



GOLF CLUB WITH DISHED BOTTOM SURFACES

5 The present invention relates to a golf club
with dished bottom surfaces, the club more particularly,
but not exclusively, being a putter.

10 There is a need to reduce drag forces at
bottom walls of putter heads, especially when putters
are used to stroke golf balls lying in turf adjacent or
very near golf greens. There is also a need to reduce
putter bottom wall drag on golf greens, should the
putter engage the green during stroking. Also, there is
15 a need to centralize such drag to locations rearwardly
of the golf ball being stroked.

20 It is envisaged that clubs other than putters
likewise could benefit from a reduction in bottom drag.

25 It is a major object of the invention to
provide structure overcoming the above problems and
disadvantages. Basically, an improved putter head
according to the invention is characterized by a ball
striking front

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wall, a bottom wall, and spaced toe and heel walls, the bottom wall is characterized as having two shallow recesses, one recess closer to the heel portion, and the other recess closer to the toe portion, the recesses being everywhere spaced rearwardly from the front wall, the one recess having an arcuate peripheral edge generally convex toward the toe portion.

Such recesses typically have downward facing surfaces with shallow upwardly dished configurations. The downward facing surfaces are concave in front-to-rear directions; and the downward facing surfaces are also concave in directions between the heel and toe.

Another object is to provide a bottom wall structure for a club that will aid in "lifting of" a golf ball having a bad lie, adjacent a green, during stroking.

The invention aims to provide, inter alia, a putter head wherein the bottom wall has a locally flattened, rearwardly divergent surface that extends at a rearwardly and upwardly extending angle, beyond a rearward extent of a medial ridge, and between rearward extents of the recesses. That flattened surface may merge with peripheries of the dished recesses, as will appear, and at cusps located equidistantly from the putter front face, whereby lift force balance is achieved.

Still further, the invention aims to provide the bottom wall to be in part defined by a sole plate having a peripheral edge rigidly connected to the bounding edge of an opening defined by the bottom wall,



rearwardly of the front wall, whereby the sole plate closes the opening, the medial ridge and recesses also being in part defined by the sole plate. In this regard, the sole plate typically defines major extents of the shallow recesses. A head body shell may also define a rigidizing bottom wall corner plate section integral with shaft supporting tube structure, the sole plate also being connected to that corner plate section, the corner plate section moreover forming a portion of the shallow recess closer to the head heel portion.

The invention also seeks to provide a putter head bottom wall which controls engaged turf relative movement (during a golf swing) so as to create upward force or forces acting on the head in a manner resulting in reduced drag as the head is swung.

A putter head according to the invention has a bottom wall having a medial ridge, and forming two dished, similar shallow recesses, one recess between the ridge and putter heel portion and the other recess between the ridge and putter toe portion, such recesses being located rearwardly of the putter front wall, one recess having an arcuate peripheral edge portion generally convex toward said heel portion and the other recess having an arcuate peripheral edge portion generally convex toward said toe portion. Each recess may have a downwardly facing surface wherein:

- 1) a vertical plane bisecting the recess in a toe to heel direction intersects the recess surface along a downwardly



concave line, and

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- ii) a vertical plane bisecting the recess in a front to rear direction relative to the head intersects the recess surface along a downwardly concave line.

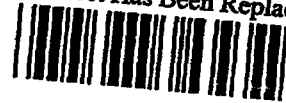
Also, the two concave recesses of each head typically have similar configurations with respect to a vertical plane that bisects said ridge in a front to rear direction relative to the head. Further each recess may have a downwardly facing surface wherein:

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- i) the rearwardmost extent of said downwardly facing surface is inclined forwardly and upwardly relative to the head forward swing path as the head bottom wall engages the turf,
 - ii) whereby lift force is created in response to engagement of that rearwardmost extent of said surface with the turf as the head is swung forwardly along said path, such lift force acting to urge the head bottom wall and the head in an upward direction.
- 20

25 Yet another object is to provide a club with a bottom wall having a rearwardly divergent surface (which may be locally flattened) that extends at a rearwardly and upwardly extending angle, beyond a rearward extent of said ridge, and between rearward extents of said recesses, for reducing drag as the head

30



is swung forwardly in an arc, adjacent the turf. In this regard, guided engagement with the turf and upward force exertion are enhanced by a configuration wherein the rearwardly divergent surface and the two recesses
5 have edges which, when viewed from the rear of the head, are upwardly convex. Also, there may be provided a substantially continuous, hollow, metallic tube extending within the shell of the heel portion and from proximate the shell top wall to proximate the shell
10 bottom wall, that tube having a bore to receive a club shaft, the bore being aligned with the said one shallow recess.

The invention will now be described in more
15 detail by way of example only with reference to the accompanying drawings, in which:

Fig. 1 is a front face view of the putter
head;

20 Fig. 2 is a top plan view of the Fig. 1 head;
Fig. 3 is a toe end view of the Fig. 1 head;
Fig. 4 is a heel end view of the Fig. 1 head;
Fig. 5 is a bottom plan view of the Fig. 1
head;

25 Fig. 6 is a rear elevation of the Fig. 1
head;

Fig. 7 is a section in elevation on lines 7-7
of Fig. 5;

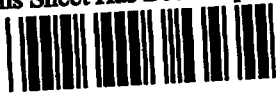


Fig. 8 is a section in elevation on lines 8-8 of Fig. 5;

Fig. 9 is a section in elevation on lines 9-9 of Fig. 7; and

Fig. 10 is a section taken in elevation on lines 10-10 of Fig. 7.

Referring now to the drawings, a putter 10, in accordance with a preferred embodiment of the present invention, is shown. It includes a shaft 12 bi-directionally curved to form a knee 12a, and having a lower portion which is attached to putter head 14. The head 14 is in the configuration of a so-called "wood" club, although it is made of metal. As shown in Figs. 7-10, the body of the head comprises a hollow metal shell 16, which may be filled with a plastic foam filling 18, preferably polyurethane.

The shell 16 is preferably made of stainless steel, and it may be fabricated by the "lost wax" casting method that is well-known in the art. The shell 16 may be formed in two pieces: a main upper portion 20, and a sole plate 22 that is peripherally welded to the main portion 20, and as will be described.

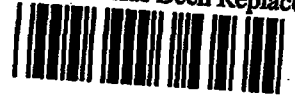
The main shell portion 20 has a top surface 24, a rear surface 26, and a ball-striking surface or face 28 opposite the rear surface 26. The face 28 is angled with respect to the vertical with a specified



"pitch" that is determined by the amount of loft desired. The end portion of the head 14 proximate the shaft 12 is commonly termed the "heel" 30, while the end portion opposite the heel 30 is termed the "toe" 32. As shown in Fig. 2, the head body is typically convexly curved from the heel 30 to the toe 32, at the rear side of the head. The main shell portion 20 has a bottom corner portion 34 (shown in Fig. 5) that is cast integrally with the front wall 28a and with the heel wall 30a, and flush with the sole plate 22, and that forms a bottom surface or sole in combination with the sole plate 22 when the two shell portions are welded together.

Referring now to Fig. 7, the shell 16 is provided with a substantially continuous hollow tube 36 that extends from an upper opening 38 in the top surface 24 to a lower opening 40 in the bottom surface or sole through the bottom corner portion 34 of the main shell portion 20. The tube 36 side wall is interrupted by an internal orifice 42 that opens into the interior of the shell. The orifice 42 provides an entrance for the introduction of the foam material 18 into the shell interior during the manufacturing process.

The tube 36 is dimensioned to receive the lower part of the shaft 12 with a snug fit. The upper opening 38 is provided with a radiused lip 43, as shown in Fig. 7, to minimize the possibility of stress fractures in the shaft due to impact against the edge



of the opening. A portion of the interior wall of the tube 36, extending downwardly from the upper opening 38, may be provided with striations, preferably in the form of internal threads, or a series of concentric steps, to provide a "glue lock" for better bonding of the shaft in the tube.

In the preferred embodiment of the invention, the lip 43 is at the end of a slight rise at the heel end of the head, the height of the rise being less than, or approximately equal to, the height of a horizontal plane 200 defined by the highest point of the club head top surface 24.

The shaft 12 is a hollow tube made of any suitable material. Steel is the most common material, but titanium and graphite-boron may also be used. If the shaft is of steel, the exterior of the shaft may be chrome-plated to minimize corrosion. The lower part of the shaft may be fitted with a plug 46 to prevent the entry of moisture into the interior of the shaft. The plug 46 may be of any suitable resilient material, such as Nylon, epoxy, polyurethane, or Delrin. The plug 46 may be retained in the shaft by an annular crimp in the shaft wall. The crimp also serves as a glue lock. A locator ring 50, preferably of glass fiber-reinforced nylon, is adhesively bonded to the shaft at a distance above the bottom end of the shaft approximately equal to the length of the tube 36.

The shaft 12 may be attached to the head 14 by a suitable epoxy adhesive, the steps or threads in the tube 36 and a crimp in the shaft providing "glue



locks", as mentioned above, for better adhesive bonding. (Any plating on the lower part of the shaft is first buffed off.) During assembly, the lower part of the shaft is inserted into the tube 36 until the
5 locator ring 50 abuts against the radiused lip 43 at the upper tube opening 38. The bottom end of the shaft 12 then extends slightly beyond the lower tube opening 40. The shaft bottom end is then cut and ground so as to be flush with the sole of the head, as shown in
10 Figs. 4 and 5.

The structure described above allows the shaft to be attached to the head without a neck or hosel. As a result, substantially all of the mass of the head is "effective mass" that contributes to the
15 transfer of energy from the player to the ball. By increasing the effective mass of the club head, there is a more effective transfer of energy to the ball from the player, yielding increased putting distance without an increase in effort on the part of the player. This
20 can be important for large greens and also where the ball lies in grassy turf near a green edge, where the putter is used to stroke the ball.

Moreover, without an external hosel, the lower part of the shaft may extend all the way through
25 the head, with the bottom end of the shaft terminating flush with the sole. Thus, by eliminating the external hosel, the shaft both enters, and may exit the head, within the area defined between the top and bottom of the face of the putter head, which area is sometimes
30 called the "ball control zone". By bringing the lower



end of the shaft within the control zone, and extending the shaft deeply into the head shell, for example through to the sole of the head, the tactile sense of the location of the putter face, or "head feel", is maximized, yielding increased control of the shot, greater ability of the skilled player to "work" the ball, and a more solid feel of impact with the ball regardless of where on the face the ball is struck. The increase in effective mass of the head, plus the rigid support for the lower end of the shaft, provided by the internal tube 36 in which the lower end of the shaft is received, further contribute to this improvement in "head feel".

Furthermore, a number of advantages in the manufacturing process can be achieved by eliminating the hosel. For example, the mass that would have been taken up by the hosel can be redistributed to a part of the head where it can contribute to the effective mass of the head without increasing the total head mass. Optimally, this mass can be added by increasing the overall size of the putter head.

Still another advantage of eliminating the hosel is that there is a more even cooling of the putter head in the mold. Where there is an upward hosel, by comparison, the hosel and the rest of the head shell may cool at unequal rates, thereby resulting in a slight warping that can produce a lack of uniformity in loft, lie, and face angle from club head to club head.

A golf putter, in accordance with a preferred



embodiment of the invention, includes the sole configuration shown in the drawings.

As shown in the drawings, the bottom wall is characterized as forming a medial ridge 60, and as forming two shallow recesses, one recess between the ridge and the heel portion, and the other recess between the ridge and the toe portion, the recesses being everywhere spaced rearwardly from the front wall, the one recess having an arcuate peripheral edge generally convex toward the heel portion, and the other recess having an arcuate peripheral edge generally convex toward the toe portion. Examples of such shallow, upwardly dished recesses are seen at 162 between the ridge 60 and the toe 32, and at 164 between the ridge and heel 30.

Recess 162 curved periphery, extends in a looping edge path, indicated at 162a, 162b, 162c, and 162d, and recess 164 also extends in a looping edge path indicated at 164a, 164b, 164c, and 164d, both paths located on the bottom wall, as shown. The maximum depth of each recess below a plane containing its peripheral looping edge path is less than 1/4 inch, and preferably between 1/16 inch and 3/16 inch. These depths are sufficient to avoid direct frictional contact of recess dished inner surfaces 162' and 164' with the ground during a club stroke, ground contact, if any, being confined to the lowermost extent of the central ridge 60. Also, the upward bi-directional concavity of the bottom wall extents 162' and 164' forming the recesses adds to bottom wall strength, and



stiffness, for transmitting loading transmitted to and from the front wall 28 during ball stroking. The bottom wall thickness may then be minimized and metal "redistributed" to enable provision of a larger sized head.

Note also the provision of a bottom wall rearwardly divergent surface that extends at a rearwardly and upwardly extending angle, beyond rearward extent of the ridge, and between rearward extents of the recesses.

Specifically, there is a trailing surface 56, which is a relieved, upwardly angled, somewhat flattened portion extending upwardly from a curved edge 56a and between that edge and the center of the sole and a trailing edge 58 at the juncture between the rear surface 26 of the club head and the sole plate 22. The lowermost curved part 56a of the surface 56 is contiguous with the rearward end of ridge 60 that extends forward toward and diverges at 60a and 60b to merge laterally with the bottom U-shaped edge of the face 28 of the club head.

The trailing surface 56 preferably extends at an angle A of approximately 18° with respect to the horizontal. The angle A may be varied by plus or minus up to 5 degrees, depending on the type of club and the preference of the player. The trailing surface 56 minimizes the club head's closing, or "hooding", when the ball is stroked "fat", while reducing the overall drag of the head if the head engages the turf. Further, in regard to the described combination of



bottom wall contours, the ridge downward curvature rearwardly of the front face, and between the dished recesses 162 and 164 enables the sole to penetrate the turf, resisting and repelling the turf against the dished out zones 162 and 164 to limit penetration in proportion to or accordance with the unique shape of the sole as a unit, in a unique way, the front face having a downward U-shape forward of the recesses and ridge, as is clear from Fig. 1. Note the ridge diverging forwardly toward the U-shaped front face.

Accordingly, a golf ball having a "bad lie" next to a green can be approached in a confident way, to "dig" the ball out by means of a club stroke characterized in that the club head sole planes over the turf, considering the turf as fluid. For a golf ball having a more conventional lie, no "digging out" is required, and an improved downward sole shape "footprint" is produced on the turf, as will be referred to.

Referring to Figs. 2, 5 and 7, internal hosel tube 36 extends downwardly into the hollow interior of the heel portion of the head, and is adapted to receive a shaft 12. Thus, the weight of the hosel is concentrated more directly behind, or close to, the rear side of front wall 28, near the heel, to contribute to the ball-striking mass of the front wall. Also, the hosel tube cylindrical wall reinforces the junction of the front wall, bottom wall, and heel wall. See also rigidizing hosel webbing or filleting 34 which forms the corner plate section of the bottom wall 22.



Corner section also forms a portion of the dished portion of the bottom wall recess 164. When the sole plate is attached to the shell, a weld may be formed along edges 99a, and 100a. See Fig. 5.

A further important aspect of the invention concerns the provision of a golf putter head having a metal shell defining top, bottom, front, rear, toe, and heel walls, and wherein:

a) the bottom wall has upwardly dished wall extent,

b) said upwardly dished wall extent defining downward facing surface means inclined forwardly and upwardly relative to the head swing path as the bottom wall engages the turf, so that the turf moving relatively rearwardly engages said inclined surface means for creating lift force acting to urge the bottom wall and the head in an upward direction, whereby drag is reduced and more kinetic energy is available for transfer to the ball.

Further, and as described, the bottom wall also has a downward facing medial ridge 60 which extends generally forwardly, said dished wall extent preferably including two dished extents 162 and 164, respectively, located at opposite sides of said ridge, each of said two dished extents defining a portion of said inclined surface means (at the rears of said dished extents 162 and 164) whereby upward lift forces are developed at opposite sides of said ridge, for torsionally balanced upward lift imparted to the head.

Finally, the turf controlling head bottom

wall can be formed or cast integrally with the remainder of the head, if desired, i.e., it need not be separately formed and later welded to a rim defined by a separately cast head. Such forming may be by a casting or molding process employing metallic or non-metallic material.

The bottom wall and/or the rest of the head can be made of materials other than metal.

As used herein, the word "turf" shall be understood to mean grass, weeds, sand, mud, and other material engageable and displaceable by the bottom wall of the head.

Each recess 162' and 164' as referred to has a downward facing surface and

- i) a vertical plane bisecting the recess in a toe to heel direction intersects the recess surface along a downwardly concave line (see Fig. 7), and
- ii) a vertical plane bisecting each recess in a front to rear direction relative to the head intersects the recess surface along a downwardly concave line (see Figs. 9 and 10). Further and as shown, the two recesses of each head have similar configuration (see Fig. 5) with respect to a vertical plane (the plane of Fig. 8) that bisects said ridge in a front to rear direction relative to the head.

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It will also be seen that each recess has a downward facing surface, and

- i) the rearwardmost extents 162d' and 164d' of said downwardly facing surfaces are inclined forwardly and upwardly relative to the head forward swing path as the head bottom wall engages the turf,
- ii) whereby balanced lift forces are created in response to engagement of said rearwardmost extents of said surfaces with the turf as the head is swung forwardly along said path, said lift forces acting to urge said head bottom wall and the head in an upward direction.

The medial ridge 60 increases in width at 60a and 60b toward the front wall and between forward extents of the two recesses 162 and 164. Beyond rearward extent of the ridge, the bottom wall has a rearwardly divergent surface 56 that extends rearwardly and upwardly, that surface for example being flattened, and that surface merging with the recesses at cusps that are substantially equidistant from the head front wall, contributing to balanced lift force creation.

Referring to Fig. 6, the recesses 162 and 164 have edges 162g and 164g which, when viewed from the rear of the head, are upwardly convex. The rearward edge 56g of flattened beveled surface 56 is also upwardly convex in Fig. 6, and located

approximately mid-way between edges 162g and 164g. Such convex edges extend in an arcuate row, as seen in Fig. 6, and define a V-shape. Upward lift force vectors appear at 190 and 191, and result from engagement of the inclined rear portions of the inclined rear portions of the dished recess surfaces with the turf, as referred to above. Note that the vectors are angled upwardly and toward one another.

Referring again to Fig. 5,

- i) the dished recesses 162 and 164 are located in substantially mirror imaged position with respect to a forwardly extending, vertical plane (the plane of Fig. 8) bisecting the ridge 60;
- ii) the convergent rearward terminus of dished recess rearwardmost extent 162d' is intersected by a cusp 210 defined by surface or bevel 56; and the convergent rearward terminus of dished recess rearwardmost extent 164d' is intersected by a cusp 211 also defined by bevel 56. These cusps are further defined by intersection of the bevel with head rounded outer bottom surface 213 and intersection of the bevel with the ridge rearwardmost and rearwardmost divergent extents, as shown. The cusps 210 and 211 are substantially equidistant from the head front face 28, whereby the



bevel is centered between the rearwardmost extents 162d' and 164d' of the recesses,

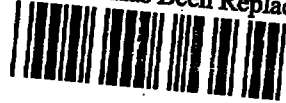
- iii) the cusps 210 and 211 are located at substantially equal distances from the bisecting plane of Fig. 8; that plane also intersects the rearwardmost extent 26a of the head. Note the ridge 60 is divergent, forwardly.

The above features contribute to the balanced lift force creation discussed above.

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CLAIMS:

1. A golf club head for a putter, comprising
a body having toe and heel portions, a front wall
5 defining a ball-striking face, and top and bottom walls,
said bottom wall having a medial ridge, and two dished
shallow recesses, one recess being between the ridge and
the heel portion, and the other recess between the ridge
and the toe portion, said recesses everywhere being
10 spaced rearwardly from said front wall, the said one
recess having an arcuate peripheral edge generally
convex toward the heel portion, and the said other
recess having an arcuate peripheral edge generally
convex toward the toe portion, the recesses being
15 located to either side of, or in substantially mirror
imaged positions with respect to, a forwardly extending
vertical plane bisecting said ridge.

2. A club head according to claim 1, wherein
20 the medial ridge increases in width toward the front
wall and between forward extents of the recesses.

3. A club head according to claim 1 or claim
2, wherein said bottom wall has a rearwardly divergent
25 surface that extends at a rearwardly and upwardly
extending angle, beyond a rearward extent of the ridge,
and between rearward extents of the recesses.



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4. A club head according to claim 1, 2 or 3, wherein the recesses have downward facing surfaces with shallow upwardly dished configurations.

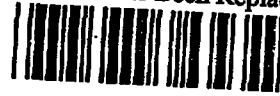
5 5. A club head of claim 4, wherein the said downward facing surfaces are concave in front-to-rear directions.

10 6. A club head according to claim 5, wherein the said downward facing surfaces are also concave in directions between the heel and toe.

15 7. A club head according to any of claims 1 to 6, wherein the bottom wall is in part defined by a sole plate having a peripheral edge rigidly connected to the bounding edge of an opening defined by said bottom wall, whereby the sole plate closes said opening, said ridge and recesses being in part defined by the sole plate.

20 8. A club head according to any preceding claim, wherein the recesses have surfaces that merge in arcuate sloping relation with opposite sides of the ridge.





9. A club head according to any preceding claim having a substantially continuous, hollow, metallic tube extending within the shell of the heel portion and from proximate the shell top wall to proximate the shell bottom wall, said tube having a bore to receive a club shaft, and said bore being aligned with the said one recess.

10. A club head according to claim 9, wherein the bottom wall includes a sole plate peripherally connected to a shell rim defining a bottom opening, the sole plate defining major extents of the said recesses, the shell defining a bottom wall corner plate section integral with the tube, and the sole plate also being connected to said corner plate section, the latter forming a portion of the said one recess between the ridge and heel portion.

11. A club head according to any preceding claim, wherein the ridge is downwardly convex rearwardly of said front wall and co-acts with the recesses in use during a club stroke to direct the turf toward and into the recesses, the recesses having surfaces inclined forwardly and upwardly to be engaged by the turf moving relatively rearwardly, for creating lift forces at opposite sides of the ridge, urging the bottom wall and head in an upward direction.





12. A club head according to any preceding claim, wherein the said two recesses have similar configurations with respect to the vertical plane that bisects the ridge in a front-to-rear direction relative to the head.

13. A club head according to any preceding claim, wherein each recess has a downward facing surface, and wherein:

10 the rearwardmost extent of said downwardly facing surface is inclined forwardly and upwardly relative to the head forward swing path as the head bottom wall engages the turf, whereby lift force is created in response to engagement of the rearwardmost extent of said surface with the turf as the head is swung forwardly along said path, said lift force acting to urge said head bottom wall and the head in an upward direction.

20 14. A club head according to any preceding claim, wherein the bottom wall has a rearwardly divergent surface that extends at a rearwardly and upwardly extending angle, beyond the rearward extent of the ridge, and between rearward extents of the recesses, 25 the said surface merging with rearwardmost extents of the recesses at cusps which are spaced substantially equidistantly from the head front wall.





15. A club head according to claim 14, where the body is a shell, and there is a substantially continuous, hollow, metallic tube extending within shell of the heel portion and from proximate the shell top wall to proximate the shell bottom wall, said tube having a bore to receive the club shaft, and said bore being aligned with the said one recess.

16. A club head according to claim 15, including said shaft, which projects upwardly from the head with bi-directional curvature to define a knee.

17. A club head according to claim 16, where the head front wall defines a sweet spot, and the shell has an upper extent above said knee which defines an axis directed at the head, rearwardly of the sweet spot.

18. A golf club head for a putter, having shell and defining top, bottom, front, rear, toe and heel walls, and a shell interior:

a) the bottom wall having upwardly dished wall extent,

b) the upwardly dished wall extent having downwardly facing surface means inclined forwardly and upwardly relative to the head swing path as the bottom wall in use engages the turf during a swing, so that turf moving relatively rearwardly engages said inclined



surface means for creating lift force acting to urge the bottom wall and the head in an upward direction,

c) the head having a club shaft-receiving hosel having an axis that projects to intersect said
5 dished wall extent,

d) said bottom wall also having a downward facing medial ridge which extends generally forwardly, said dished wall extent including two dished extents each defining a portion of said inclined surface means
10 whereby upward lift forces are developed at opposite sides of said ridge,

e) said dished extents defining shallow recesses.

15 19. A club head, e.g. for a putter, substantially as herein described with reference to and as shown in the accompanying drawings.

20 20. A golf club having a club head as claimed in any of claims 1 to 19.

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