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(54) **GOLF CLUB HEAD**

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(57) **ABSTRACT**

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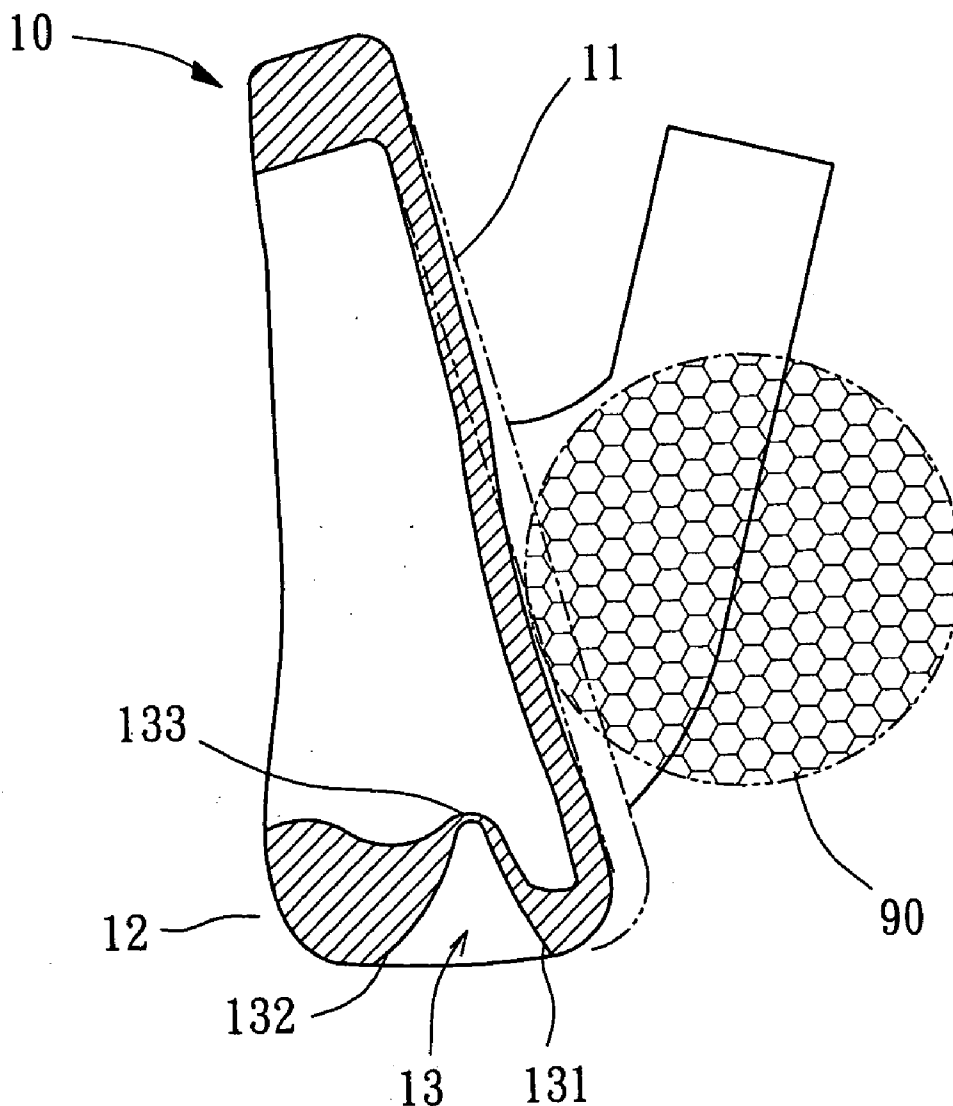
A golf club head includes a face portion disposed on a front face of a golf club head for hitting a golf ball and a sole portion formed on a lower portion of the golf club head. The sole portion includes a recessed deformation portion. The deformation portion includes a deformation-starting section, a deformation-ending section, and a maximum deformation section between the deformation-starting section and the deformation-ending section. A thickness of the deformation-starting section and a thickness of the deformation-ending section decrease toward the maximum deformation section so that the maximum deformation section has the smallest thickness allowing elastic deformation, thereby increasing elastic deforming capability of the sole portion.

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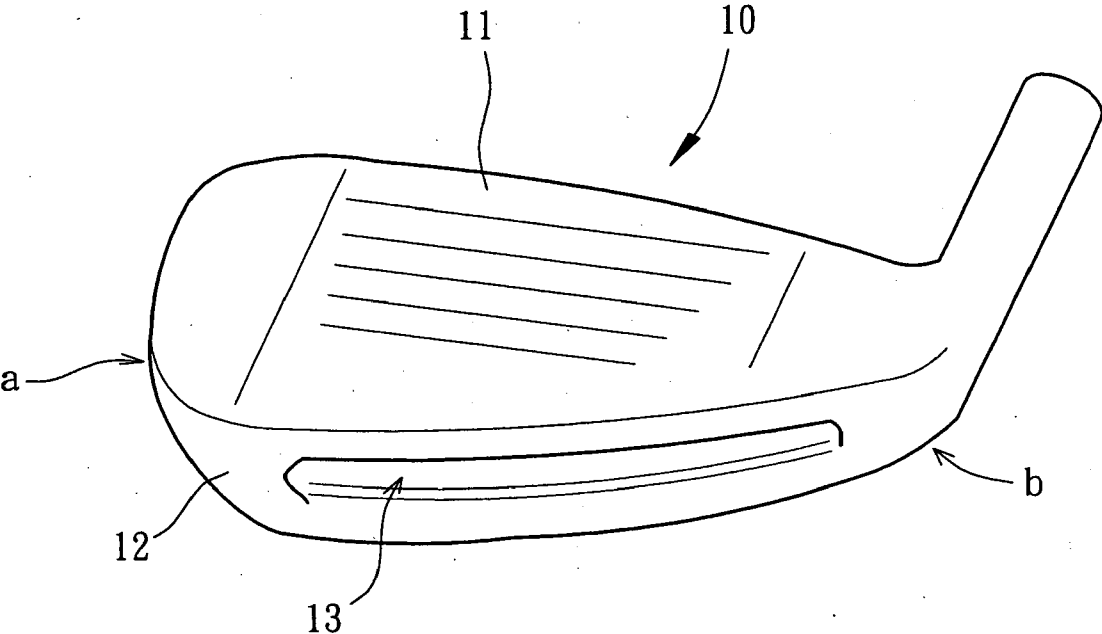


FIG. 1

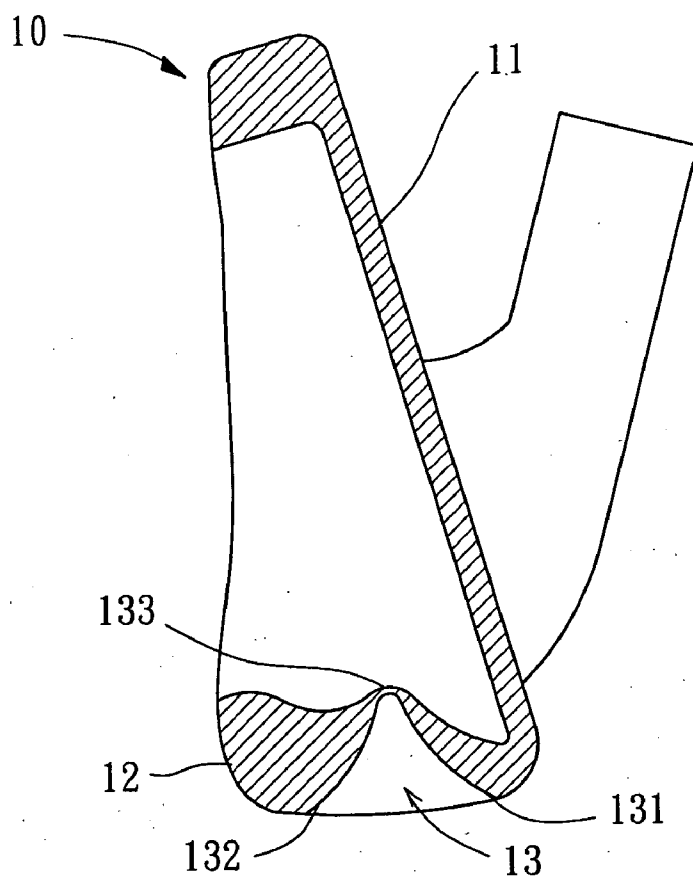


FIG. 2

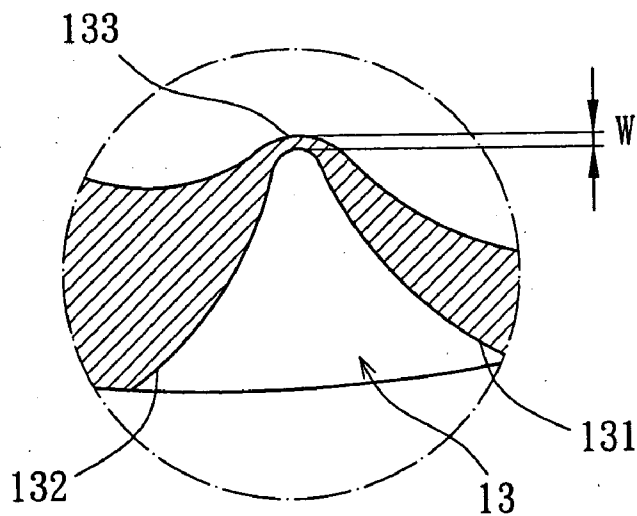


FIG. 3

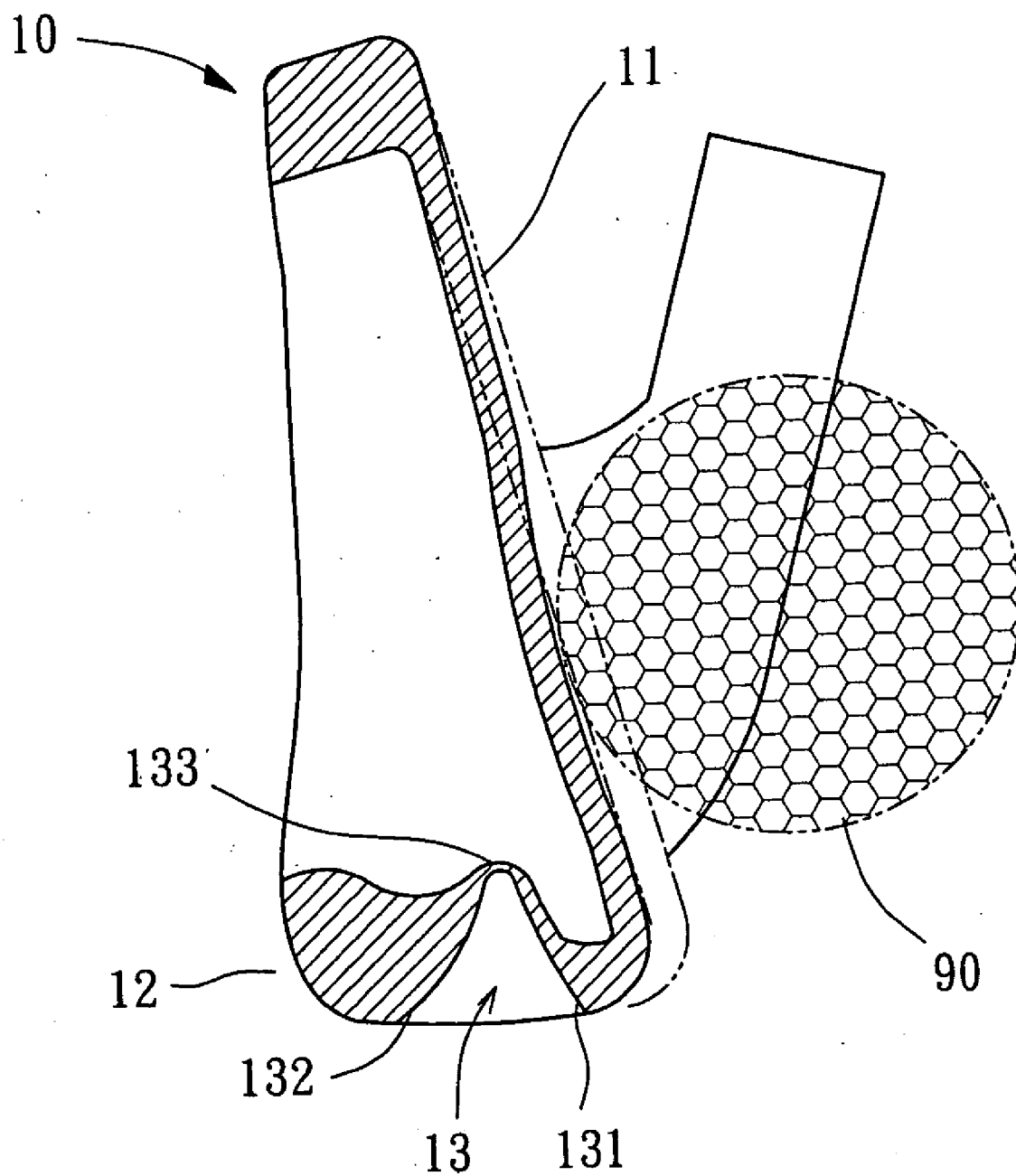


FIG. 4

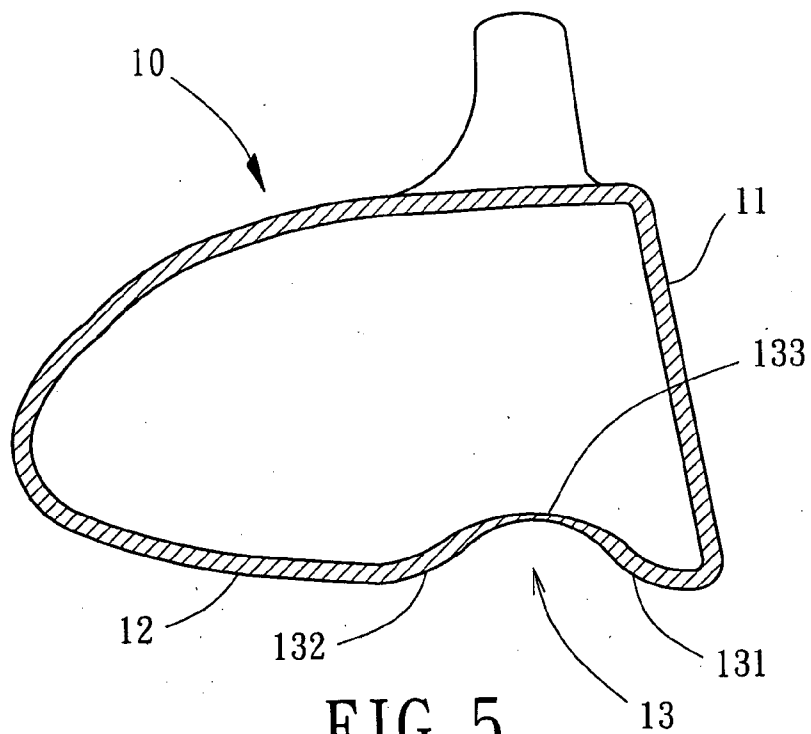


FIG. 5

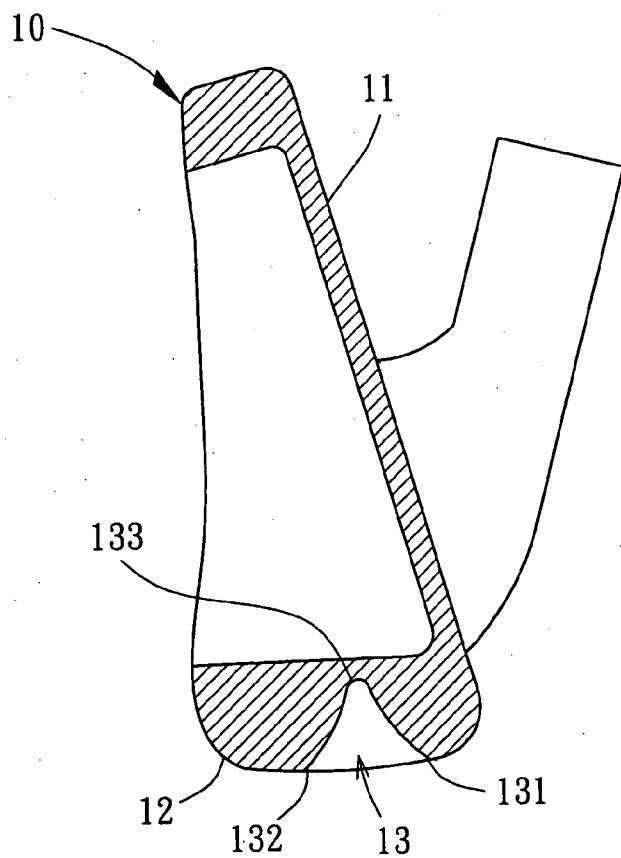


FIG. 6

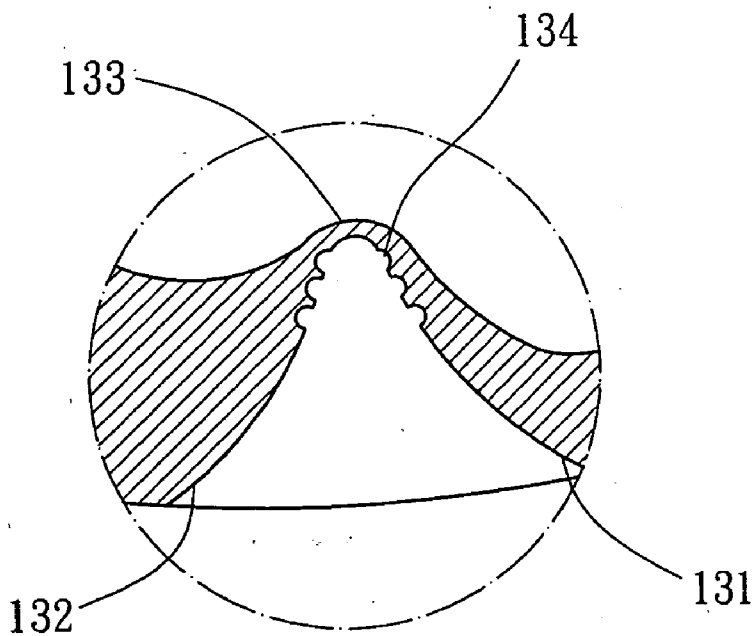


FIG. 7

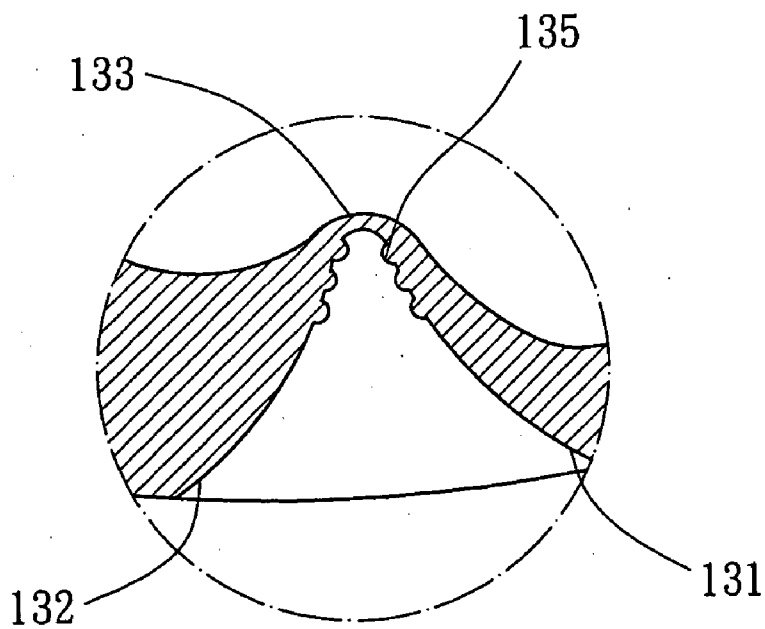


FIG. 8

GOLF CLUB HEAD

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention relates to a golf club head. In particular, the present invention relates to a golf club head with an improved sole portion.

[0003] 2. Description of Related Art

[0004] U.S. Pat. No. 6,887,165 discloses a golf club including a face portion, a sole portion, and a crown portion. The face portion is disposed on a front face of a metallic golf club head and has a hitting surface for hitting a golf ball. The sole portion and the crown portion respectively form a lower portion and an upper portion of the metallic golf club head. A deformation portion is disposed on the sole portion and capable of elastic deformation when a golf ball is struck. The deformation portion comprises a protruding part which protrudes such that the sole portion is formed in an obtuse angle, in continuation with the hitting surface and the face portion in order to enhance an elastic effect. The protruding part has a first corner in the obtuse angle linking the face portion and the sole portion. The protruding part further has a second corner in the sole portion.

[0005] Although the above-mentioned golf club head may enhance the elastic deforming effect of the sole portion and thus the hitting performance by providing a deformation portion without greatly altering the shape of the head, further improvement is not provided in the basic structure of the deformation portion. For example, the deformation portion is generally of a uniform thickness. The elastic effect is enhanced when the thickness of the deformation portion is small, yet the structural strength of the sole portion is adversely affected. On the other hand, the structural strength of the sole portion is enhanced when the deformation portion is thicker, yet the elastic effect is sacrificed. In brief, an optimal elastic effect and maximum carry could not be reached if the deformation portion is merely a result of a change in a shape and angle in the sole portion.

OBJECTS OF THE INVENTION

[0006] An object of the present invention is to provide a golf club head including a deformation portion in a sole portion, wherein maximum deformation occurs in the thinnest portion of the deformation portion, thereby enhancing the elastic effect and the hitting performance.

[0007] Another object of the present invention is to provide a golf club head including a sole portion with a deformation portion near the face portion for shifting the center of gravity of the overall golf club head rearward, allowing more flexible adjustment of the center of gravity of the golf club head.

[0008] A further object of the present invention is to provide a golf club head including a sole portion with a deformation portion, wherein the deformation portion has a plurality of recesses in a surface thereof to enhance the elastic effect and the hitting performance.

[0009] Still another object of the present invention is to provide a golf club head including a sole portion with a deformation portion that has a plurality of protrusions on a surface thereof to improve the structural strength, thereby

enhancing the structural strength of the sole portion and prolonging the life of the golf club head.

SUMMARY OF THE INVENTION

[0010] A golf club head in accordance with the present invention comprises a face portion disposed on a front face of a golf club head for hitting a golf ball and a sole portion formed on a lower portion of the golf club head. The sole portion comprises a recessed deformation portion. The deformation portion comprises a deformation-starting section, a deformation-ending section, and a maximum deformation section between the deformation-starting section and the deformation-ending section. A thickness of the deformation-starting section and a thickness of the deformation-ending section decrease toward the maximum deformation section so that the maximum deformation section has the smallest thickness allowing elastic deformation, thereby increasing elastic deforming capability of the sole portion.

[0011] Preferably, the deformation portion extends from a toe portion of the golf club head to a heel portion of the golf club head.

[0012] Preferably, the deformation portion protrudes toward a blade of the golf club head.

[0013] Preferably, the deformation portion is near the face portion.

[0014] Preferably, the deformation portion is an elongated groove.

[0015] In a modified embodiment of the invention, the sole portion comprises a flat inner face and a flat outer face, and the deformation portion is formed on the flat outer face adjacent to the face portion.

[0016] In another embodiment of the invention, the deformation portion comprises a plurality of recesses in an outer face thereof for increasing elastic deforming capability of the deformation portion.

[0017] In a further embodiment of the invention, the deformation portion comprises a plurality of protrusions on an outer face thereof for enhancing structural strength of the deformation portion.

[0018] The golf club head may be a head of an iron club, a wood club, or a utility golf club.

[0019] Other objects, advantages and novel features of this invention will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020] FIG. 1 is a perspective view of a first embodiment of a golf club head in accordance with the present invention;

[0021] FIG. 2 is a sectional view of the first embodiment of the golf club head in accordance with the present invention;

[0022] FIG. 3 is an enlarged view of a portion of the golf club head in FIG. 2;

[0023] FIG. 4 is a sectional view similar to FIG. 2, illustrating deformation of the golf club head when hitting a golf ball;

[0024] FIG. 5 is a sectional view of a second embodiment of the golf club head in accordance with the present invention;

[0025] FIG. 6 is a sectional view of a third embodiment of the golf club head in accordance with the present invention;

[0026] FIG. 7 is a sectional view similar to FIG. 3, illustrating a fourth embodiment of the golf club head in accordance with the present invention; and

[0027] FIG. 8 is a sectional view similar to FIG. 3, illustrating a fifth embodiment of the golf club head in accordance with the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0028] Referring to FIGS. 1 through 3, a first embodiment of a golf club head 10 in accordance with the present invention comprises a face portion 11, a sole portion 12, a toe portion "a" and a heel portion "b". In the illustrated embodiment, the golf club head is an iron club head made by casting, forging, or mechanical processing. The face portion 11 is disposed on a front face of the golf club head for hitting a golf ball. The sole portion 12 forms a lower portion of the golf club head.

[0029] The sole portion 12 comprises a deformation portion 13. In the illustrated embodiment, the deformation portion 13 is formed on an outer face of the sole portion 12 near the face portion 11, with an inner face of the sole portion 12 protruding upward toward a blade (not labeled) of the golf club head 10. The deformation portion 13 extends from the toe portion "a" to the heel portion "b" of the golf club head 10, providing a structure with enhanced elastic effect.

[0030] The deformation portion 13 comprises a deformation-starting section 131, a deformation-ending section 132, and a maximum deformation section 133 between the deformation-starting section 131 and the deformation-ending section 132. The deformation-starting section 131 is formed on a side of the deformation portion 13 near the face portion 11. The deformation-ending section 132 is formed on the other side of the deformation portion 13 near a rear portion of the golf club head 10. The maximum deformation section 133 between the deformation-starting section 131 and the deformation-ending section 132 bends upward toward the blade of the golf club head.

[0031] As best shown in FIG. 3, the thickness of the deformation-starting section 131 and the thickness of the deformation-ending section 132 decrease toward the maximum deformation section 133 so that the maximum deformation section 133 has the smallest thickness W, providing an elongated groove (not labeled). Thus, the elastic deforming capability of the sole portion 12 of the golf club head 10 is increased without sacrificing the structural strength of the sole portion 12. The hitting performance of the golf club head 10 is enhanced accordingly.

[0032] Referring to FIG. 4, when hitting a golf ball 90 with the golf club head 10 in accordance with the present invention, at the moment the golf ball 90 comes in contact with the face portion 11, a rearward momentum is applied to the face portion 11. At this time, the face portion 11 and the deformation-starting section 131 of the deformation portion

13 begin to progressively deform toward the deformation-ending section 132. Since the maximum deformation section 133 has the smallest thickness, a relatively larger rearward deforming capability is provided for the face portion 11 and the deformation-starting section 131;

[0033] Then, the deformation-starting portion 131 creates a restitution force toward the face portion 11 by the restitution property of the sole portion 12, which restitution force is transmitted to the golf ball 90, increasing the striking momentum of the golf club head 10 and thus the hitting effect (the flying distance of the golf ball 90). A perimeter of the deformation portion 13 is well supported and the thickness of the deformation portion 13 varies without sacrificing the structural strength of the sole portion 12.

[0034] FIG. 5 illustrates a second embodiment of the invention. In this embodiment, the golf club head 10 is a head of a wood club or utility golf club. Similarly, the sole portion 12 comprises a deformation portion 13 near the face portion 11. The deformation portion 13 extends from the toe portion (not labeled) through the heel portion (not labeled) of the golf club head 10.

[0035] The deformation portion 13 comprises a deformation-starting section 131, a deformation-ending section 132, and a maximum deformation section 133 between the deformation-starting section 131 and the deformation-ending section 132. The thickness of the deformation-starting section 131 and the thickness of the deformation-ending section 132 decrease toward the maximum deformation section 133 so that the maximum deformation section 133 has the smallest thickness. Thus, the elastic deforming capability of the sole portion 12 of the golf club head 10 is increased without sacrificing the structural strength of the sole portion 12. The hitting performance of the golf club head 10 is enhanced accordingly.

[0036] FIG. 6 illustrates a third embodiment of the invention modified from the first embodiment. The difference between the third embodiment and the first embodiment is that the sole portion 12 of the golf club head 10 of the third embodiment has greater thickness and a flat inner face and that the deformation portion 13 is substantially a groove in the outer face of the sole portion 12 near the face portion 11. Complex structure of the sole portion 12 is avoided and the deformation portion 13 can be located as near to the face portion 11 as possible. The elastic deforming capability of the sole portion 12 of the golf club head 10 is increased without sacrificing the structural strength of the sole portion 12. The hitting performance of the golf club head 10 is enhanced accordingly. Further, the deformation portion 13 shifts the center of gravity of the golf club head 10 rearward, thereby allowing more flexible adjustment of the center of gravity of the golf club head.

[0037] FIG. 7 illustrates a fourth embodiment of the invention modified from the first embodiment, wherein a plurality of recesses 134 are defined in the outer face of the sole portion 12. Preferably, the recesses 134 are located adjacent to the maximum deformation section 133. The recesses 134 may be in the form of dimples or annular grooves. The recesses 134 may be arranged regularly or irregularly and have identical or different sizes. The recesses 134 further increase the elastic deforming capability of the deformation portion 13.

[0038] FIG. 8 illustrates a fifth embodiment of the invention modified from the first embodiment, wherein a plurality

of protrusions 135 are formed on the outer face of the sole portion 12. Preferably, the protrusions 135 are located adjacent to the maximum deformation section 133. The protrusions 135 may be in the form of separate spots or annular ribs. The protrusions 135 may be arranged regularly or irregularly and have identical or different sizes. The protrusions 135 further enhance the structural strength of the deformation portion 13, thereby prolong the life of the golf club head 10.

[0039] While the principles of this invention have been disclosed in connection with specific embodiments, it should be understood by those skilled in the art that these descriptions are not intended to limit the scope of the invention, and that any modification and variation without departing the spirit of the invention is intended to be covered by the scope of this invention defined only by the appended claims.

What is claimed is:

- 1. A golf club head comprising:
 - a face portion disposed on a front face of a golf club head for hitting a golf ball; and
 - a sole portion formed on a lower portion of the golf club head, the sole portion comprising a recessed deformation portion, the deformation portion comprising a deformation-starting section, a deformation-ending section, and a maximum deformation section between the deformation-starting section and the deformation-ending section, a thickness of the deformation-starting section and a thickness of the deformation-ending section decreasing toward the maximum deformation

- section so that the maximum deformation section has the smallest thickness allowing elastic deformation, thereby increasing elastic deforming capability of the sole portion.
- 2. The golf club head as claimed in claim 1, wherein the deformation portion extends from a toe portion of the golf club head to a heel portion of the golf club head.
- 3. The golf club head as claimed in claim 1, wherein the deformation portion protrudes toward a blade of the golf club head.
- 4. The golf club head as claimed in claim 1, wherein the deformation portion is near the face portion.
- 5. The golf club head as claimed in claim 1, wherein the deformation portion is an elongated groove.
- 6. The golf club head as claimed in claim 1, wherein the sole portion comprises a flat inner face and a flat outer face, and wherein the deformation portion is formed on the flat outer face adjacent to the face portion.
- 7. The golf club head as claimed in claim 1, wherein the deformation portion comprises a plurality of recesses in an outer face thereof for increasing elastic deforming capability of the deformation portion.
- 8. The golf club head as claimed in claim 1, wherein the deformation portion comprises a plurality of protrusions on an outer face thereof for enhancing structural strength of the deformation portion.
- 9. The golf club head as claimed in claim 1, wherein the golf club head is a head of one of an iron club, a wood club, and a utility golf club.

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