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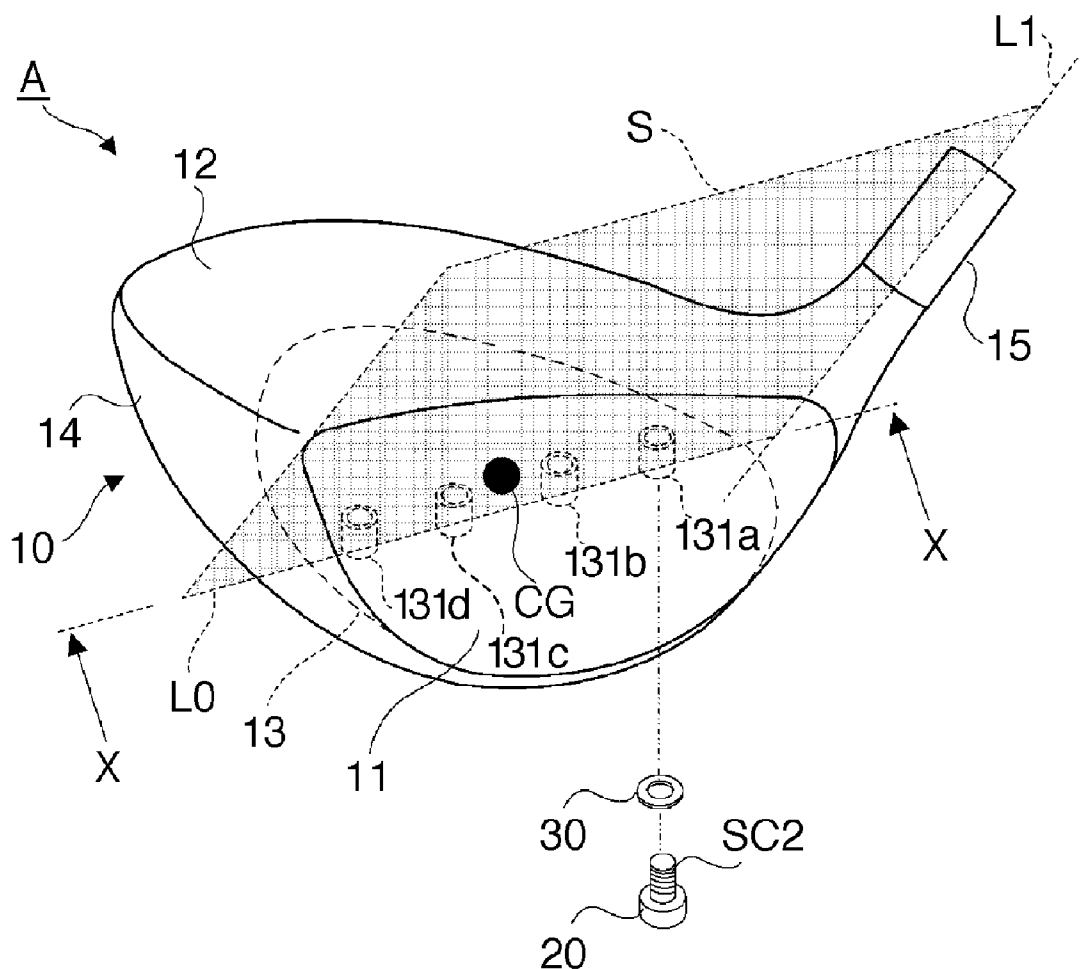
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A golf club head of this invention includes a head body, a weight member attached to the head body, and a fixing unit to fix the weight member at one of a plurality of attachment positions of the head body. The plurality of attachment positions are located on a plane. The plane includes the center-of-gravity position of the head body without the weight member attached thereto and the axis of a shaft to be attached to the golf club head.



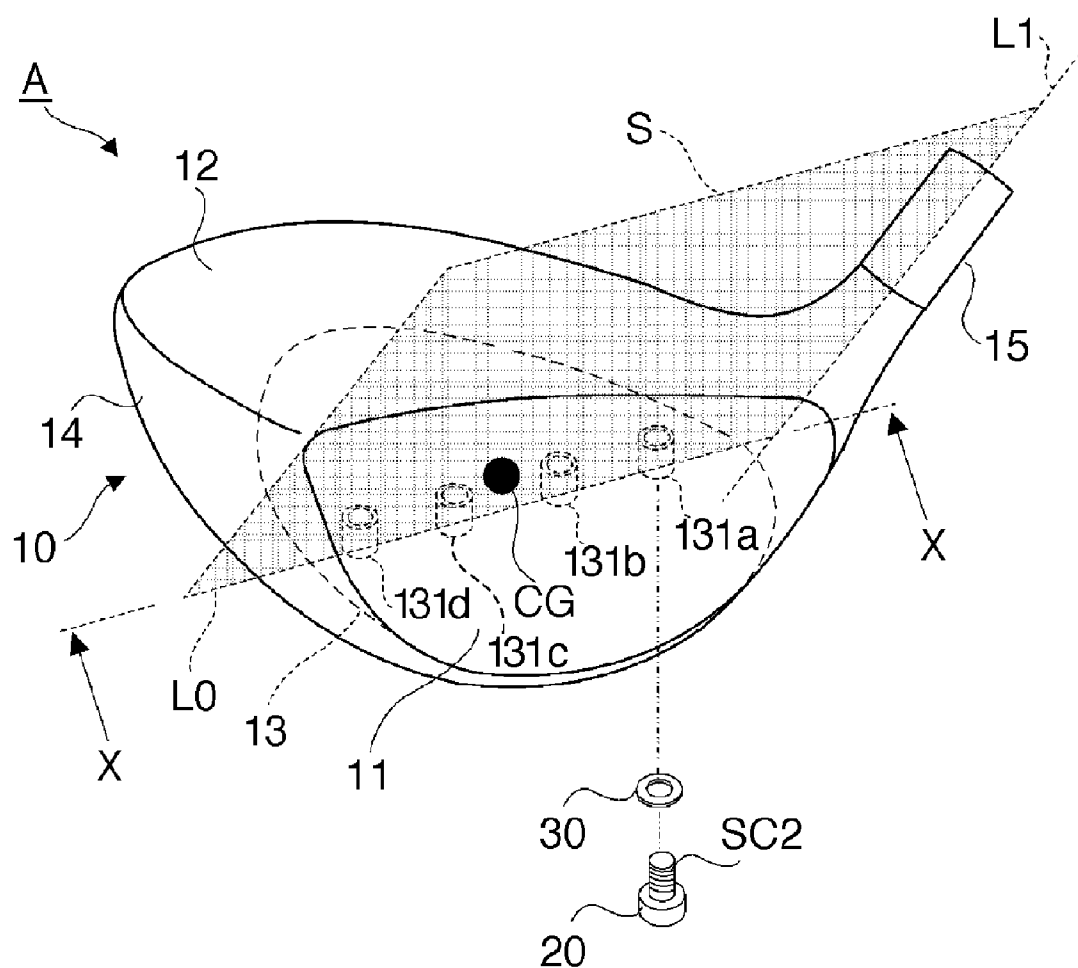


FIG. 2

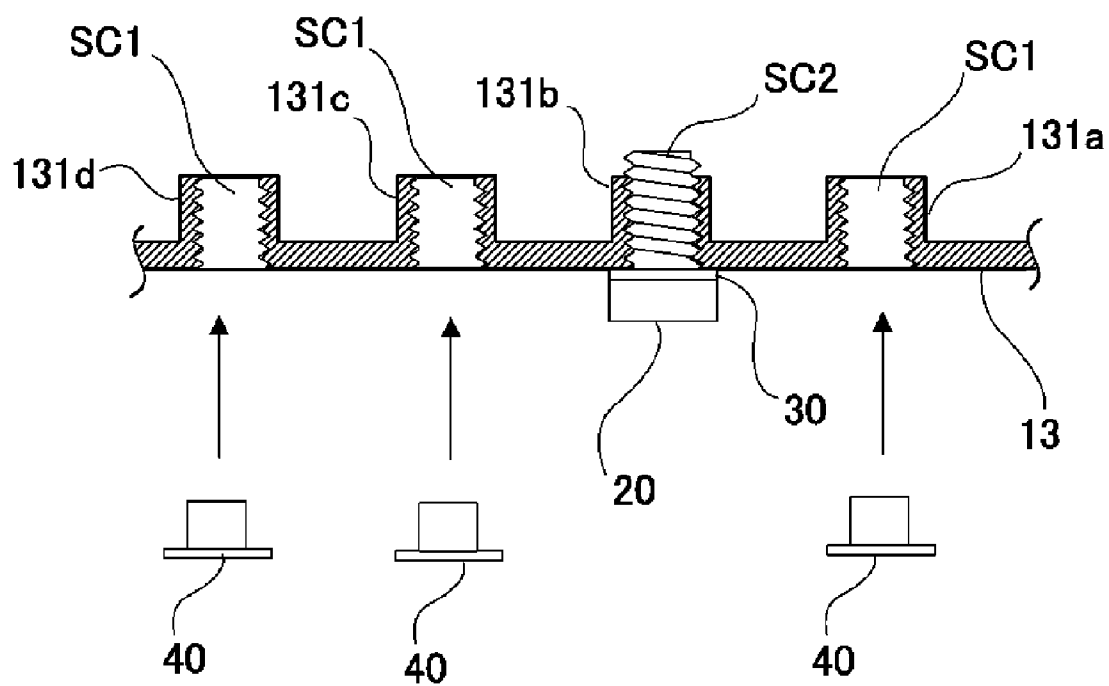


FIG. 3

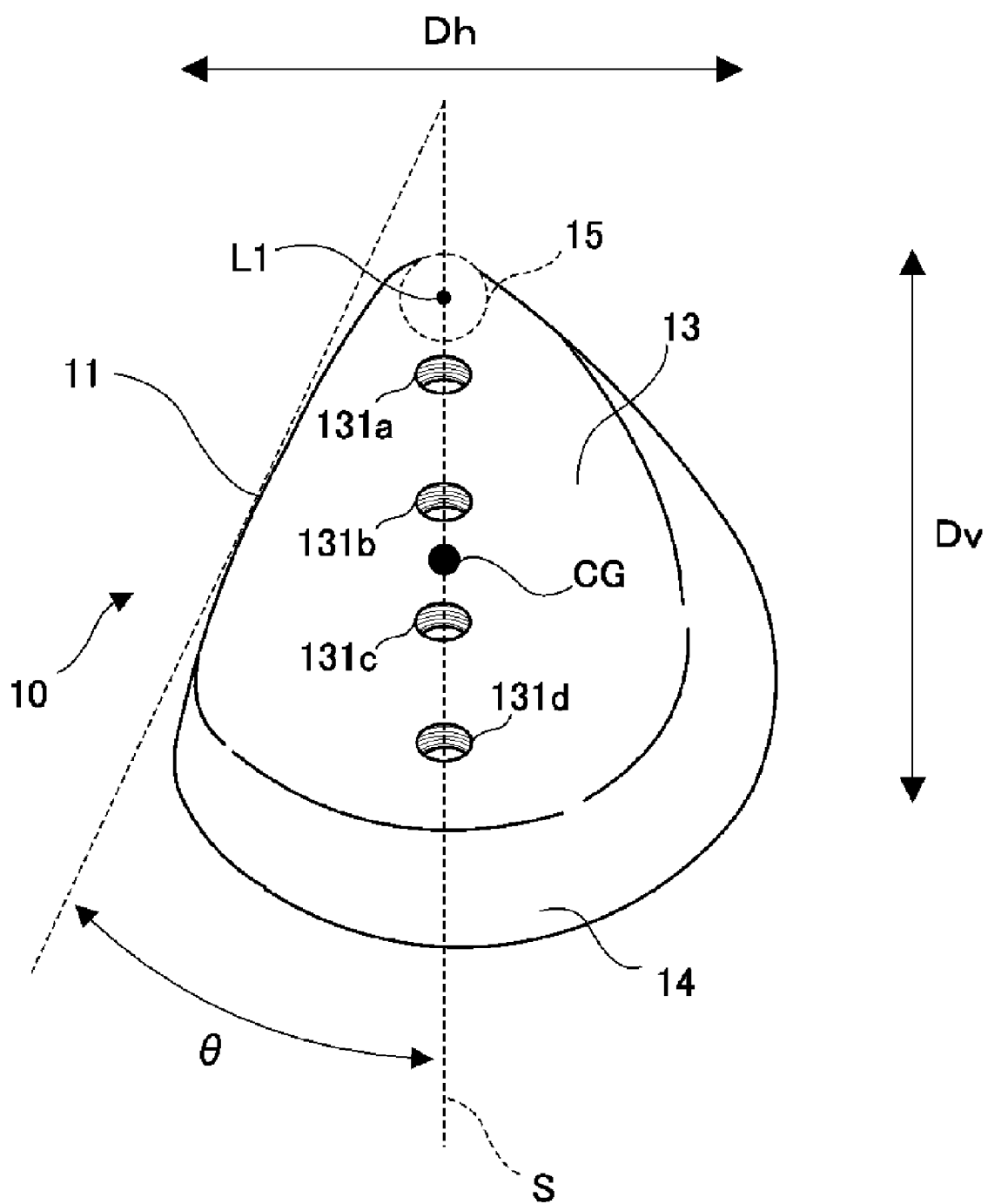


FIG. 4

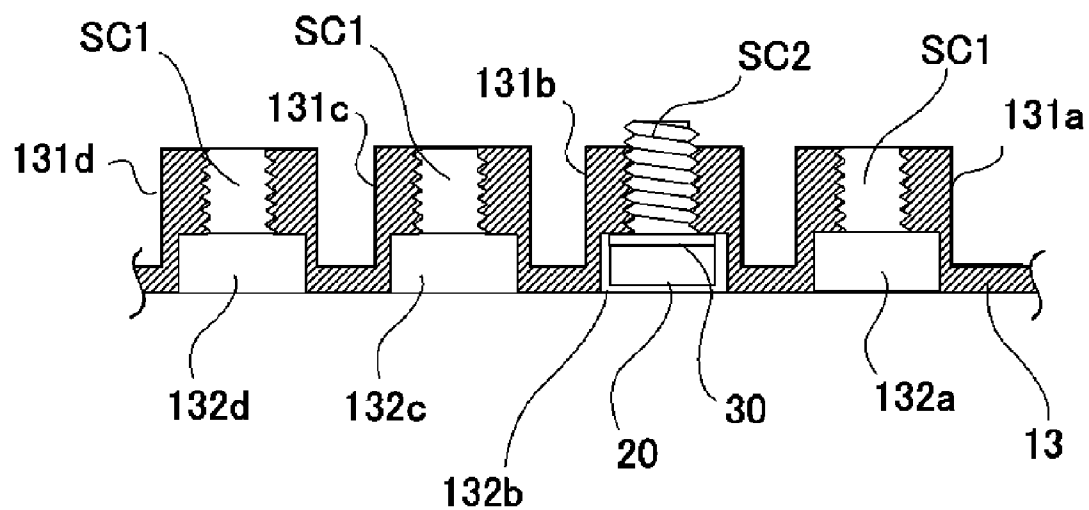


FIG. 5

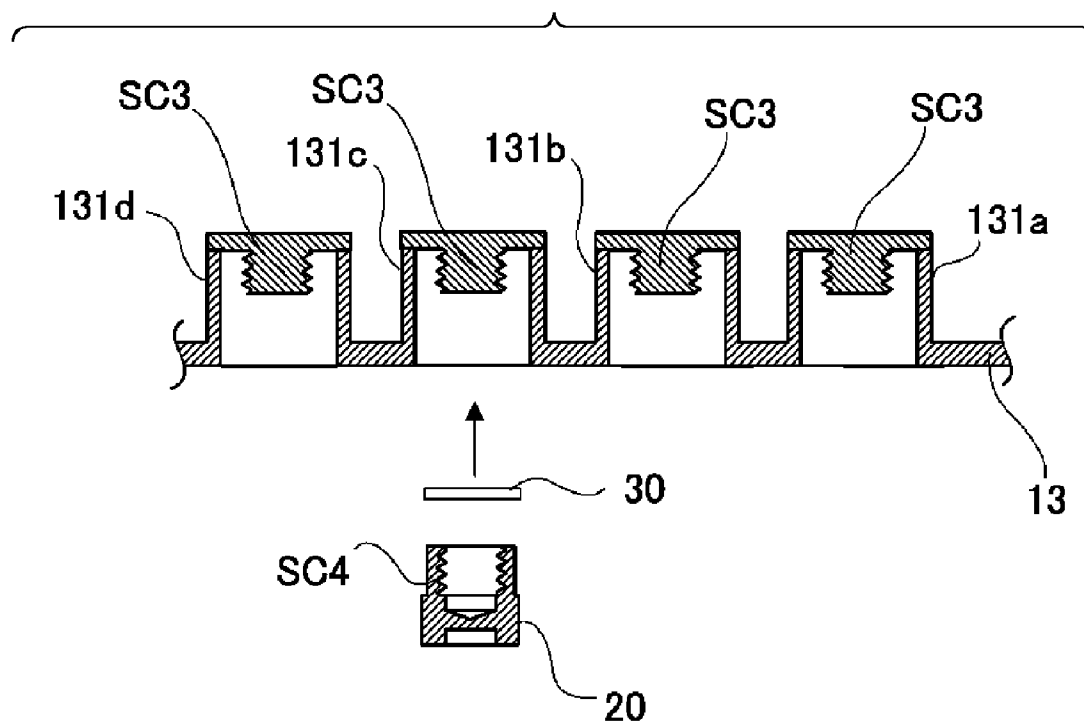


FIG. 6A

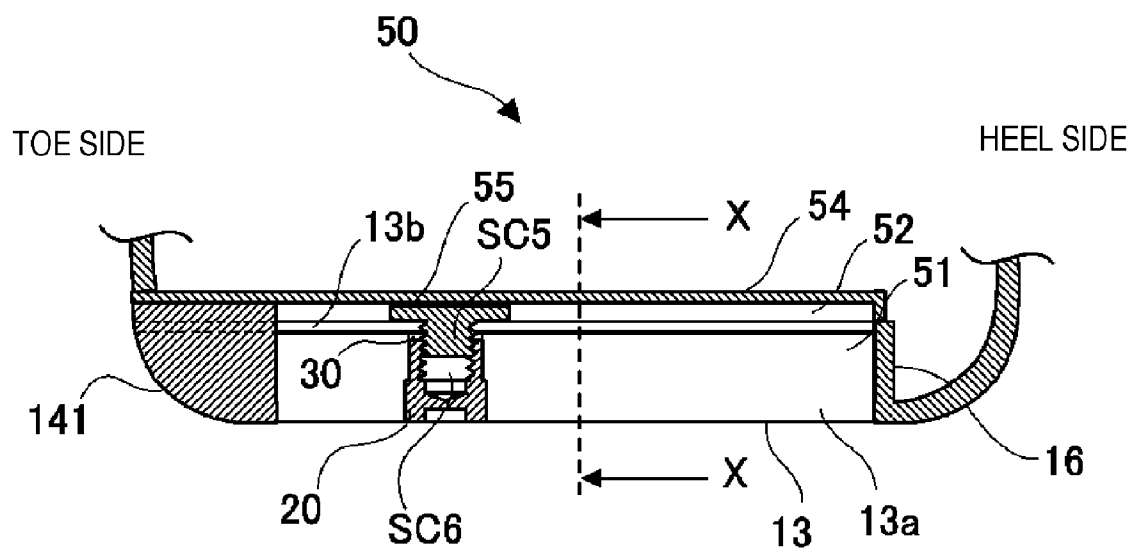
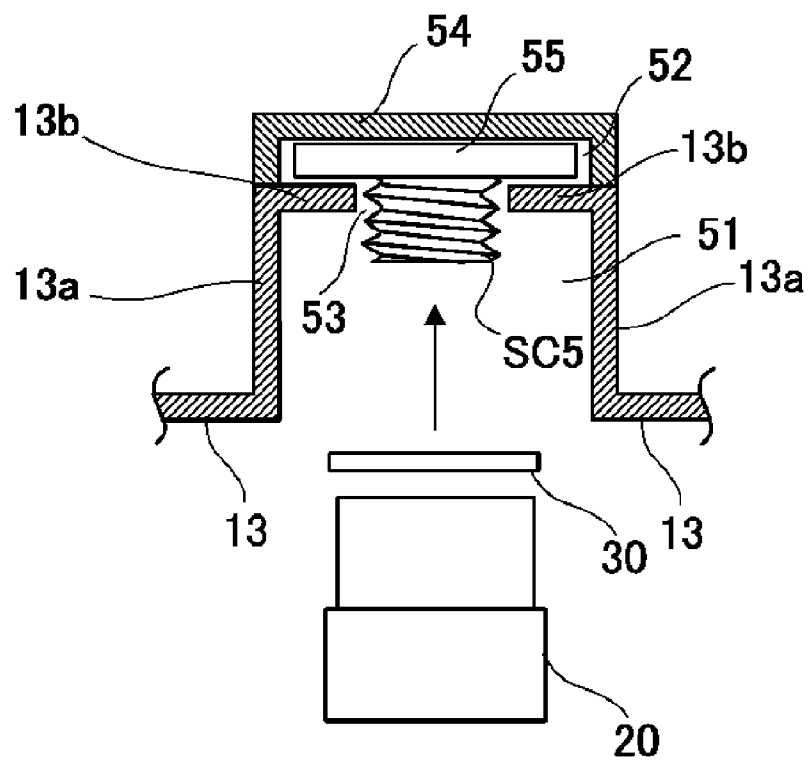


FIG. 6B



GOLF CLUB HEAD

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention relates to a golf club head.

[0003] 2. Description of the Related Art

[0004] There have been proposed golf club heads in which golfers can change the position of a weight member attached to the golf club head in accordance with their preference. Japanese Patent Laid-Open Nos. 2001-137400, 2006-102235, and 2007-222257 disclose putter heads in which the position of the weight member can be changed. Japanese Utility Model Laid-Open No. 7-15067, Japanese Patent Laid-Open No. 11-9742, and Japanese Utility Model Registration No. 3127234 disclose wood type golf club heads in which the position of the weight member can be changed.

[0005] When the position of the weight member is changed, the center-of-gravity position of the golf club head changes. When the center-of-gravity position changes, the characteristics of the golf club head change and, for example, the height or lateral directionality of flight of a hit ball, playability, ball catchability, and the like change. The catchability means golfer's feeling at the impact. A Golfer feels good catchability if the golfer obtains solid ball striking and easily rotates the golf club head through impact. Golfers can change the position of the weight member in accordance with their preference.

[0006] When the position of the weight member is changed, however, a plurality of characteristics of the golf club head may simultaneously change. Some golfers may want to keep the ball catchability unchanged but change other characteristics of the golf club head.

SUMMARY OF THE INVENTION

[0007] It is an object of the present invention to provide a golf club head in which the position of a weight member can be changed, a change in ball catchability is suppressed as much as possible but the other characteristics of the golf club head can be changed by changing the position of the weight member.

[0008] According to the present invention, there is provided a golf club head comprising a head body, a weight member attached to the head body, and fixing means for fixing the weight member at any one of a plurality of attachment positions of the head body, wherein the plurality of attachment positions are located on a plane, and the plane includes a center-of-gravity position of the head body without the weight member attached thereto and an axis of a shaft to be attached to the golf club head.

[0009] Further features of the present invention will become apparent from the following description of exemplary embodiments with reference to the attached drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] FIG. 1 is a perspective view of a golf club head A according to one embodiment of the present invention;

[0011] FIG. 2 is a sectional view of a sole portion 13 taken along a line X-X in FIG. 1;

[0012] FIG. 3 is a view for explaining a center-of-gravity angle θ ;

[0013] FIG. 4 is a sectional view showing the arrangement of attachment portions 131a to 131d according to the second embodiment of the present invention;

[0014] FIG. 5 is a sectional view showing the arrangement of attachment portions 131a to 131d and a weight member 20 according to the third embodiment of the present invention;

[0015] FIG. 6A is a sectional view of a sole portion 13 in the fourth embodiment; and

[0016] FIG. 6B is a sectional view taken along a line X-X in FIG. 6A.

DESCRIPTION OF THE EMBODIMENTS

[0017] Preferred embodiments of the present invention will now be described in detail in accordance with the accompanying drawings.

First Embodiment

[0018] FIG. 1 is a perspective view of a golf club head A, and particularly of a sole portion 13 according to one embodiment of the present invention.

[0019] The golf club head A includes a head body 10 and a weight member 20. The head body 10 is a hollow body, and its circumferential wall constitutes a face portion 11 forming a golf ball hitting surface, a crown portion 12 forming the top surface of the golf club head A, the sole portion 13 forming the bottom surface of the golf club head A, and a side portion 14 forming the toe-side, heel-side, and back-side side surfaces of the golf club head A. A hosel portion 15 to which a shaft is to be attached is also provided in the head body 10.

[0020] Although the golf club head A is a golf club head for a driver, the present invention is applicable to wood type golf club heads including a fairway wood and the like other than a driver, utility type (hybrid type) golf club heads, and other hollow golf club heads. The head body 10 is a hollow body in this embodiment, but it may be solid.

[0021] The head body 10 can be assembled by joining a plurality of parts. For example, the face portion 11 and the other part can be formed as different members and joined to form the head body 10. Also, the face portion 11, sole portion 13, and the other part can be formed as different members and joined to form the head body 10. The head body 10 can be made from, for example, a metal material including a titanium metal material and stainless steel. The head body 10 can be made from different materials. For example, it can be formed from a metal material and a carbon fiber material. As a carbon fiber material, a carbon fiber reinforced resin (CFRP) is available.

[0022] A plurality of attachment portions 131a to 131d, which define the attachment positions of the weight member 20, are formed in the sole portion 13. Although four attachment portions 131a to 131d are provided in this embodiment, the number of the attachment portions is not limited to four. The user of the golf club head A can attach the weight member 20 to any one of the attachment portions 131a to 131d. FIG. 2 is a sectional view of the sole portion 13 taken along a line X-X in FIG. 1.

[0023] Each of the attachment portions 131a to 131d forms a tube having a female screw hole SC1. The weight member 20 has an axial male screw portion SC2. The weight member 20 can be fixed to the head body 10 by threadably engaging the female screw hole SC1 and male screw portion SC2 to each other.

[0024] A washer 30 is a resin member inserted between the weight member 20 and the sole portion 13. The washer 30 serves to prevent loose threadable engagement between the female screw hole SC1 and male screw portion SC2, thereby

preventing the weight member 20 fixed once from falling easily. The washer 30 may be integrally provided in the weight member 20. For example, the washer 30 may be fixed to the weight member 20 in advance. Also, the surface of the weight member 20 may be covered with a resin material.

[0025] As shown in FIG. 2, of the attachment portions 131a to 131d, the female screw holes SC1 to which the weight member 20 is not attached can be closed by attaching caps 40. With this arrangement, it is possible to prevent dust and the like from entering the head body 10 through the female screw holes SC1. The cap 40 is made from, for example, a resin material, and detachably fitted in the female screw hole SC1. In order to prevent dust and the like from entering the head body 10 through the female screw holes SC1, instead of using the caps 40, the female screw holes SC1 may be closed at their upper ends.

[0026] The cap 40 is formed to have the same shape as the weight member 20. The material of the cap 40 is selected such that its weight substantially gives no influence on a change in center-of-gravity position. The cap 40 may be formed to screw in the female screw hole SC1.

[0027] The weight member 20 can be made from, for example, a metal material. As such a metal material, for example, tungsten, a tungsten alloy, aluminum, an aluminum alloy, magnesium, and a magnesium alloy are available. The weight member 20 may be made by, for example, mixing a metal powder with a viscoelastic material. In this case, the vibration dampening effect of the golf club head A at impact can improve. As such a viscoelastic material, for example, NBR (acrylonitrile-butadiene rubber) is available.

[0028] The positions of the attachment portions 131a to 131d will be described with reference to FIGS. 1 and 3.

[0029] FIG. 3 is a view for explaining a center-of-gravity angle θ , which shows the golf club head A seen from the sole portion 13 side while the shaft of the golf club using the golf club head A is kept rotatable about the axis of the shaft and horizontally supported. In FIG. 3, an arrow Dh represents the horizontal direction and an arrow Dv represents the vertical direction.

[0030] In FIGS. 1 and 3, a center-of-gravity position CG represents the center-of-gravity position of the head body 10 without the weight member 20 attached thereto. A plane S is a virtual plane that includes the center-of-gravity position CG of the head body 10 and an axis L1 of a shaft (not shown) to be mounted to the golf club head A. Since the shaft is mounted to the hosel portion 15, the axis L1 is substantially the same as the axis of the hosel portion 15. The attachment portions 131a to 131d are located on the plane S, and particularly on a straight line L0 included in the plane S in this embodiment.

[0031] The effect obtained by arranging the attachment portions 131a to 131d on the plane S will be described next. When the weight member 20 is fixed to any one of the attachment portions 131a to 131d, the center-of-gravity position and center-of-gravity depth of the golf club head A change accordingly. In this embodiment, the center-of-gravity depth is the length of a perpendicular from the center-of-gravity position of the golf club head to the face portion. When the face portion 11 forms not a flat surface but an arcuate surface, a virtual plane touching the face center is used as the reference.

[0032] For example, when the weight member 20 is attached to the attachment portion 131a, the center-of-gravity position of the golf club head A moves toward the heel side from the center-of-gravity position CG of the head body 10.

Accordingly, the center-of-gravity length of the golf club head A becomes relatively short, and the playability of the golf club head A improves. When the center-of-gravity position of the golf club head A is located relatively on the heel side, it becomes relatively easy to hook a ball. However, since the center-of-gravity angle hardly changes, as described below, it can be avoided to excessively catch the ball. Therefore, when the weight member 20 is attached to the attachment portion 131a, a club that is good in playability and easily produces a draw ball flight can be obtained.

[0033] When the weight member 20 is attached to the attachment portion 131d, the center-of-gravity position of the golf club head A moves toward the toe side from the center-of-gravity position CG of the head body 10. Accordingly, the center-of-gravity length of the golf club head A becomes relatively long and, in regard of the playability of the golf club head A, the golfer easily feels the weight of the head and the movement of golfer's fingers rarely influences the behavior of the golf club head A. In addition, when the center-of-gravity position of the golf club head A is located relatively on the toe side, it becomes relatively easy to slice a ball. However, since the center-of-gravity angle hardly changes, as described below, it can be avoided to excessively deteriorate ball catchability. Therefore, when the weight member 20 is attached to the attachment portion 131d, the golf club head A becomes to show a behavior insensitive to golfer's operation, and a club that easily produces a fade ball flight independent of golfer's skill can be obtained.

[0034] As described above, in this embodiment, the characteristics of the golf club head A can be changed by selecting the attachment portions 131a to 131d used to fix the weight member 20.

[0035] Since the attachment portions 131a to 131d are located on the plane S, the center-of-gravity angle θ hardly changes regardless of the attachment portions 131a to 131d used to attach the weight member 20, as will be understood from FIG. 2. The center-of-gravity angle θ is an angle formed by the face portion 11 and the vertical plane (plane S in FIG. 1) that passes the axis L1. The center-of-gravity angle θ mainly influences ball catchability at impact. When the center-of-gravity angle θ is larger, a ball is caught relatively more easily. When the center-of-gravity angle θ is smaller, a ball is caught relatively less easily.

[0036] As described above, in this embodiment, a change in ball catchability at impact can be suppressed as much as possible but other characteristics of the golf club head A can be changed by changing the attachment position of the weight member 20.

[0037] Although the one weight member 20 is used in this embodiment, one of a plurality of the weight members 20 having different weights may be selectively fixed to the head body 10. With this arrangement, it becomes possible to widen the selection range of center-of-gravity position and center-of-gravity depth of the golf club head A and to increase their choices as well. In this case, the two or more weight members 20 may simultaneously be fixed to the head body 10.

[0038] The change amount of center-of-gravity depth of the golf club head A caused by the difference between the attachment portions 131a to 131d used to fix the weight member 20, for example, the difference in center-of-gravity depth between a case in which the weight member 20 is attached to the attachment portion 131a and a case in which the weight member 20 is attached to the attachment portion 131d, is preferably 3 mm or more. When the difference in center-of-

gravity depth is 3 mm or more, a golfer can more clearly feel the change in characteristics of the golf club head caused by the change in center-of-gravity position.

Second Embodiment

[0039] FIG. 4 is a sectional view showing another arrangement example of attachment portions 131a to 131d, which corresponds to the sectional view of a sole portion 13 taken along the line X-X in FIG. 1. The same components as in the golf club head A of the above-described first embodiment are denoted by the same reference numerals below, and a description thereof will not be repeated. Only components different from those of the golf club head A will be described.

[0040] In this embodiment, recesses 132a to 132d to accommodate a weight member 20 are provided in the attachment portions 131a to 131d, respectively. The depth of each of the recesses 132a to 132d is set such that the lowest portion of the weight member 20 fixed to a head body 10 is positioned above the lowest portion of the sole portion 13.

[0041] With this arrangement, as shown in FIG. 4, the weight member 20 does not project from the sole portion 13. Accordingly, it is possible to prevent the weight member 20 from catching the ground upon hitting a ball.

Third Embodiment

[0042] FIG. 5 is a sectional view showing another arrangement example of attachment portions 131a to 131d and weight member 20, which corresponds to the sectional view of a sole portion 13 taken along the line X-X in FIG. 1. The same components as in the golf club head A of the above-described first embodiment are denoted by the same reference numerals below, and a description thereof will not be repeated. Only components different from those of the golf club head A will be described.

[0043] In this embodiment, axial male screw portions SC3 are provided in the respective attachment portions 131a to 131d, and a female screw hole SC4 which threadably engages with the male screw portion SC3 is provided in a weight member 20. Each of the attachment portions 131a to 131d has an internal space to accommodate the weight member 20, thereby preventing the weight member 20 from projecting from the sole portion 13, as in the above-described second embodiment.

[0044] In this manner, the screw portion on the sole portion 13 side and that on the weight member 20 side are a male screw and female screw, respectively, and vice versa.

Fourth Embodiment

[0045] In the above-described first to third embodiments, the weight member 20 can be fixed at a plurality of positions spaced apart from each other. However, a weight member 20 may be fixable at a given position on a straight line included in a plane S. With this arrangement, it is possible to more finely adjust the center-of-gravity position and center-of-gravity depth of the golf club head.

[0046] FIG. 6A is a sectional view of a sole portion 13 in the fourth embodiment, and corresponds to the sectional view of the sole portion 13 taken along the line X-X in FIG. 1. FIG. 6B is a sectional view taken along a line X-X in FIG. 6A, and shows a state in which the weight member 20 is detached. The same components as in the golf club head A of the above-described first embodiment are denoted by the same reference numerals below, and a description thereof will not be

repeated. Only components different from those of the golf club head A will be described.

[0047] A rail portion 50 extending along a straight line L0 (see FIG. 1) included in the plane S is formed in the sole portion 13. As described below, the rail portion 50 guides the movement of the weight member 20. The rail portion 50 includes a groove 51 formed by recessing the sole portion 13 and open at its lower part, and a partitioned chamber 52 formed in the upper portion of the groove 51. Both the groove 51 and partitioned chamber 52 are formed along the above-described straight line L0.

[0048] The groove 51 has a pair of side walls 13a and a pair of partitioning portions 13b formed by bending the side walls 13a. The partitioning portions 13b are located between the groove 51 and partitioned chamber 52, thereby vertically partitioning them. The pair of the partitioning portions 13b are spaced apart from each other to form a slit 53. The groove 51 accommodates the weight member 20. The depth of the groove 51 is set such that the lowest portion of the weight member 20 fixed to the head body 10 is positioned above the lowest portion of the sole portion 13. With this arrangement, the weight member 20 does not project from the sole portion 13, and therefore it is possible to prevent the weight member 20 from catching the ground upon hitting a ball.

[0049] The partitioned chamber 52 is formed by joining the lower ends of a lid member 54 having a U-shaped cross section to the partitioning portions 13b. The upper part of the partitioned chamber 52 is closed by the lid member 54.

[0050] The partitioned chamber 52 accommodates a slide member 55. The slide member 55 is sized such that it cannot rotate in the partitioned chamber 52 and, for example, has a square shape when viewed from the above. An axial male screw portion SC5 that passes the slit 53 is integrally connected to the slide member 55. A female screw hole SC6 which threadably engages with the male screw portion SC5 is formed in the weight member 20. The width of the weight member 20 is larger than that of the slit 53 in the widthwise direction.

[0051] The end portion of the rail portion 50 on the heel side is closed by a wall portion 16, which is formed by bending a part of the head body 10, and a part of the lid member 54. The toe-side end portion of the rail portion 50 is open, and a closing member 141 is mounted thereto to close it. Upon assembling the head body 10, after the slide member 55 is inserted into the partitioned chamber 52 from the toe-side end portion of the rail portion 50, the closing member 141 is secured to the head body 10 to close the toe-side end portion. For example, the closing member 141 may be made from an elastic body such as rubber so that it is detachable from the head body 10. In this case, it becomes possible to exchange the slide member 55.

[0052] In this embodiment with the above-described components, when the male screw portion SC5 threadably engages with the female screw hole SC6, the slide member 55 and weight member 20 sandwich the partitioning portions 13b, thereby fixing the weight member 20 to the head body 10. A washer 30 inserted between the partitioning portions 13b and weight member 20 prevents the loose threadable engagement between the male screw portion SC5 and female screw hole SC6.

[0053] When changing the position of the weight member 20, the threadable engagement between the male screw portion SC5 and female screw hole SC6 is loosened, and the slide member 55 and the weight member 20 are moved. Since these

members are guided by the rail portion **50** during movement, their positions can be easily changed. By threadably engaging the male screw portion **SC5** with the female screw hole **SC6** at a desired position, the weight member **20** can be fixed.

[0054] As described above, in this embodiment, the weight member **20** can be fixed at a given position on the straight line **L0**, and therefore it is possible to more finely adjust the center-of-gravity position and center-of-gravity depth of the golf club head. Note that in this embodiment, the center-of-gravity position of the head body **10** is defined as a center-of-gravity position **CG** of the head body **10** without the weight member **20** and slide member **55**. Also, in this embodiment, since the weight member **20** can be completely detached from the slide member **55**, one of a plurality of the weight members **20** having different weights may be selectively fixed to the head body **10**.

[0055] In this embodiment, since the rail portion **50** is enclosed by the closing member **141**, wall portion **16**, and lid member **54**, it is possible to prevent dust and the like from entering the head body **10** through the rail portion **50**.

[0056] Note that the structure of the rail portion **50** is not limited to that shown in FIGS. **6A** and **6B**, but any structure can be used as long as the weight member **20** can be moved and fixed at a given position.

[0057] While the present invention has been described with reference to exemplary embodiments, it is to be understood that the invention is not limited to the disclosed exemplary embodiments. The scope of the following claims is to be accorded the broadest interpretation so as to encompass all such modifications and equivalent structures and functions.

[0058] This application claims the benefit of Japanese Patent Application No. 2008-313695, filed Dec. 9, 2008, which is hereby incorporated by reference herein in its entirety.

What is claimed is:

1. A golf club head comprising:
 - a head body;
 - a weight member attached to said head body; and
 - fixing means for fixing said weight member at any one of a plurality of attachment positions of said head body, wherein the plurality of attachment positions are located on a plane, and
 - the plane includes a center-of-gravity position of said head body without said weight member attached thereto and an axis of a shaft to be attached to the golf club head.
2. The head according to claim **1**, wherein said fixing means comprises:
 - a plurality of first screw portions which are provided in a sole portion of said head body and define the plurality of attachment positions; and

- a second screw portion which is provided in said weight member and threadably engages with one of said plurality of first screw portions.

3. The head according to claim **1**, further comprising a rail portion which is formed along a straight line included in the plane in said sole portion of said body and defines the plurality of attachment positions,

- wherein said fixing means fixes said weight member at a given position on said rail portion.

4. The head according to claim **3**, wherein said rail portion comprises:

- a groove open at a lower part thereof, which is formed along the straight line and forms an accommodation space to accommodate said weight member;

- a partitioned chamber closed at an upper part thereof, which is formed along the straight line in an upper portion of said groove;

- a partitioning portion which is provided between said groove and said partitioned chamber and vertically partitions the space into said groove and said partitioned chamber; and

- a slit which is formed along the straight line in said partitioned chamber and makes the space in said groove communicate with said partitioned chamber, and

- said fixing means comprises:

- a slide member which is accommodated in said partitioned chamber such that said slide member can move along the straight line, and connected to said weight member through said slit; and

- screw portions which are respectively provided in said slide member and said weight member, and threadably engage with each other.

5. The head according to claim **1**, wherein a change amount of center-of-gravity depth of the golf club head caused by a difference between the attachment positions used to fix said weight member is not less than 3 mm.

6. The head according to claim **1**, wherein said weight member comprises a plurality of weight members having different weights.

7. The head according to claim **1**, further comprising a resin member which is inserted between said head body and said weight member at the attachment position.

8. The head according to claim **7**, wherein said resin member is integrally provided in said weight member.

9. The head according to claim **1**, wherein said weight member is fixed to said sole portion of said head body, said sole portion includes a recess formed in the attachment position of said weight member, and

- a depth of said recess is set such that a lowest portion of said weight member fixed to said head body is positioned above a lowest portion of said sole portion.

* * * * *