated in FIG. 6, ribs 640 comprise ribs 641, 642, 643, 644, 645, and 646 that have a first end that is proximal to toe end 632 and a second end that is proximal to heel end 630.

[043] In some examples, one or more of ribs 640 can be curved. As an example, each of ribs 641, 642, 643, 644, 645, and 646 are curved in the example of FIG. 6. In other examples, however, some of ribs 640 may not be curved. For example, rib 641 can be linear.

[044] Each of ribs 640 of FIG. 6 are curved. In some examples, ribs 640 are all curved in the same direction. For example, ribs 641, 642, 643, 644, 645, and 646 are curved convexly with respect to front wall 620. Therefore, the first end and second end of ribs 640 are curved away from front wall 620. It should be noted that there may be alternate curve arrangements for ribs 640. For example, if the dimensions of golf club head 612 decrease significantly at rear side 628 relative to front wall 620, some of ribs 640 may be curved concavely with respect to front wall 602. In other embodiments, some of ribs 640

may have a first end that is proximal to front wall 620 and a second end that is proximal to rear side 628. In addition, there may be less or more than six ribs 440.

[045] Each of ribs 640 can have a radius of curvature. In some examples, each of ribs 640 has a different radius of curvature. In other examples, some of the radii of curvature can be approximately equal to each other.

[046] In the example of golf club head 612 illustrated in FIG. 6, rib 641 has the largest radius of curvature. The radius of curvature of the subsequent ribs decreases the closer the rib is to rear end 628. For example, the radius of curvature of rib 642 is less than that of rib 641; the radius of curvature of rib 643 is less than that of rib 642; the radius of curvature of rib 644 is less than that of rib 643; the radius of curvature of rib 645 is less than that of rib 644; and the radius of curvature of rib 646 is less than that of rib 645. In other examples, the radii of curvature of ribs 640 can increase for each rib that is closer to rear 628. In yet other examples, the radii of curvature of ribs 640 have no relation to the rib's position relative to rear end 628.

[047] Each of ribs 640 has a width dimension. In the example of FIG. 6, each of ribs 640 has a width that is approximately equal to the other ribs. In other examples, ribs 640 can have widths that are not equal to the other ribs. In some examples, each of ribs 640 has a tapering first end and a tapering second end. In other examples, there is no tapering of the first end and/or the second end.

[048] In addition, each of ribs 640 has a height dimension. The height dimension is a measure of the distance that a rib extends from crown 622 into hollow body 618. In the example of FIG. 7, each of ribs 640 have a height that is approximately equal to the

heights of each of the other ribs. In other examples, ribs 640 can have heights that are not equal to the other ribs.

[049] Each of ribs 640 has a length dimension also. The length dimension is a measure of the (curved) distance between a rib's first end and its second end. In the example of FIG. 6, the ribs closer to front wall 620 generally have a greater length than the ribs closer to rear side 628. As an example, the length of rib 642 is greater than that of rib 643; the length of rib 643 is greater than that of rib 644; the length of rib 644 is greater than that of rib 645; and the length of rib 645 is greater than that of rib 646. The length of rib 642, however, is greater than that of rib 641. In other examples, all of ribs 640 have an approximately equal length.

[050] FIG. 8 illustrates another embodiment of a golf club head. FIG. 9 illustrates a cross-sectional view of the embodiment of FIG. 8 taken at the lines labeled "9." Golf club head 812 (FIG. 8) includes a hollow body 818 (FIG. 8) with a front wall 820 (FIG. 8), a crown 822 (FIG. 8), a sole 924 (FIG. 9), a side wall 926 (FIG. 9) connecting crown 422 and sole 524, a heel end 830 (FIG. 8), a toe end 832 (FIG. 8), and a rear side 828 (FIG. 8) that is opposite of front wall 820. In addition, golf club head 812 can also include ribs 840 (FIG. 8) that extend downwardly from the lower surface of crown 822. In the example of the embodiment illustrated in FIG. 8, ribs 840 comprise ribs 841, 842, 843, 844, and 845 that have a first end that is proximal to toe end 832 and a second end that is proximal to heel end 830.

[051] In some examples, one or more of ribs 840 can be curved. As an example, each of ribs 841, 842, 843, 844, and 845 are curved in the example of FIG. 8. In other

examples, however, some of ribs 840 may not be curved. For example, rib 841 can be linear.

[052] Each of ribs 840 of FIG. 8 are curved. In some examples, ribs 840 are all curved in the same direction. For example, ribs 841, 842, 843, 844, and 845 are curved concavely with respect to front wall 820. Therefore, the first end and second end of ribs 840 are curved toward front wall 820. It should be noted that there may be alternate curve arrangements for ribs 840. For example, some of ribs 840 may have a first end that is proximal to front wall 820 and a second end that is proximal to rear side 828. In addition, there may be less or more than six ribs 840.

[053] Each of ribs 840 has a radius of curvature. In some examples, each of ribs 840 has a different radius of curvature. In other examples, some of the radii can be approximately equal.

[054] In the example of golf club head 812 illustrated in FIG. 8, rib 841 has the smallest radius of curvature. The radius of curvature of the subsequent ribs increases the closer the rib is to rear end 828. For example, the radius of curvature of rib 842 is greater than that of rib 841; the radius of curvature of rib 843 is greater than that of rib 842; the radius of curvature of rib 844 is greater than that of rib 843; and the radius of curvature of rib 845 is greater than that of rib 844. In other examples the radii of curvature of ribs 840 can decrease for each rib that is closer to rear end 828. In yet other examples, the radii of curvature of ribs 840 have no relation to the rib's position relative to rear end 828.

[055] In the same or other examples, the radii of curvature for the ribs can be such that the ribs are concentric. If each of ribs 840 was extrapolated to complete a circle, the

resulting circles would be concentric. In other examples, the radii of curvature for ribs 840 are not concentric.

[056] Each of ribs 840 has a width dimension. In the example of FIG. 8, each of ribs 840 has a width that is approximately equal to the other ribs. In other examples, ribs 840 can have widths that are not equal to the other ribs. In some examples, each of ribs 840 has a tapering first end and a tapering second end. In other examples, there is no tapering of the first end and/or the second end.

[057] In addition, each of ribs 840 has a height dimension. The height dimension is a measure of the (curved) distance that a rib extends from crown 822 into hollow body 818. In the example of FIG. 9, each of ribs 840 has a height that is approximately equal to the heights of the other ribs. In other examples, ribs 840 can have heights that are not equal to the other ribs.

[058] Each of ribs 840 has a length dimension also. The length dimension is a measure of the distance between a rib's first end and its second end. In the example of FIG. 8, the ribs closer to rear side 828 have a greater length than the ribs closer to front wall 820. As an example, rib 845 has the greatest length; the length of rib 844 is greater than that of rib 843; the length of rib 843 is greater than that of rib 842; and the length of rib 842 is greater than that of rib 841. In other examples, all of ribs 840 have an approximately equal length.

[059] In addition to having curved ribs, a golf club head can have ribs that have varying widths. For example. FIG. 10 illustrates another embodiment of a golf club head. FIG. 11 illustrates a cross-sectional view of the embodiment of FIG. 10 taken at the lines labeled "11." Golf club head 1012 (FIG. 10) includes a hollow body 1018 (FIG. 10) with

a front wall 1020 (FIG. 10), a crown 1022 (FIG. 10), a sole 1124 (FIG. 11), a side wall 1126 (FIG. 11) connecting crown 1022 and sole 1124, a heel end 1030 (FIG. 10), a toe end 1032 (FIG. 10), and a rear side 1028 (FIG. 10) that is opposite of front wall 1020. In addition, golf club head 1012 can also include ribs 1040 (FIG. 10) that extend downwardly from the lower surface of crown 1022. In the example of the embodiment illustrated in FIG. 10, ribs 1040 comprise ribs 1041, 1042, 1043, 1044, and 1045 that have a first end that is proximal to front wall 1020 and a second end that is proximal to rear end 1028.

[060] In some examples, one or more of ribs 1040 are linear. As an example, each of ribs 1041, 1042, 1043, 1044, and 1045 are linear in the example of FIG. 10. In other examples, however, some of ribs 1040 may not be linear. For example, one or more of ribs 1040 can be curved. In some examples, ribs 1040 are arranged so that each of the axes of ribs 1040 converge at a common point. In some examples, the common point is forward of the front wall. In other examples, each of the axes of ribs 1040 do not converge at a common point.

[061] Each of ribs 1040 has a width dimension. In the example of FIG. 10, each of ribs 1040 has a width that tapers. For example, the width of each of ribs 1040 decreases from its midpoint to its first end and its second end. As demonstrated in FIG. 10, the width at the midpoint of each of ribs 1040 can be approximately equal to the width of each of the other ribs at their respective midpoints. In other examples, ribs 1040 can have widths at their midpoints that are not equal to the width of the other ribs at their respective midpoints.

[062] The widths of ribs 1040 can taper at any rate. For example, as illustrated in FIG. 10, the widths can have a smooth, non-constant tapering, giving ribs 1040 the shape of an elongated oval. In other examples, the widths can taper in a linear or constant manner, giving ribs 1040 a shape similar to that of a diamond.

[063] In addition, each of ribs 1040 has a height dimension. The height dimension is a measure of the distance that a rib extends from crown 1022 into hollow body 1018. In the example of FIG. 11, each of ribs 1040 has a height that tapers. For example, the height of each of ribs 1040 decreases from its midpoint to its first end and its second end. As demonstrated in FIG. 11, each of ribs 1040 can have a height that is approximately equal to the heights of the other ribs at their respective midpoints. In other examples, ribs 1040 can have heights at their midpoints that are not equal to the height of the other ribs at their respective midpoints.

[064] The heights of ribs 1040 can taper at any rate. For example, as illustrated in FIG. 11, the widths can have a smooth, non-constant tapering, giving ribs 1040 a smooth contour. In other examples, the widths can taper more drastically or in a linear or constant manner, giving ribs 1040 a shape having a much more pointed height at the midpoint of ribs 1040.

[065] Each of ribs 1040 has a length dimension also. The length dimension is a measure of the distance between a rib's first end and its second end. In the example of FIG. 10, the ribs closer to the midpoint between toe end 1032 and heel end 1030 have a greater length than the ribs closer to toe end 1032 or heel end 1030. As an example, rib 1041 has the greatest length; the length of rib 1042 is greater than that of rib 1043; and

the length of rib 1044 is greater than that of rib 1045. In other examples, all of ribs 1040 have an approximately equal length.

[066] FIG. 12 illustrates another embodiment of a golf club head. FIG. 13 illustrates a cross-sectional view of the embodiment of FIG. 12 taken at the lines labeled "13." Golf club head 1212 (FIG. 12) includes a hollow body 1218 (FIG. 12) with a front wall 1220 (FIG. 12), a crown 1222 (FIG. 12), a sole 1324 (FIG. 13), a side wall 1326 (FIG. 13) connecting crown 1222 and sole 1324, a heel end 1230 (FIG. 12), a toe end 1232 (FIG. 12), and a rear side 1228 (FIG. 12) that is opposite of front wall 1220. In addition, golf club head 1212 can also include ribs 1240 (FIG. 12) that extend downwardly from the lower surface of crown 1222. In the example of the embodiment illustrated in FIG. 12, ribs 1240 comprise ribs 1241, 1242, 1243, 1244, and 1245 that have a first end that is proximal to front wall 1220 and a second end that is proximal to rear end 1228.

[067] In some examples, one or more of ribs 1240 are linear. As an example, each of ribs 1241, 1242, 1243, 1244, and 1245 are linear in the example of FIG. 12. In other examples, however, some of ribs 1240 may not be linear. For example, one or more of ribs 1240 can be curved. In some examples, ribs 1240 are arranged so that each of the axes of ribs 1240 converge at a common point. In some examples, the common point is forward of the front wall. In other examples, each of the axes of ribs 1240 do not converge at a common point.

[068] Each of ribs 1240 has a width dimension. In the example of FIG. 12, each of ribs 1240 has a width that remains substantially constant. In some examples, the width of each of ribs 1240 tapers at its first end and its second end. In other examples, the width of each of ribs 1240 does not taper at its first and/or second end. As demonstrated in

FIG. 12, the width of each of ribs 1040 can vary. For example, the closer a rib is to the midpoint between toe end 1232 and heel end 1230, the greater the width of that particular rib. As illustrated in FIG. 12, rib 1241 can have the largest width; the width of rib 1242 is greater than width of rib 1243; and the width of rib 1244 is greater that the width of rib 1245. In some examples, the widths of ribs 1240 are symmetric across golf club head 1212. For example, the width of rib 1243 is approximately equal to the width of rib 1245, and the width of rib 1242 is approximately equal to the width of rib 1244. In other examples, the widths of ribs 1240 are asymmetric across golf club head 1212. In yet other examples, the widths of ribs 1240 can change such as, for example, by increasing the closer the rib is to toe end 1232 or heel end 1230. In further examples, the widths of ribs 1240 have no correlation to the rib's position relative to toe end 1232 and/or heel end 1230. Ribs 1240 can be positioned so that the ribs with greater widths can be placed in areas of higher vibration.

[069] In addition, each of ribs 1240 has a height dimension. The height dimension is a measure of the distance that a rib extends from crown 1222 into hollow body 1218. In the example of FIG. 13, each of ribs 1240 has a height that remains substantially constant. As also demonstrated in FIG. 13, each of ribs 1240 can have a height that is different from the height of at least one of the other ribs. In some examples, the height of ribs 1240 increases the closer a rib is to the midpoint between toe end 1232 and heel end 1230. As illustrated in FIG. 12, rib 1241 can have the largest height; the height of rib 1242 is greater than height of rib 1243; and the height of rib 1244 is greater that the height of rib 1245. In some examples, the heights of ribs 1240 are symmetric across golf club head 1212. For example, the height of rib 1243 is approximately equal to the height

of rib 1245, and the height of rib 1242 is approximately equal to the height of rib 1244. In other examples, the heights of ribs 1240 are asymmetric across golf club head 1212. In yet other examples, the heights of ribs 1240 can change, such as, for example, by increasing the closer the rib is to toe end 1232 and heel end 1230. In further examples, the height of ribs 1240 has no correlation to the rib's position relative to toe end 1232 and/or heel end 1230. Ribs 1240 can be positioned so that the ribs with greater heights can be placed in areas of higher vibration.

[070] Each of ribs 1240 has a length dimension also. The length dimension is a measure of the distance between a rib's first end and its second end. In the example of FIG. 12, the ribs closer to the midpoint between toe end 1232 and heel end 1230 have a greater length than the ribs closer to toe end 1232 or heel end 1230. As an example, rib 1241 has the greatest length; the length of rib 1242 is greater than that of rib 1243; and the length of rib 1244 is greater than that of rib 1245. In other examples, all of ribs 1240 have an approximately equal length.

[071] In other embodiments, ribs can have widths and/or heights that taper and vary from one rib to the next. For examples, ribs can have tapering widths as illustrated by ribs 1040 of FIG. 10, and ribs can have varying widths as illustrated by ribs 1240 of FIG. 12. In addition, ribs can have tapering heights as illustrated by ribs 1040 of FIG. 11, and ribs can have a varying heights as illustrated by ribs 1240 of FIG. 13.

[072] In another embodiment, a method of providing a golf club head is provided. The method of providing a golf club head can include providing a body having a heel end, a toe end, a crown having an upper surface and a lower surface, a sole, a front wall, a rear side, and ribs extending from a first end to a second end and extending downwardly from

the lower surface of the crown. In addition, the ribs can comprise a first rib and at least one second rib that is curved. As an example, the heel end can be heel end 430 (FIG. 4), heel end 630 (FIG. 6), or heel end 830 (FIG. 8); the toe end can be toe end 432 (FIG. 4), toe end 632 (FIG. 6), or toe end 832 (FIG. 8); the crown can be crown 422 (FIG. 4), crown 622 (FIG. 6), or crown 822 (FIG. 8); the sole can be sole 524 (FIG. 5), sole 724 (FIG. 7), or sole 924 (FIG. 9); the front wall can be front wall 420 (FIG. 4), front wall 620 (FIG. 6), or front wall 820 (FIG. 8); the rear side can be rear side 428 (FIG. 4), rear side 628 (FIG. 6), or rear side 828 (FIG. 8); and ribs can be ribs 440 (FIG. 4), ribs 640 (FIG. 6), or ribs 840 (FIG. 8).

[073] In one example, the ribs can be provided to be integral with the body. In other examples, the ribs can be provided to be initially separate from the body. Afterwards, the ribs can be coupled to the body by way of a brazing technique, a welding technique, or an adhesive.

[074] In yet another embodiment, a method of providing a golf club head is provided. The method of providing a golf club head can include providing a body having a heel end, a toe end, a crown having an upper surface and a lower surface, a sole, a front wall, a rear side, and generally linear ribs extending downwardly from the lower surface of the crown and extending from a first end proximal the front wall to a second end proximal the rear side. In some examples, the ribs can have a tapering width from its midpoint towards its ends. In the same or other examples, the widths of at least two of the ribs are different. As an example, the heel end can be heel end 1030 (FIG. 10) or heel end 1230 (FIG. 12); the toe end can be toe end 1032 (FIG. 10) or toe end 1232 (FIG. 12); the crown can be crown 1022 (FIG. 10) or crown 1222 (FIG. 12); the sole can be sole 1124 (FIG.

11) or sole 1324 (FIG. 13); the front wall can be front wall 1020 (FIG. 10) or front wall 1220 (FIG. 12); the rear side can be rear side 1028 (FIG. 10) or rear side 1228 (FIG. 12); and ribs can be ribs 1040 (FIG. 10) or ribs 1240 (FIG. 12).

[075] In one example, the ribs can be provided to be integral with the body. In other examples, the ribs can be provided to be initially separate from the body. Afterwards, the ribs can be coupled to the body by way of a brazing technique, a welding technique, or an adhesive.

[076] Continuing with the figures, FIG. 14 illustrates a partial front cross-sectional view of golf club head 140. FIG. 15 illustrates a top cross-sectional view of golf club head 140 with respect to line XV-XV of FIG. 14. Golf club head 140 is similar to other golf club heads presented herein, such as golf club head 12 (FIGs. 1-4), but differs by comprising ribs 1420 located at rib surface 1415, where rib surface 1415 is defined by the extension of ribs 1420 and the space therebetween. In the present example, ribs 1420 comprise a single piece of material with rib surface 1415, but there may be other embodiments where ribs 1420 may not be integral with rib surface 1415 and could be secured thereto via one or more mechanical or chemical fasteners.

[077] Oftentimes, players or users of golf clubs can be able to gauge the quality of their hits based on the sound that the golf club head makes at impact with a golf ball. The ability to keep a consistent sound at impact can thus be an advantage for keeping such players or users within their comfort zone and/or for maintaining expectations regarding such sound/quality relationship. Considering the above, ribs 1420 can be configured in some embodiments to channel stresses and/or vibrations to achieve a desired impact sound when golf club head 140 impacts a golf ball such as golf ball 1570 (FIG. 15). Such

a characteristic may be valuable to maintain and/or restore a desired sound characteristic for the golf club head design, such as when the desired sound characteristic would otherwise be altered as a result of other modifications or improvements made to the structure of the golf club head design in search of better performance. In addition, as previously described with respect to other golf club heads herein disclosed, ribs 1420 may add reinforcement characteristics to the portion of the club head where rib surface 1415 is located to better dissipate or channel stress or impact forces.

[078] Golf club head 140 comprises body 1410 having heel end 1411, toe end 1412, sole 1413, crown 1414, front surface 1416 (comprising strike face 1430 and target strike zone 1431), rear surface 1517 (FIG. 15), and skirt portion 1418. Body 1410 also comprises rib surface 1415, from which ribs 1420 protrude. In the present example, ribs 1420 comprise rib 1421 with rib longitudinal axis 1521 (FIG. 15), rib 1422 with rib longitudinal axis 1522 (FIG. 15), and rib 1423 with rib longitudinal axis 1523 (FIG. 15), where rib longitudinal axes 1521-1523 intersect external to body 1410 at common point 1550 (FIG. 15). Rib 1421 is located closest to heel end 1411, rib 1422 is located closest to toe end 1412 of body 1410, and rib 1423 is located between ribs 1411 and 1412. Ribs 1420 are arranged on or over rib surface 1415 in a substantially radial pattern in the present example, forming a fan-like shape between rib 1421 and rib 1422. Common point 1550 is located forward of front surface 1416 in the present embodiment, but there can be embodiments where common point 1550 is located elsewhere external to body 1410. As an example, a different embodiment could comprise ribs similar to ribs 1420 but configured to intersect at a common point located behind rear surface 1517.

[079] Ribs 1420 also comprise rib 1424 with longitudinal axis 1524, and rib 1425 with longitudinal axis 1525. In the present example, longitudinal axes 1524 and 1525 also intersect at common point 15500 with longitudinal axes 1521-1523. There can be other embodiments, however, where not all longitudinal axes of ribs 1420 need to intersect at common point 15500. As an example, there can be embodiments where longitudinal axes 1524 and 1525 may intersect each other external to body 1410 but elsewhere other than at common point 15500. Other embodiments may comprise a different number of ribs. As an example, ribs 1423-25 may be absent in some embodiments, such that ribs 1420 would comprise only two ribs. As another example, some embodiments may comprise more than five ribs, such as an embodiment with 10 ribs similar to that described with respect to FIGs. 1-3 but with ribs at sole 24 (FIG. 3). Some of such embodiments may comprise ribs that may not intersect with all of the other ribs thereof.

[080] In the present example of FIG. 15, rib surface 1415 is located at sole 1413 internal to body 1410, such that ribs 1420 are also internal to body 1410 and invisible at sole 1413 opposite rib surface 1415. In other examples, however, ribs 1420 may be external to body 1410, where rib surface could be located, instead, at an exterior surface of crown 1414 or at an exterior surface of sole 1413. Ribs 1420 are concave relative to crown 1414 in the present example, and rib surface 1415 extends past sole 1413 into part of skirt portion 1418 of body 1410. There can be other embodiments, however, where ribs 1420 need not extend into skirt portion 1418. In some examples, extending ribs 1420 into skirt portion 1418 can be beneficial for reinforcing one or more sections of skirt portion 1418, and/or for tuning the impact sound of golf club head 140.

[081] As can be seen in FIG. 15, each of ribs 1420 are spaced apart from front surface 1416 and from rear surface 1517. Such a characteristic can be beneficial, for example, so as to not interfere with the bending or deformation of the transition region between front surface 1416 and the rest of body 1410 upon impact with a golf ball. Also in the present example, different ribs of ribs 1420 are separated by different distances from front surface 1416 along their respective longitudinal rib axes. As an example, rib 1423 is spaced apart from front surface 1416 along rib longitudinal axis 1523 by a distance greater than the distance spacing apart ribs 1421 and/or 1422 from front surface 1416 along rib longitudinally axes 1521 and/or 1522, respectively. In the present embodiment, rib 1421 is spaced apart from front surface 1416 by approximately 1.732 cm, rib 1422 is spaced apart from front surface 1416 by approximately 1.638 cm, rib 1423 is spaced apart from front surface 1416 by approximately 1.742 cm, rib 1424 is spaced apart from front surface 1416 by approximately 1.737 cm, and rib 1425 is spaced apart from front surface 1416 by approximately 1.709 cm. Such different spacing may be valuable in some examples for influencing or tuning the stiffness of the transition region between strike face 1430 and sole 1413 to control one or more attributes of golf club head 140, such as a characteristic time, a coefficient of restitution, an impact sound, and/or a feel thereof. In other examples, ribs 1420 may be equally spaced apart from front surface 1416.

[082] In the present embodiment, rib 1421 comprises a length of approximately 4.1 cm, rib 1422 comprises a length of approximately 7.3 cm, rib 1423 comprises a length of approximately 8.6 cm, and rib 1424 comprises a length of approximately 6.5 cm, rib 1425 comprises a length of approximately 8.8 cm. The lengths of ribs 1420 can extend through and/or above indentations or other features of rib surface 1415, such as

indentations 1580 including indentations 1581-1583. Indentations 1580 may thus partially engulf one or more portions of one or more of ribs 1420, as can be seen in the example of FIG. 15. As an example, parts of the top of ribs 1422 and 1425 are shown protruding above indentation 1581, while parts of the top of ribs 1421, 1424, and 1423 are shown protruding above indentation 1582. As another example, parts of ribs 1422-1425 are shown protruding above indentations 1583. Indentations 1581-1583 all protrude from rib surface 1415 into an interior of golf club head 140 in the embodiment of FIGs. 14-15, where indentations 1581-1582 delineate pockets into which external weights can be attached to an exterior surface of golf club head 140, and where indentations 1583 can correspond to a logo or other design located or embossed at rib surface 1415. There can be other embodiments, however, where one or more of ribs 1420 may not protrude above one or more of indentations 1580. As an example, in another embodiment, ribs 1420 may protrude above indentations 1583, while the length of one or more of ribs 1420 may end at the interface with one or more of indentations 1581-1582. In the same or other embodiments, one or more of indentations 1580 may completely engulf at least one portion of one or more of ribs 1420.

[083] Ribs 1420 can be configured to comprise a maximum width of approximately 4.5 millimeters (mm) to approximately 5 mm, and/or a maximum thickness of approximately 0.5 to approximately 1.0 mm in some embodiments. More specifically, in the present example of FIGs. 14-15, the maximum width of ribs 1420 can be of approximately 4.8 mm, and the maximum thickness of ribs 1420 can be approximately 0.76 mm.

[084] Ribs 1420 are non-intersected by any rib in the present example. In addition, the thickness and width of ribs 1420 blend into rib surface 1415 proximate to front surface

1416. Such characteristics may permit ribs 1420 to better pick up or channel stresses and/or vibrations along their length for dissipation towards or throughout desired portions of body 1410 without interruption or deviation of such channeling by any intersecting rib. The blending of ribs 1420 into rib surface 1415 may also permit a reduction of stress concentration than if ribs 1420 protruded abruptly proximate to front surface 1416. Other embodiments, however, may comprise one or more ribs that may or may not intersect all of ribs 1420, and/or one or more of ribs 1420 that may not blend into rib surface 1415.

[085] In the present example, as can be seen in FIG. 15, adjacent ribs of ribs 1420 diverge from each other towards rear surface 1517, and converge towards each other towards front surface 1416. Also, body 1410 comprises forward portion 1561 and rearward portion 1562, divided by midline 1563 therebetween, where midline 1563 lies generally parallel to front surface 1416 at substantially one-half the distance between a forwardmost point of front surface 1416 and a rearwardmost point of rear surface 1517. In the present example, the front end of each of ribs 1422-1425 lies at forward portion 1561, while the rear end of each of ribs 1422-1425 lies at rearward portion 1562. There can be examples where all of ribs 1420 comprise front ends at forward portion 1561 and rear ends at rearward portion 1562. Also, in the present example, ribs 1420 are located such that their collective center of gravity is located between the center of gravity of golf club head 140 and rear surface 1517. In the same or other examples, the center of gravity of each of ribs 1420 may be located between the center of gravity of golf club head 140 and rear surface 1517. As a result, ribs 1420 may beneficially displace the center of gravity of golf club head 140 rearwards from where it would have otherwise been for better impact and launch characteristics.

[086] The embodiment of FIGs. 14-15 also present a target strike zone 1431 at front surface 1416, configured to be the desired point of impact with a golf ball under most circumstances. In the present example, longitudinal axis 1523 of rib 1423 is substantially perpendicular to strike face 1430, and is aligned with a center of target strike zone 1431. Target strike axis 1533 extends substantially perpendicular to strike face 1430, from a center of target strike zone 1431, where common point 1550 is located along target strike axis 1533 in the present embodiment such that ribs longitudinal axes 1521-1525 of ribs 1421-1425 intersect each other along target strike axis 1533. Rib longitudinal axis 1523 can be collinear with target strike axis 1533.

[087] As seen in FIG. 15, common point 1550 is separated from target strike zone 1431 by distance 1571 comprising approximately a radius of golf ball 1570. In some examples, distance 1571 may be of approximately 21.3 mm, and/or tailored with respect to the radius of a golf ball compliant with the rules of the United States Golf Association (USGA). Currently, the USGA requires conforming golf balls to have a diameter of not less than 1.680 inches (42.67 mm). In other examples, common point 1550 may be separated from target strike zone 1431 by a different distance, such as a distance of a golf ball diameter, instead.

[088] In the present example, golf club head 140 comprises sole weight 1590 located at least partially at sole 1413. Sole weight 1590 is situated at a lowermost portion of sole 1413, so as to more effectively lower the center of gravity of golf club head 140, and the perimeter of sole weight 1590 can be contoured to fill-in the volume of such lowermost portion of sole 1413. In the same or other examples, sole weight 1590 comprises a single piece of material with sole 1413 in the present example, but there may be other examples

where sole weight 1590 may comprise a different material or piece than sole 1413, and/or where sole weight 1590 may be affixed to sole 1413 via a mechanical or chemical fastener such as via an adhesive, one or more screws, welding, and/or brazing, among others. As shown in FIG. 15, sole weight 1590 may at least partially engulf one or more ribs of ribs 1420, such as ribs 1423-1424. In the same or other examples, the thickness of sole weight 1590 can engulf a thickness of one or more portions of the engulfed ribs, such as seen with respect to the portions of ribs 1423-1424 that become subsumed into the thickness of sole weight 1590.

[089] Skipping ahead in the figures, FIG. 17 illustrates a top cross-sectional view of golf club head 170. In the present example, club head 170 is similar to golf club head 140 (FIGs. 14-15), and comprises ribs 1721-1725 similar to ribs 1421-1425 (Figs. 14-15). Ribs 1721-1725 are located at rib surface 1715, which is devoid of features such as weight 1590 and indentations 1581-1583 that could otherwise engulf one or more portions of ribs 1721-1725. There can be other examples, however, where one or more indentations like indentations 1581-1583, and/or one or more weights like weight 1590, could be located at rib surface 1715.

[090] Backtracking through the figures, FIG. 16 illustrates a flowchart of a method 1600 for providing a golf club head. In some examples, the golf club head can be similar to one or more of the golf club heads previously described, such as golf club head 12 (FIGs. 1-3), golf club head 412 (FIGs. 4-5), golf club head 1012 (FIGs. 10-11), golf club head 1212 (FIGs. 12-13), golf club head 140 (FIGs. 14-15), and/or variations thereof.

[091] Block 1610 of method 1600 comprises providing a body of the golf club head with a heel end, a toe end, a sole, a front surface, and a rear surface. As an example, with

respect to the embodiment of FIGs. 14-15, the body can be similar to body 1410, the toe end can be similar to toe end 1412, the heel end can be similar to heel end 1411, the sole can be similar to sole 1413, the front surface can be similar to front surface 1416, and the rear surface can be similar to rear surface 1517. Corresponding associations are envisioned for other golf club heads taught herein, or variations thereof.

[092] Block 1620 of method 1600 comprises providing a plurality of ribs protruded from a rib surface of the body. As an example, with respect to the embodiment of FIGs. 14-15, the rib surface can be similar to rib surface 1415, and the plurality of ribs can be similar to a plurality of ribs 1420. For instance, the plurality of ribs may comprise a subset of ribs 1421-1425. Corresponding associations can be made with respect to ribs of the other golf club heads taught herein, or variations thereof. In some embodiments, at least a subset of the plurality of ribs may intersect at a common point external to the body, such as illustrated with respect to common point 1550 located forward of front surface 1416 in FIG. 15, for example. There can be other examples, however, where common point need not be located forward of the front surface of the body. In addition, the plurality of ribs may comprise a single piece of material with the rib surface, or may be attached thereto via a mechanical or chemical fastener.

[093] In some examples, providing the plurality of ribs in block 1620 can comprise providing the rib surface and the plurality of ribs internal to the body; and/or providing the plurality of ribs at the sole of the body. In other examples, the plurality of ribs may be external to the body instead, and/or the plurality of ribs may be provided elsewhere, such as at a crown of the body, and/or at a skirt portion of the body.

[094] There can be examples where different blocks of method 1600 can be combined into a single block or performed simultaneously, and/or the sequence of such blocks can be changed. For example, blocks 1610-1620 may be performed simultaneously, such as by forming the plurality of ribs integrally with the rib surface, where the rib surface comprises one or more portions of one or more parts of the body of the club head. There can also be examples where method 1600 can comprise further or different blocks. As an example, method 1600 can comprise another block for providing a weight similar to sole weight 1590 (FIG. 15), where such weight could engulf one or more portions of one or more of the plurality of ribs of block 1620. Other variations can be implemented for method 1600 without departing from the scope of the present disclosure.

[095] 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/or 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/or 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/or articles of manufacture described herein are not limited in this regard.

[096] While at least some of the above examples have been depicted and/or described with respect to with fairway wood-type golf clubs, the apparatus, methods, and/or articles of manufacture described herein may be applicable to other types of golf clubs such as a

driver-type golf club, a hybrid-type golf club, an iron-type golf club, a wedge-type golf club, and/or a putter-type golf club. Alternatively, the apparatus, methods, and/or articles of manufacture described herein may be applicable other type of sports equipment such as a hockey stick, a tennis racket, a fishing pole, a ski pole, etc.

[097] Although certain illustrative embodiments and methods have been described herein, it will be apparent from the foregoing disclosure to those skilled in the art that variations and modifications of such embodiments and methods may be made without departing from the spirit and scope of the invention. Accordingly it is intended that the invention should be limited only to the extent required by the appended claims and the rules and principles of applicable law.

CLAIMS

What is claimed is:

1. A golf club head comprising:

a body having a heel end, a toe end, a sole, a front surface, and a rear surface; and

a plurality of ribs protruded from a rib surface of the body and comprising:

a first rib with a first longitudinal axis;

a second rib with a second longitudinal axis; and

a third rib with a third longitudinal axis;

wherein the first, second, and third longitudinal axes intersect at a common point external to the body.

2. The golf club head of claim 1, wherein:

the common point is located forward of the front surface.

3. The golf club head of claim 1, wherein:

the rib surface and the plurality of ribs are internal to the body.

4. The golf club head of claim 1, wherein:

the rib surface and the first, second, and third ribs are located at the sole of the body.

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

the body comprises a skirt portion; and

the rib surface and the first, second, and third ribs are located at the skirt portion of the body.

6. The golf club head of claim 1, wherein:

each of the plurality of ribs are spaced from the front surface and from the rear surface.

7. The golf club head of claim 1, wherein:

the first, second, and third ribs are non-intersected by any rib.

8. The golf club head of claim 1, wherein:

the body comprises a forward portion and a rearward portion;

a midline between the forward and rearward portions lies generally parallel to the front surface of the body at substantially one-half a distance between a forwardmost point at the front surface and a rearwardmost point at the rear surface;

a front end portion of each of the first, second, and third ribs lies at the forward portion; and

a rear end portion of each of the first, second, and third ribs lies at the rearward portion.

9. The golf club head of claim 1, wherein:

a thickness of each of the first, second, and third ribs blends into the rib surface proximate to the front surface.

10. The golf club head of claim 1, wherein:

adjacent ribs of the plurality or ribs diverge from each other towards the rear surface and converge towards each other towards the front surface.

11. The golf club head of claim 1, wherein:

the plurality of ribs are concave relative to a crown of the golf club head.

12. The golf club head of claim 1, wherein:

the front surface of the body comprises a strike face with a target strike zone; and

the longitudinal axis of the third rib is substantially perpendicular to the strike face and aligned with the target strike zone.

13. The golf club head of claim 1, wherein:

the front surface of the body comprises a strike face with a target strike zone;

a target strike axis extends from a center of the target strike zone and substantially perpendicular to the strike face; and

the common point is located along the target strike axis.

14. The golf club head of claim 1, wherein:

the front surface of the body comprises a strike face with a target strike zone; and

the common point is separated from the target strike zone by a distance of approximately a golf ball radius.

15. The golf club head of claim 1, wherein:

a center of gravity of the plurality of ribs is located between a center of gravity of the golf club head and the rear surface of the body.

16. The golf club head of claim 1, further comprising:

a sole weight located at at least a portion of the sole;

wherein the sole weight partially engulfs one or more engulfed ribs of the plurality of ribs.

17. The golf club head of claim 16, wherein:

a thickness of the sole weight fully engulfs a thickness of one or more portions of the one or more engulfed ribs.

18. The golf club head of claim 1, further comprising:

one or more indentations at the rib surface;

wherein the one or more indentations partially engulf one or more portions of one or more of the plurality of ribs.

19. The golf club head of claim 1, wherein:

the rib surface and the plurality of ribs comprise a single piece of material.

20. A golf club head comprising:

a body comprising:

a heel end, a toe end, a crown, a sole, a front surface, and a rear surface;

and

a plurality of ribs protruded from a rib surface of the body;

wherein:

the plurality of ribs are generally straight and non-intersecting;

the plurality of ribs comprise a first rib closest to the heel end of the body and a second rib closest to the toe end of the body; and

the plurality of ribs are arranged in a substantially radial pattern to form a fan-like shape between the first and second ribs.

21. The golf club head of claim 20, wherein:

the first rib comprises a first rib longitudinal axis;

the second rib comprises a second rib longitudinal axis;

the first and second longitudinal axes intersect at a common point external to the body of the golf club head; and

the plurality of ribs are non-intersected by any rib.

22. The golf club head of claim 21 wherein:

the common point is located forward of the front surface of the body.

23. The golf club head of claim 20, wherein:

the plurality of ribs further comprises:

a third rib located between the first and second ribs and comprising a third rib longitudinal axis;

a fourth rib located between the first and third ribs and comprising a fourth rib longitudinal axis; and

a fifth rib located between the second and third ribs and comprising a fifth rib longitudinal axis;

and

at least three of the first, second, third, fourth, or fifth rib longitudinal axes intersect at a common point external to the body of the golf club head

24. The golf club head of claim 23, wherein:

the common point is located forward of the front surface of the body;

the rib surface and the plurality of ribs are internal to the body;

the plurality of ribs and the rib surface are located at the sole of the body.

each of the plurality of ribs is spaced from the front surface and from the rear surface;

at least three of the plurality of ribs are non-intersected by any rib;

the body comprises a forward portion and a rearward portion;

a midline between the forward and rearward portions lies generally parallel to the front surface of the body at substantially one-half a distance between a forwardmost point at the front surface and a rearwardmost point at the rear surface;

a front end portion of each rib of the plurality ribs lies at the forward portion;

a rear end portion of each rib of the plurality ribs lies at the rearward portion;

each of the plurality of ribs is concave relative to the crown;

the front surface of the body comprises a strike face with a target strike zone;

the longitudinal axis of the third rib is substantially perpendicular to the strike face and aligned with the target strike zone;

a target strike axis extends from a center of the target strike zone and substantially perpendicular to the strike face and substantially collinear with the longitudinal axis of the third rib;

the common point is located along the target strike axis;

the common point is separated from the target strike zone by a distance of approximately a golf ball radius;

a center of gravity of the plurality of ribs is located between a center of gravity of the head and the rear surface of the body;

the rib surface and the plurality of ribs comprise a single piece of material; and

the plurality of ribs are invisible at the sole opposite the rib surface.

25. A method comprising:

providing a body of a golf club head with:

a heel end, a toe end, a sole, a front surface, and a rear surface; and

providing a plurality of ribs protruded from a rib surface of the body and comprising:

a first rib with a first longitudinal axis extending through a common point;

a second rib with a second longitudinal axis extending through the common point; and

a third rib with a third longitudinal axis extending through the common point;

wherein the common point is external to the body.

26. The method of claim 25, wherein:

providing the plurality of ribs comprises:

providing the rib surface and the plurality of ribs internal to the body; and

providing the plurality of ribs and the rib surface at the sole of the body.

27. The method of claim 25, wherein:

the common point is located forward of the front surface;

providing the plurality of ribs comprises:

arranging the plurality of ribs in a substantially radial pattern to form a fan-like shape between the first and second ribs;

providing the rib surface and the first, second, and third ribs to be at a skirt portion of the body;

locating each of the plurality of ribs spaced from the front surface and from the rear surface;

providing the first, second, and third ribs non-intersected by any rib;

providing a thickness of each of the first, second, and third ribs blended into the rib surface proximate to the front surface;

providing the plurality of ribs as concave relative to a crown of the golf club head;

providing the body of the golf club head comprises:

providing a strike face of the front surface of the body to comprise:

a target strike zone; and

a target strike axis extending substantially perpendicular to the strike face from a center of the target strike zone and through the common point;

and

the rib surface and the plurality of ribs comprise a single piece of material.

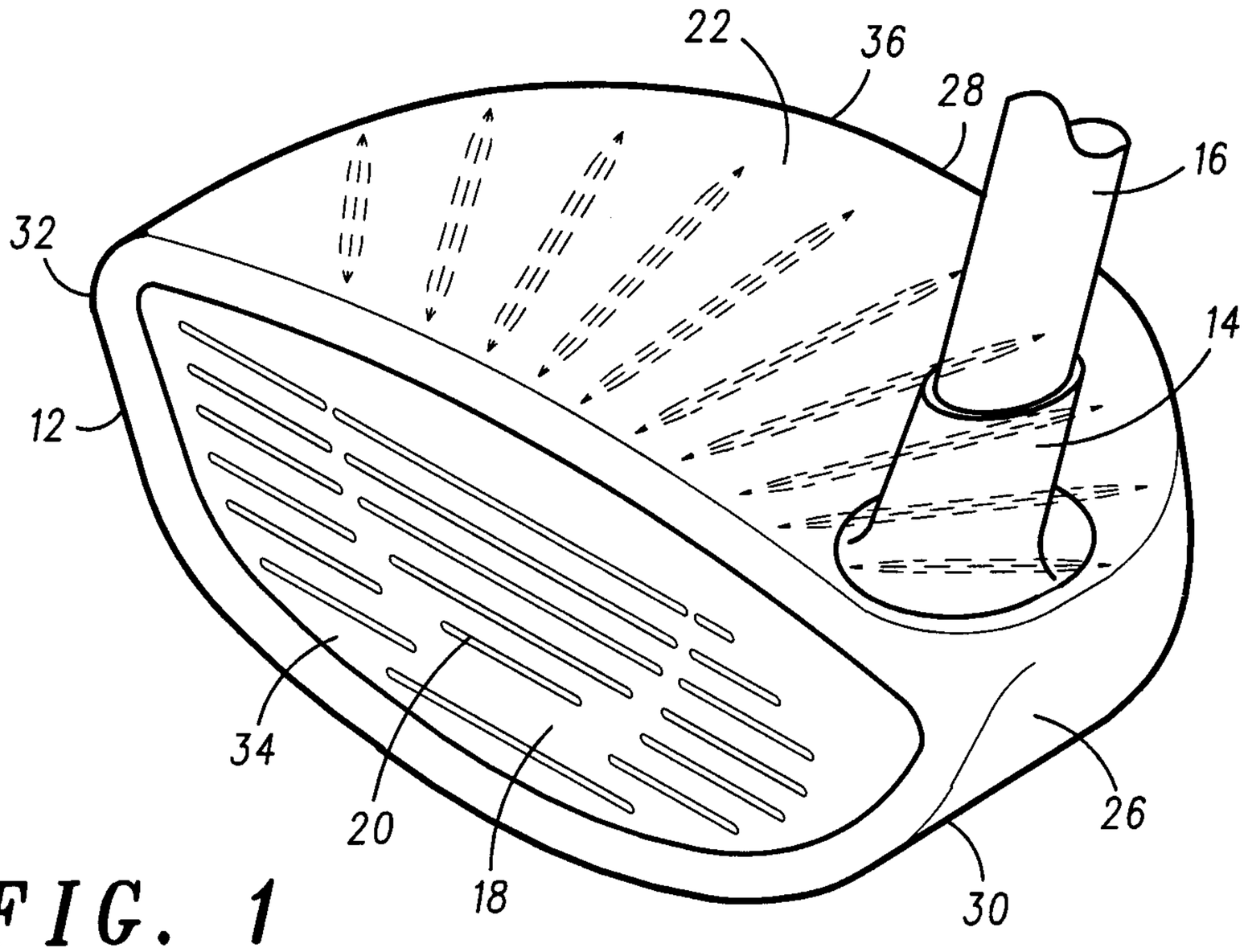


FIG. 1

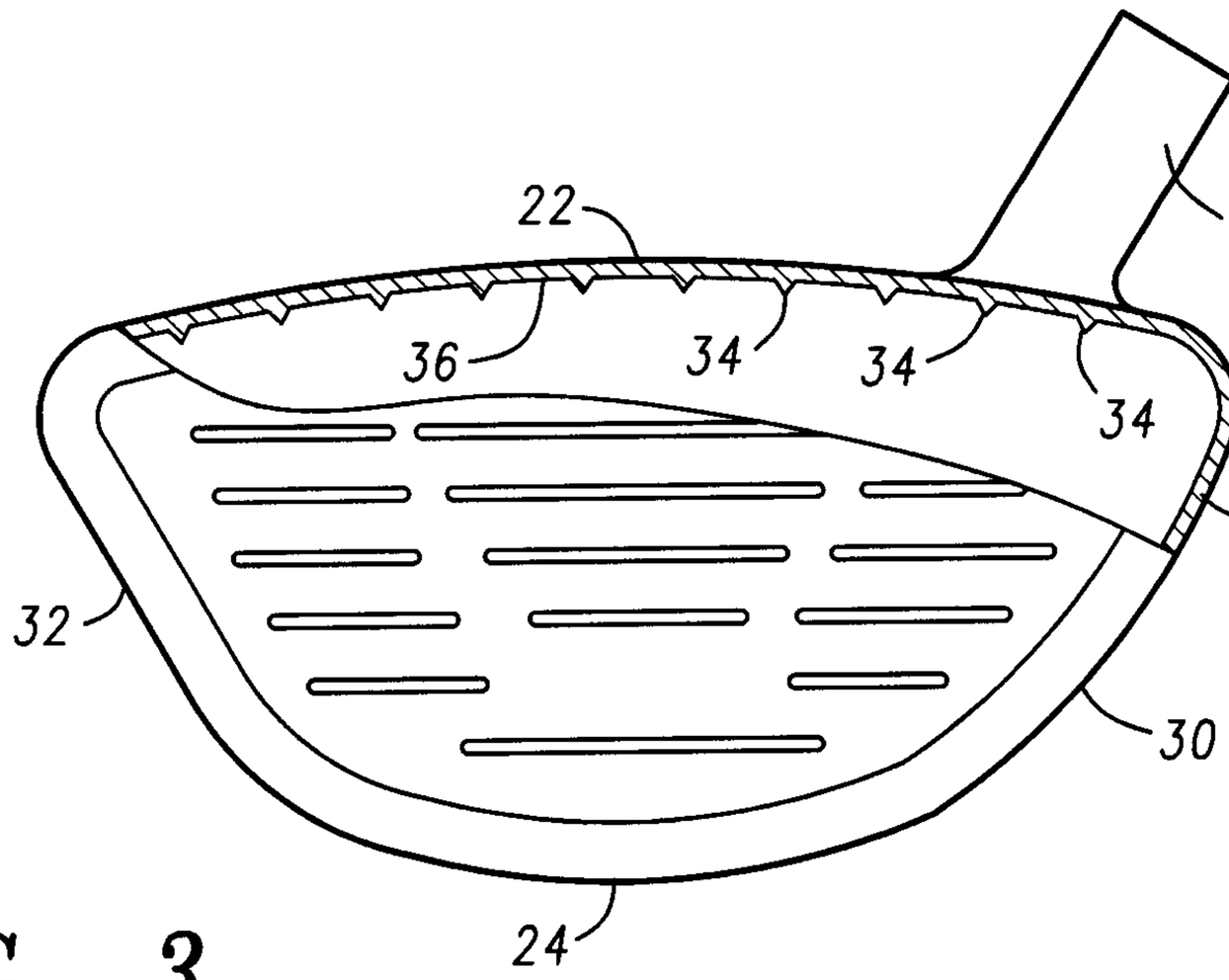
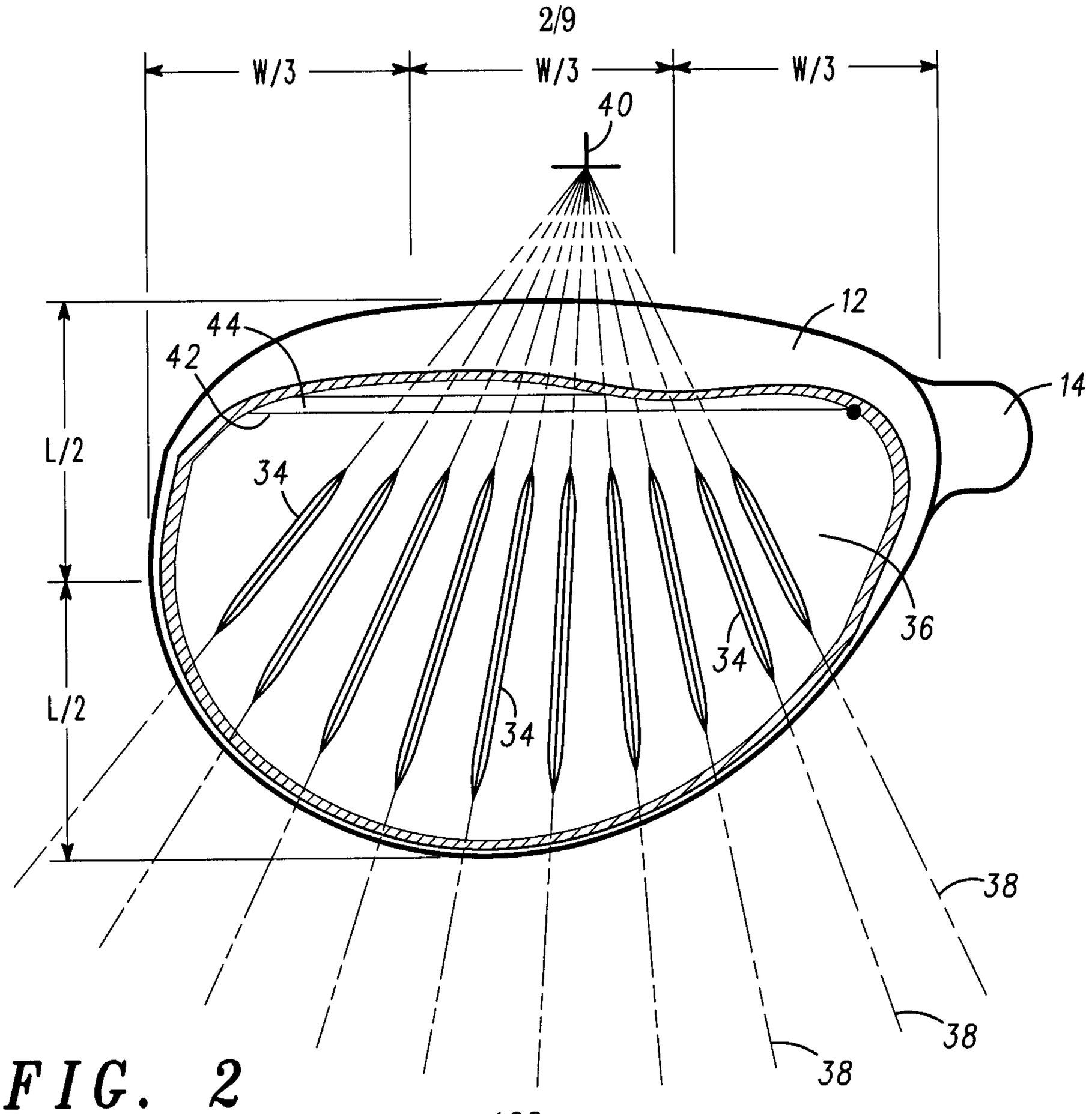


FIG. 3


W/3
W/3
W/3
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12
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14
L/2
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34
L/2
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38
38

FIG. 2

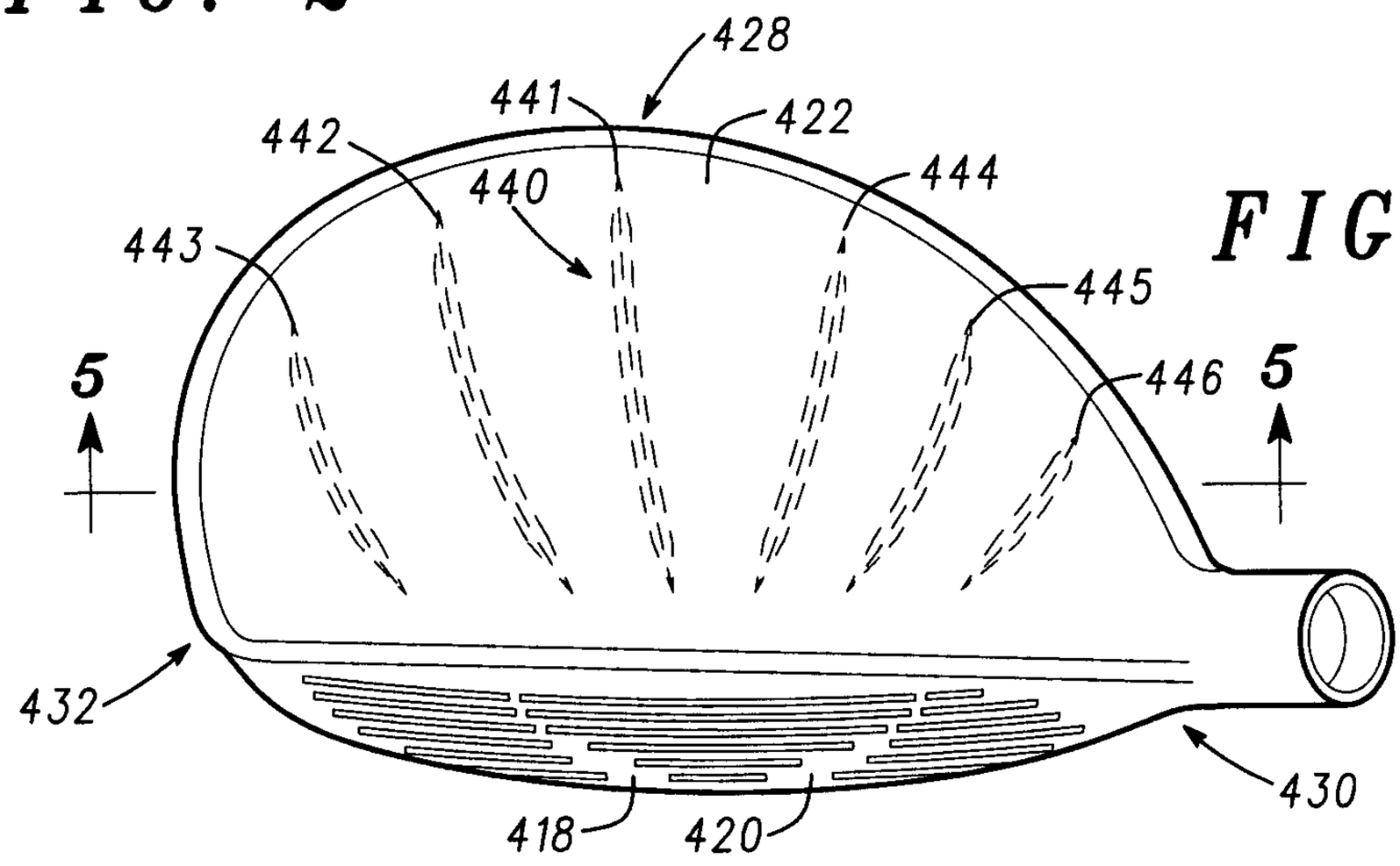
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FIG. 4

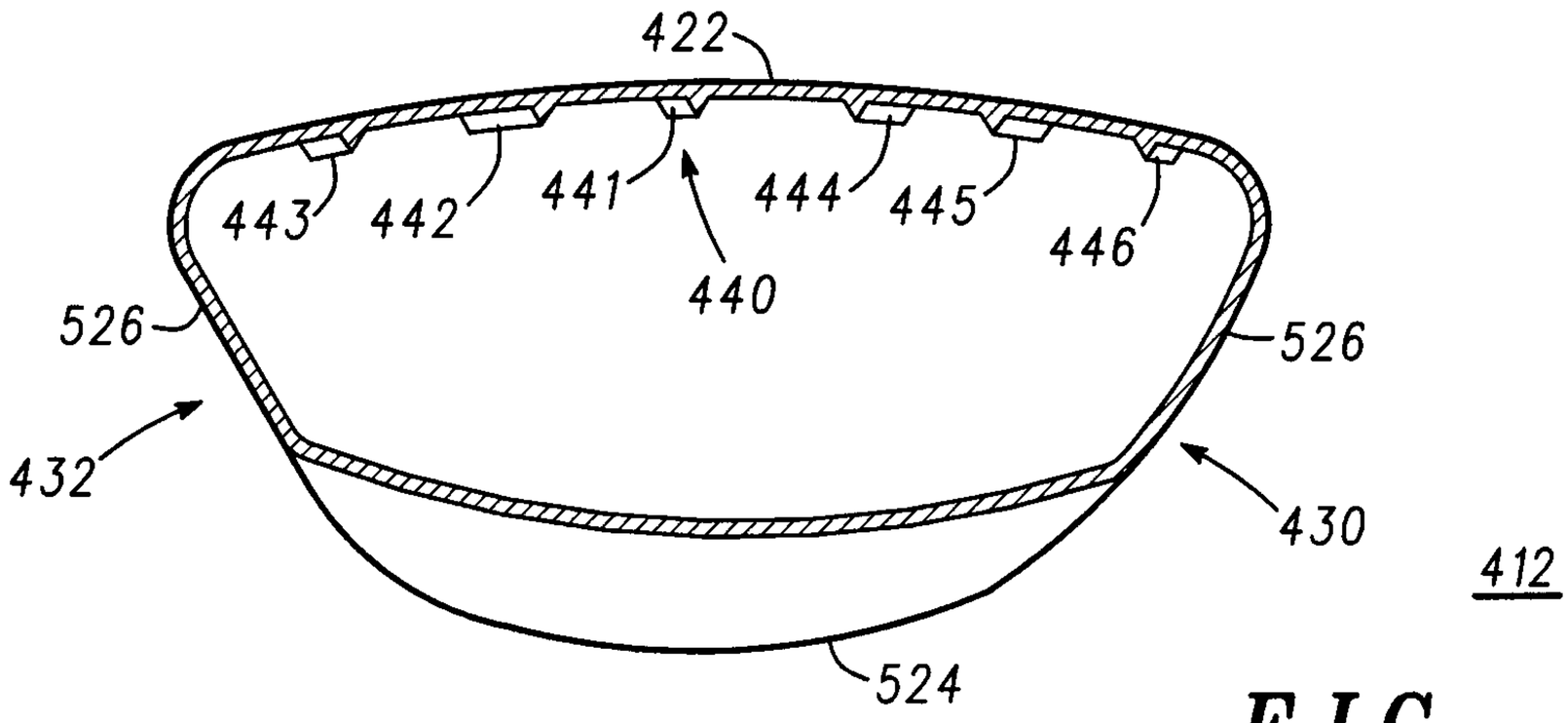
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FIG. 5

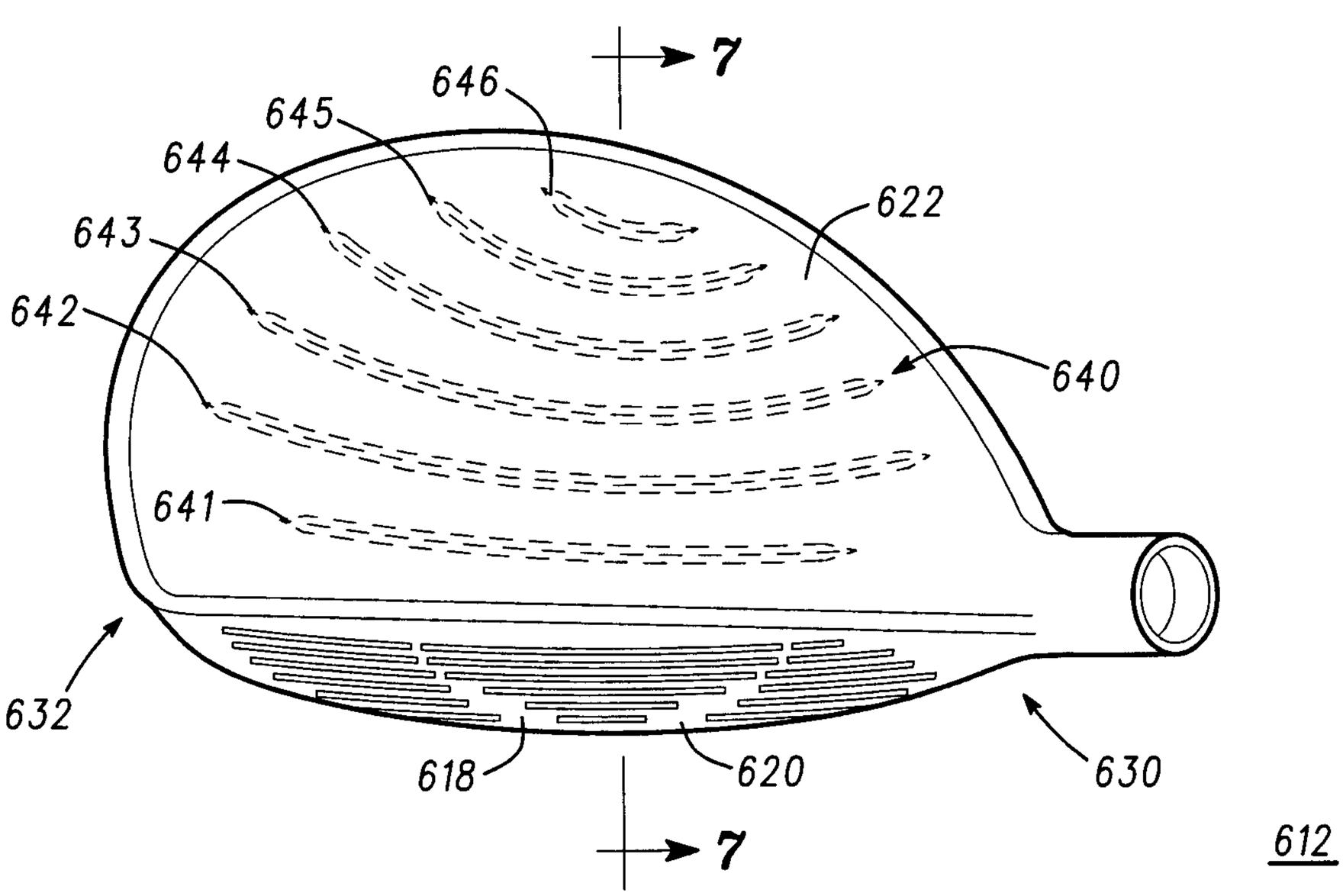
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FIG. 6

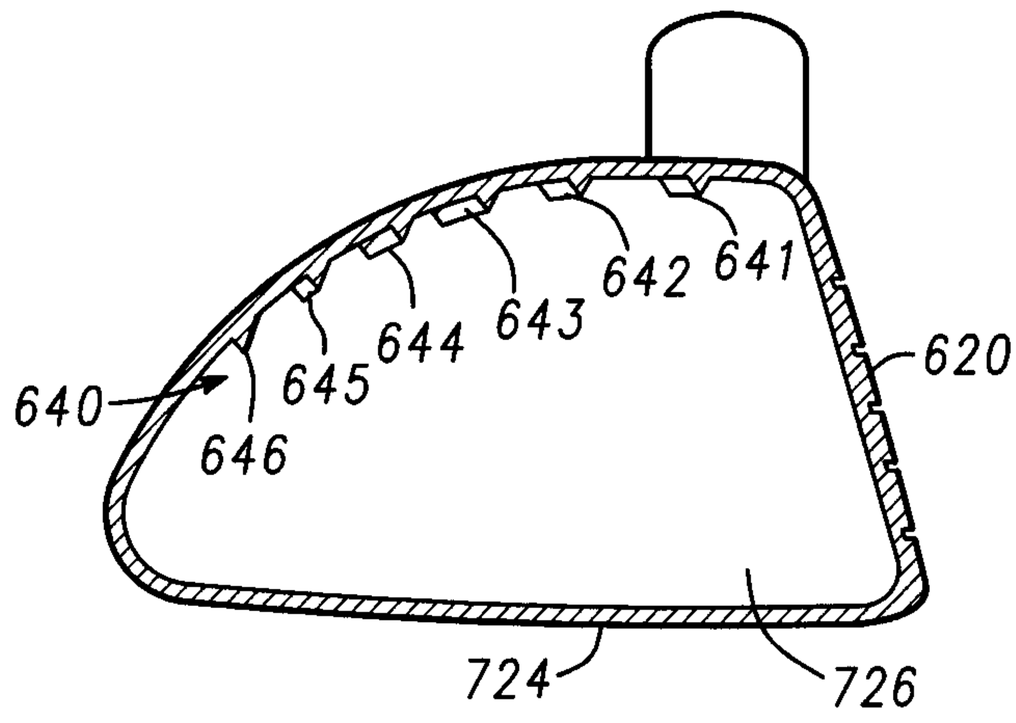
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FIG. 7

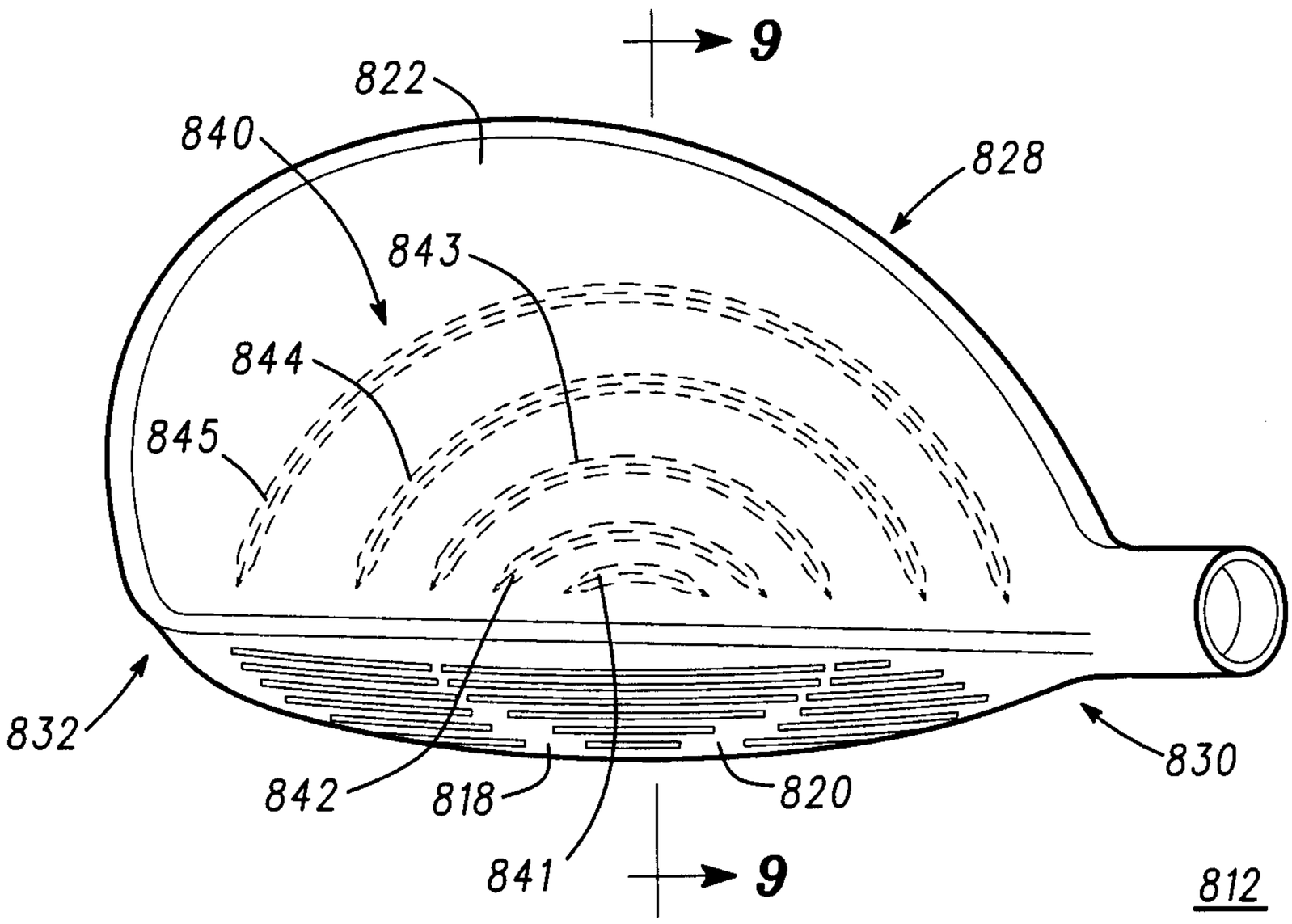
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FIG. 8

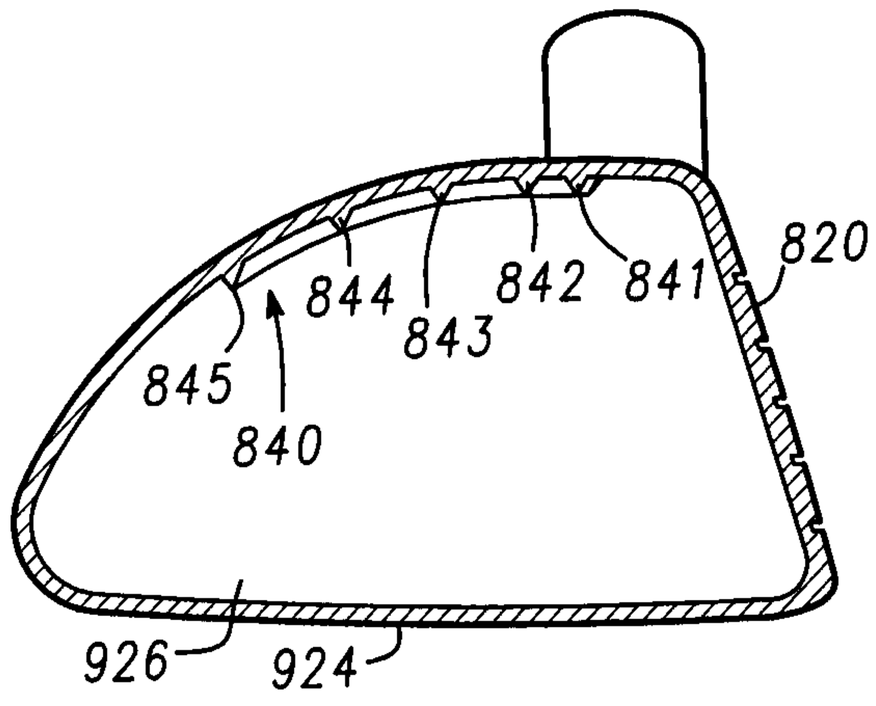
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FIG. 9

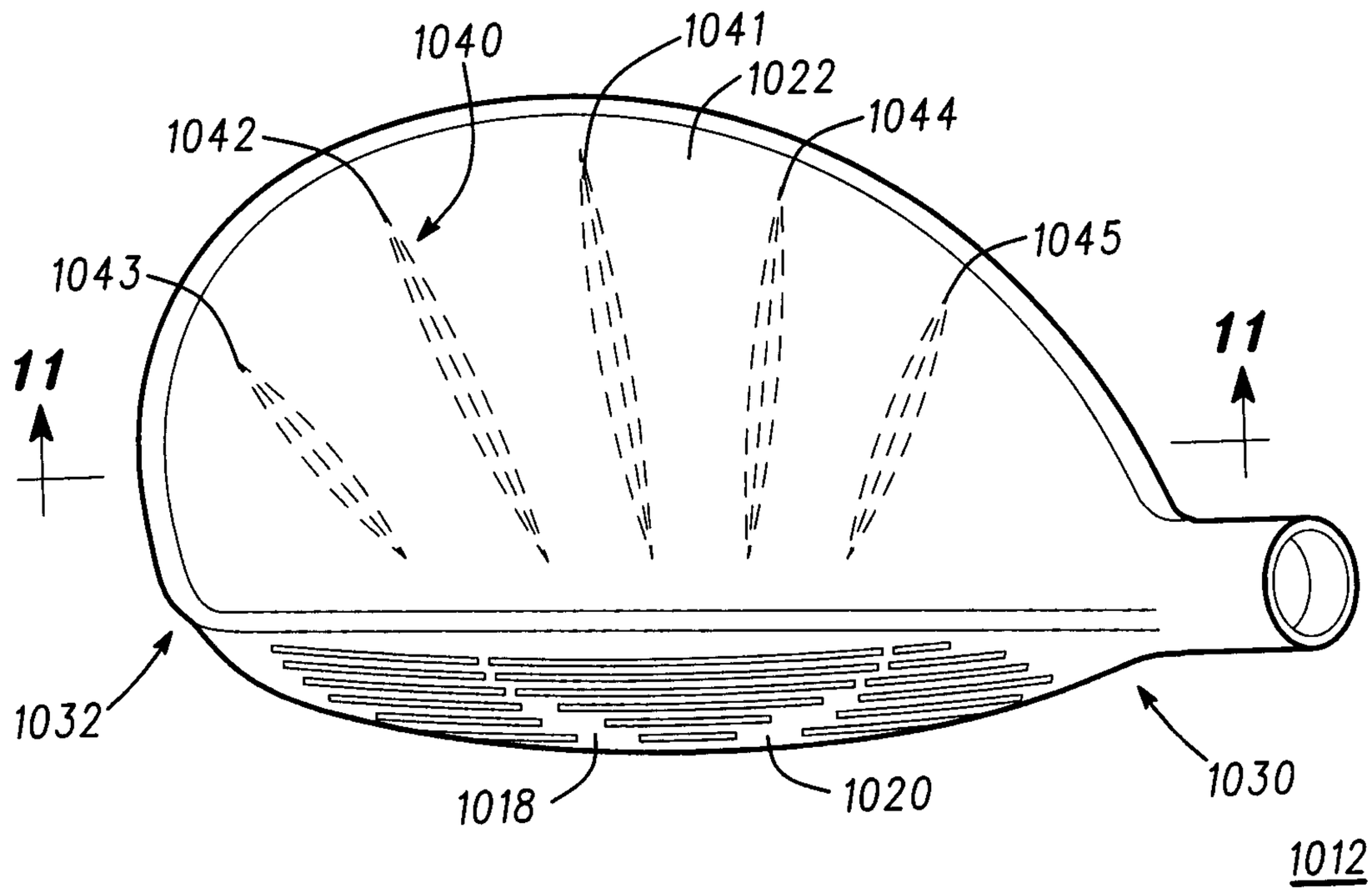
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FIG. 10

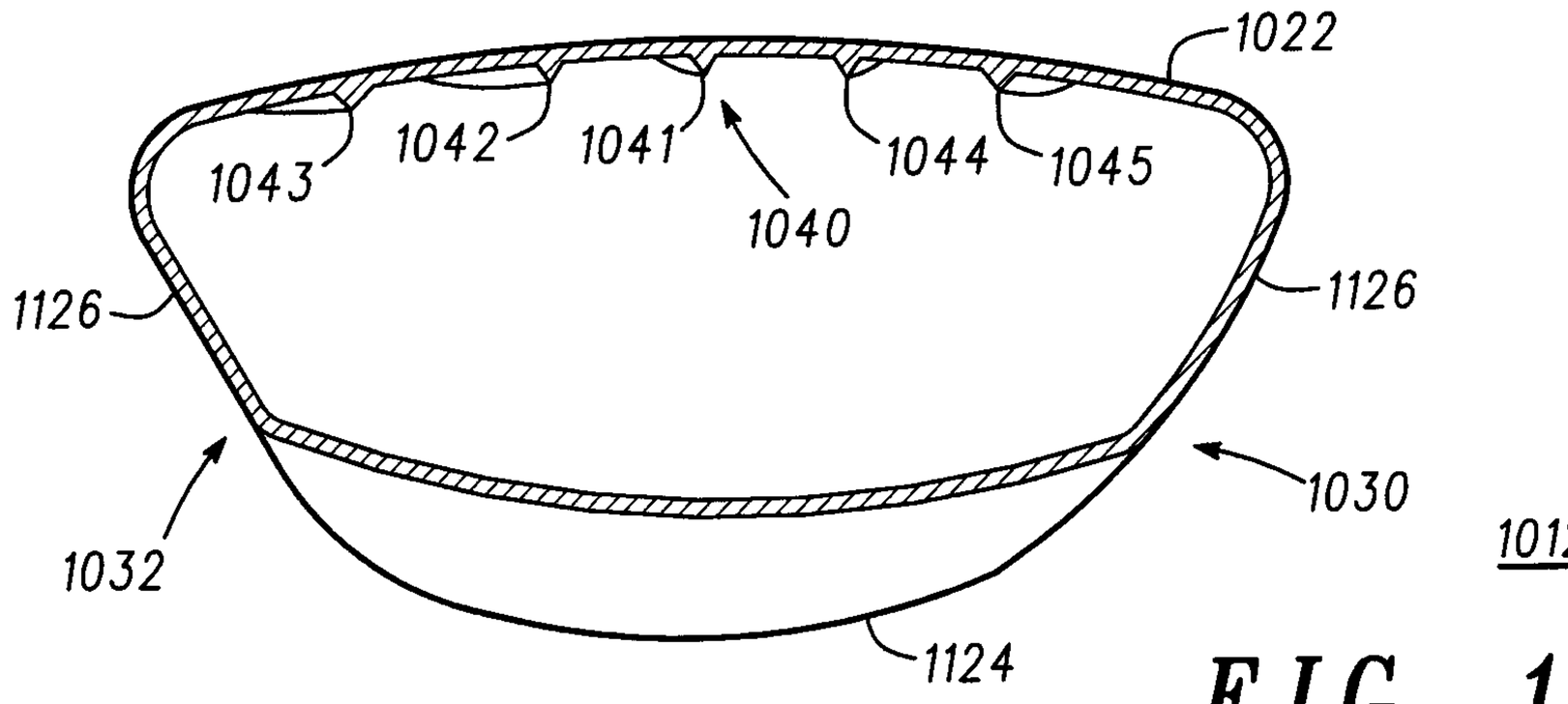
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FIG. 11

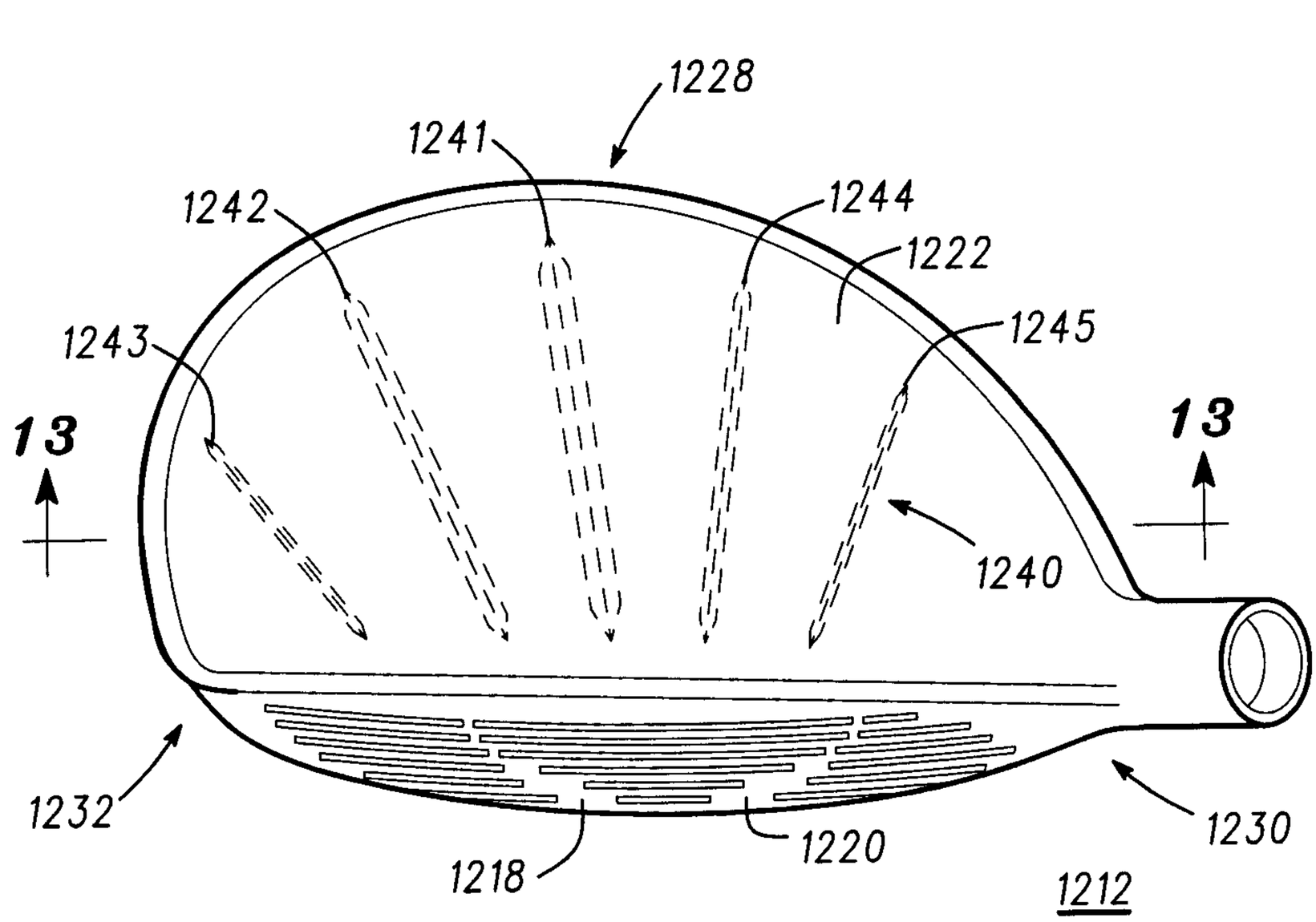
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FIG. 12

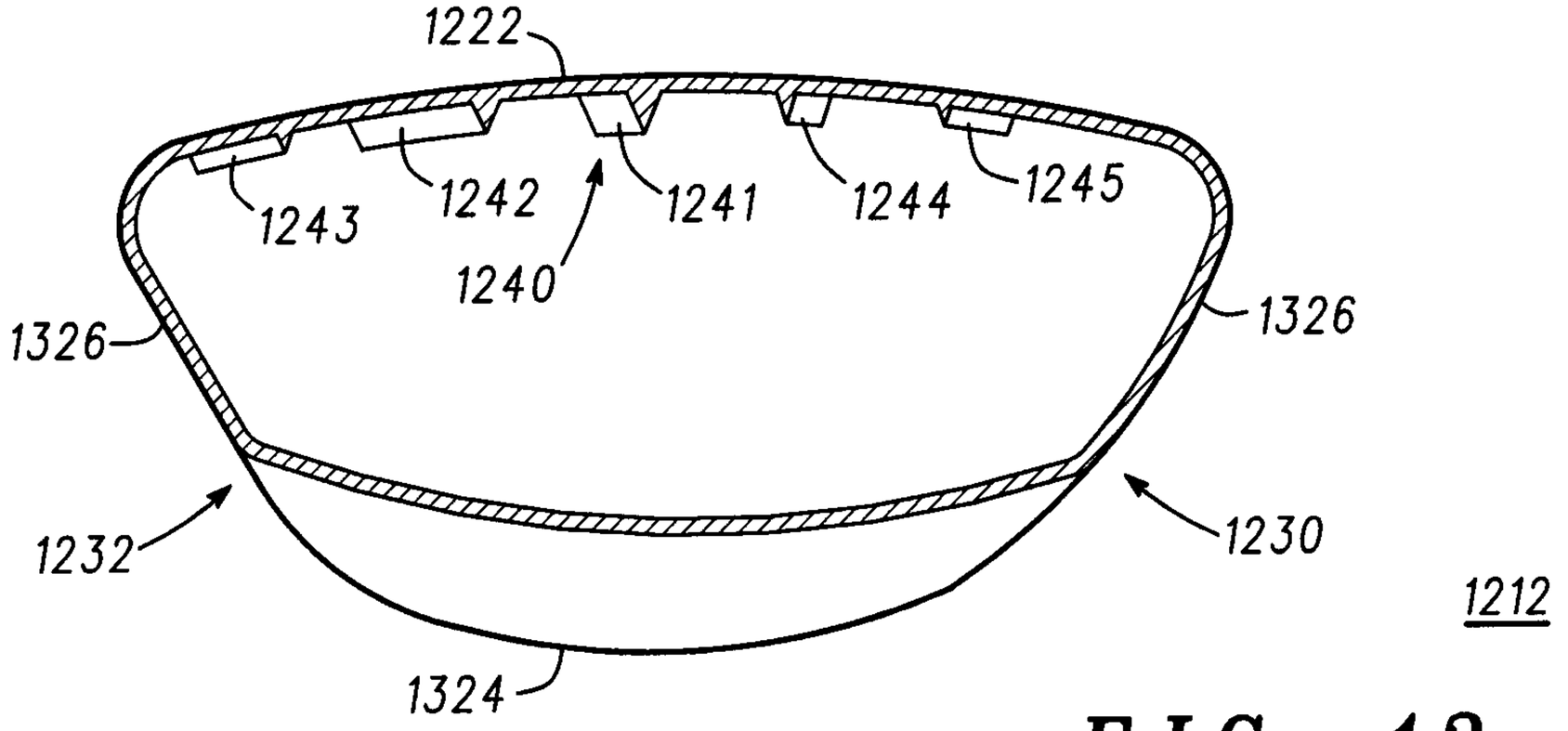
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FIG. 13

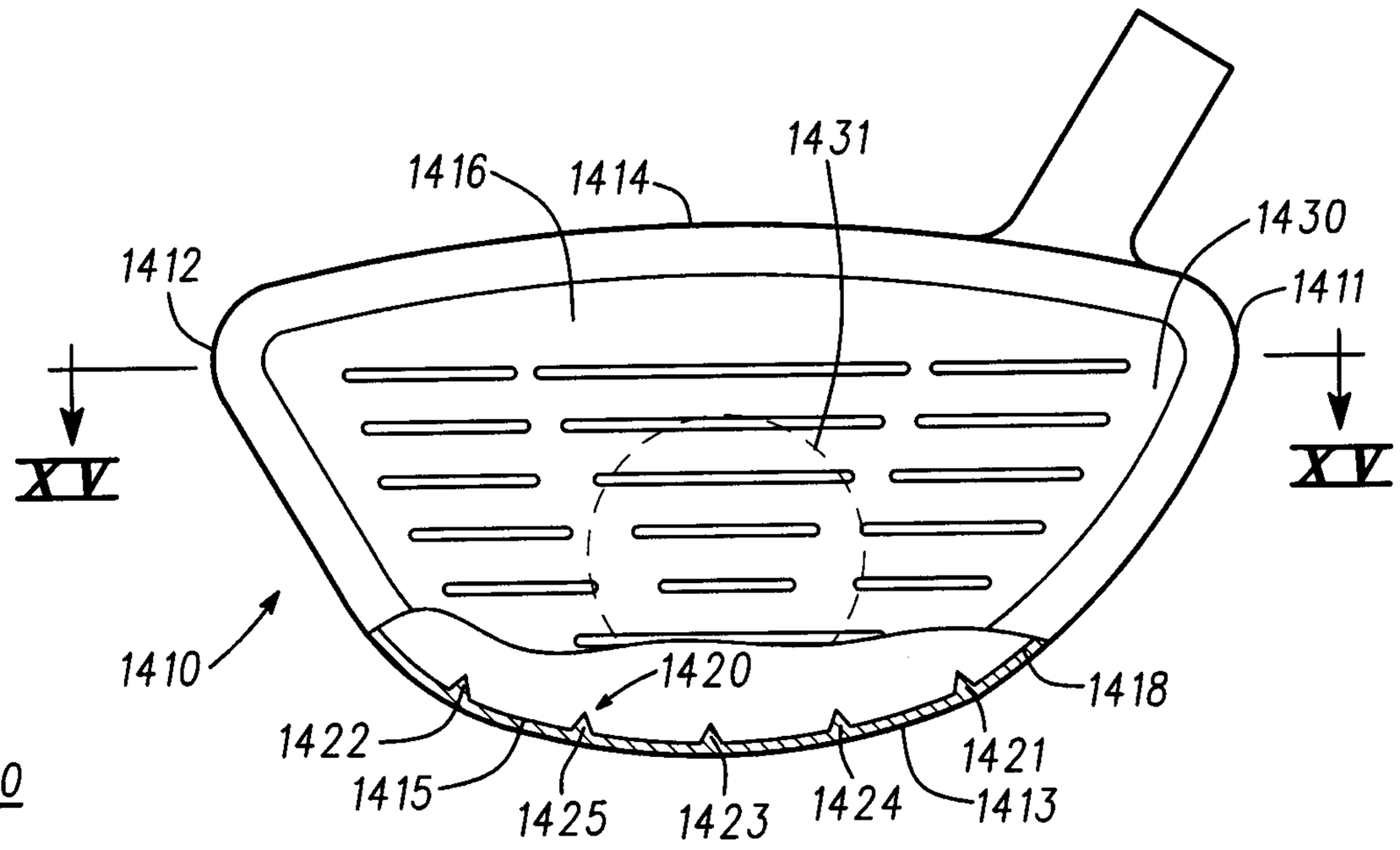
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FIG. 14

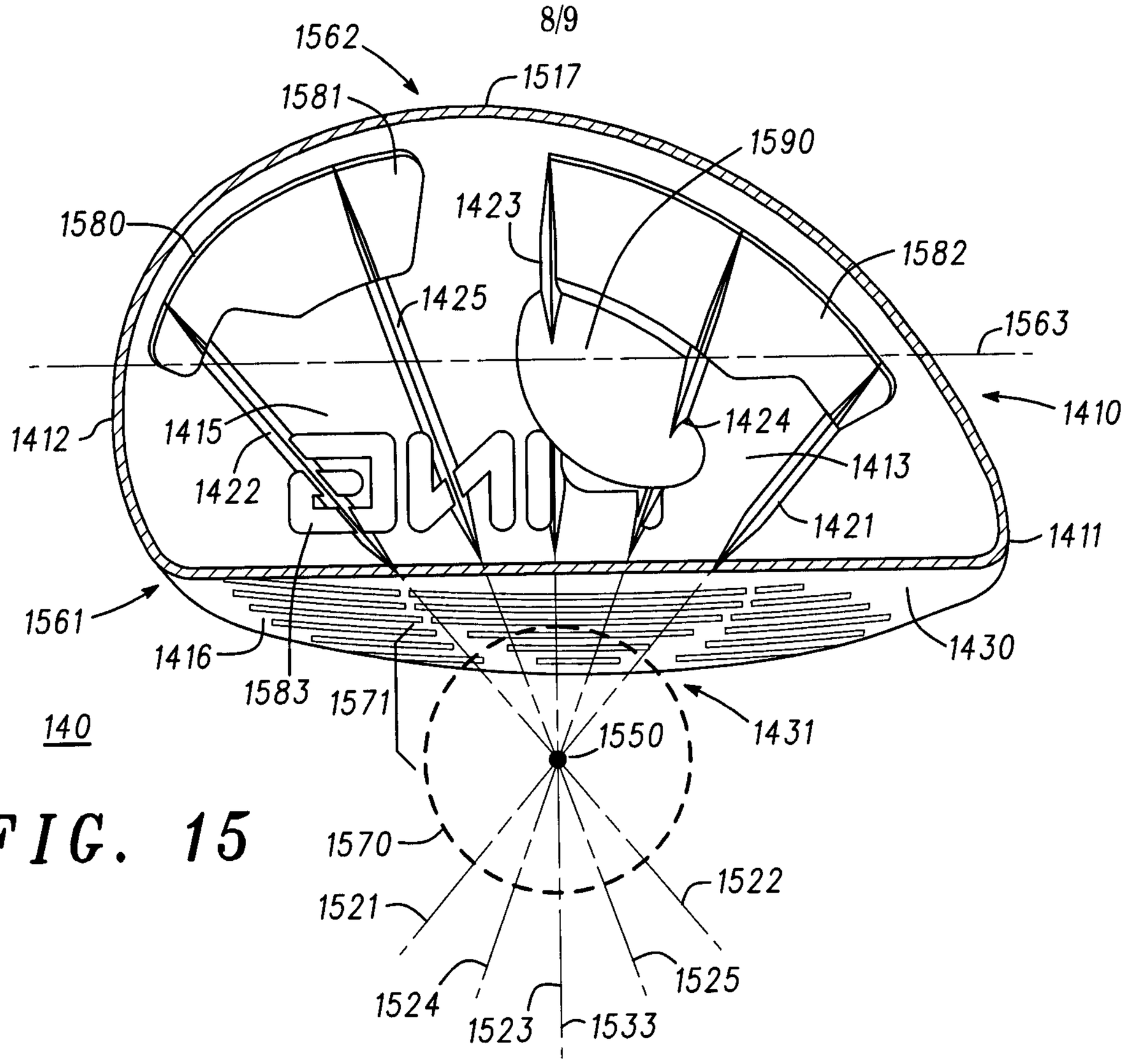
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FIG. 15

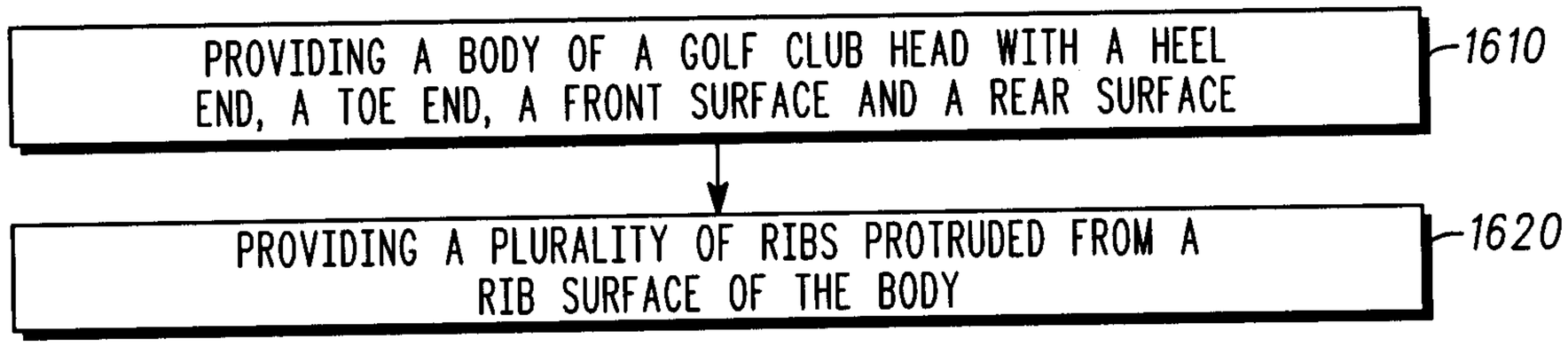
PROVIDING A BODY OF A GOLF CLUB HEAD WITH A HEEL END, A TOE END, A FRONT SURFACE AND A REAR SURFACE
1610
PROVIDING A PLURALITY OF RIBS PROTRUDED FROM A RIB SURFACE OF THE BODY
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FIG. 16

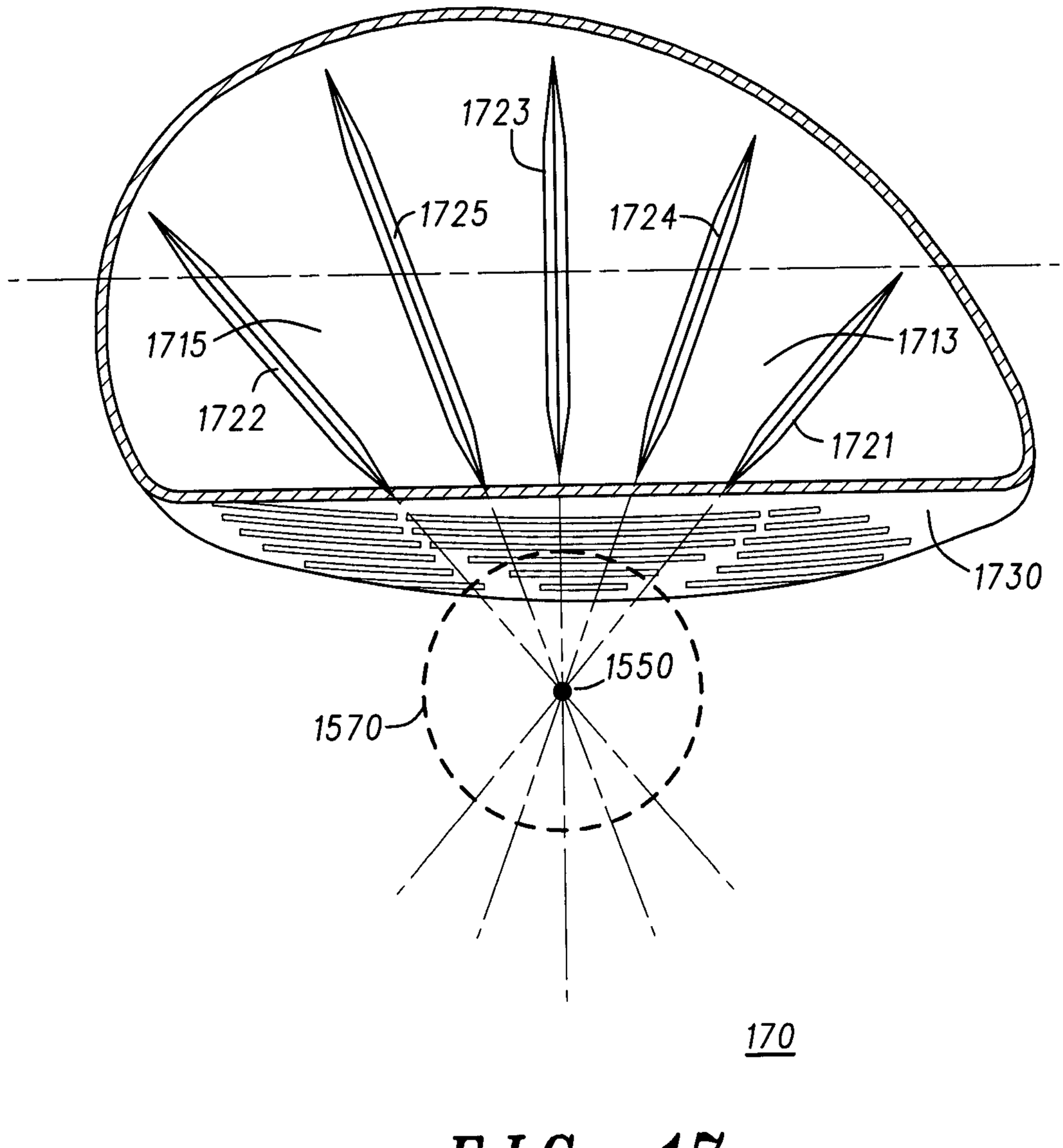
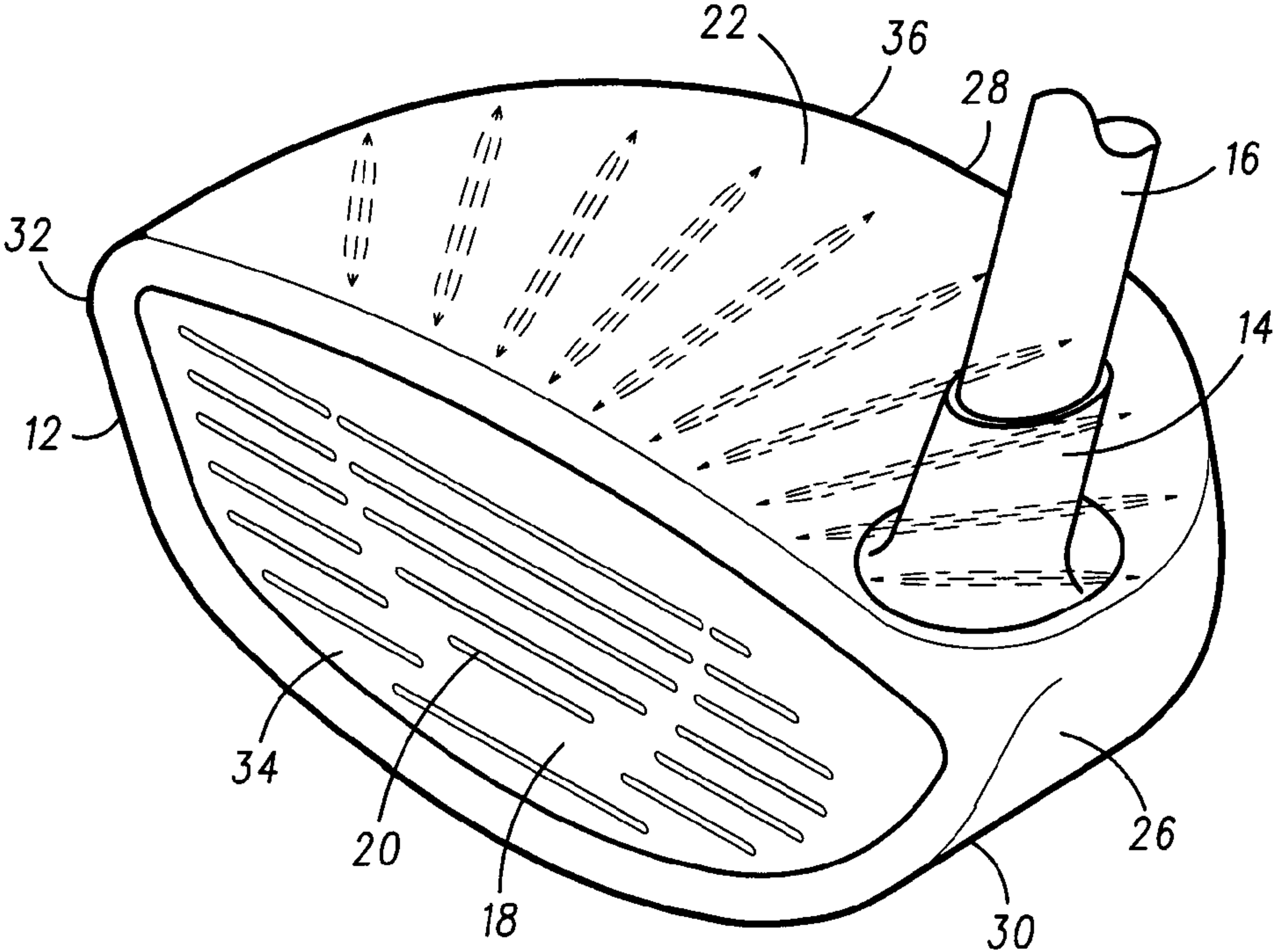


FIG. 17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