Description

This invention relates generally to metal wood golf clubs, and more particularly to methods of casting head metal and resulting head configuration, with the objective of facilitating liquid metal flow to thin walls of the head.

At the present time, it has become desirable to provide larger metal wood heads containing the same or approximately the same amount of metal as prior smaller metal wood heads, due to need to facilitate ease and accuracy of ball striking, while at the same time complying with head weight limitations imposed by existent standards. Larger heads using the same amount of metal dictate need for shell wall regions of lesser thickness. This in turn increases the difficulty of successfully casting the head, since metal flow into thinner mold spaces is impeded, as for example by excessive cooling and from interruption or slowing before the metal can penetrate fully into all regions of the mold cavity. Also, reduced wall thickness tends to weaken the walls, leading to buckling or other failure modes during repeated use of the head in striking a golf ball, at high speed. There is need for means and methods of casting head metal which will alleviate these and other problems encountered in head shell configuration and casting.

Further, there is need for concentration of as much of the mass of the head as possible into the face of the club head and the portion of the head directly behind the face. This puts the mass of the head where it effectively contributes to the energy imparted to the ball, and also increases the strength of the head front wall.

In addition, very thin-walled, metal golf club heads present the problems of cracking and buckling of metal walls, and excessive front wall deflection, during ball impact. There is need to alter the manner in which shock waves are distributed within metal wood walls, as by providing a mechanism which guides, interrupts, spreads, or otherwise alters the shock waves which emanate from the face at impact, but while maintaining optimum wall thicknesses.

SUMMARY OF THE INVENTION

It is an object of the present invention to obviate or mitigate the aforementioned problems.

US-A-4,214,754 discloses an all metal hollow golf driver having a head which includes spaced-apart rib-like members which extend internally and bridge the thin face of the head with the top side of the head.

GB-A-2,100,993 discloses an all metal golf club head which has a hollow body integrally formed with three spaced-apart rib-like members at the upper half of the inner wall of the front face.

The present invention is a metallic golf club head having a hollow interior, comprising

a) a ball-striking front wall, and the head having walls at the top, bottom, rear, heel, and toe of the head,

b) said front wall having variable thickness that varies between the heel and toe to transmit golf striking impact forces from the head front wall to said top wall without cracking or buckling of said front wall or top wall, said variable thickness locally decreasing in a direction toward said toe, and also locally decreasing in a direction toward said heel,

characterised in

c) said front wall also having an additional locally rearwardly thickened bulging portion which extends in a direction toward the heel from a mid-region of the front wall toward a peripheral region of the front wall, and

d) the locally rearwardly thickened and bulging portion also being metallically integral with said front face directly forwardly of said bulging portion.

As will be seen, the head front wall variable thickness is measured in vertical planes normal to the front wall and spaced apart between the toe and heel; and said variable thickness may locally decrease in a direction toward the heel, or a direction toward the toe, or both. Such variable thickness may advantageously exist at locations proximate a merging interconnection of the front wall and the top wall, whereby cracking or buckling of the head at such locations due to force concentration is prevented.

Embodiments of the present invention further include

e) a first group of narrow, metallic, shock wave distributing dendrites extending from the variable thickness front wall generally rearwardly adjacent the underside of the top wall and integral therewith,

f) the dendrites spaced apart by amounts greater than their widths, the maximum height dimensions of the dendrites below the underside of the top wall being between 0.127 and 0.254 cms (0.050 and 0.100 inches) and the dendrites being generally downwardly convex in cross-section.

As will be seen, a metallic hosel may be integrated into the head to strengthen the head and front wall; and the dendrites, metallic hosel within the head interior, and the variable thickness front wall all comprise parts of a single metallic casting.

Embodiments of the present invention further provide a variable thickness front wall in combination with head wall structure strengthened by dendrites, particularly narrow metallic dendrites which are integral with the rear wall and extend downwardly at the inner side of the rear wall.

A further object is to provide a variable thickness front wall in combination with a second group of narrow dendrites that extend beneath the top wall and are spaced apart in a transverse direction, the maximum height dimensions off the second group dendrites being between 0.127 and 0.254 cms (0.050 and 0.100 inches).

A still further object is to provide a variable thickness front wall characterized by a locally rearwardly thickened portion which extends in a direction from a mid-region off the front wall toward a peripheral region of the front wall near the heel.

Typically, the thickened portion projects into the hollow interior of the head; and the thickened portion has an upright width which progressively increases in the heelward direction. Further, the thickened portion is generally rearwardly dome-shaped, in upright planes which extend rearwardly; and the front wall has decreasing thickness in a direction from the mid-region toward the toe, as well as from the mid-region toward the heel. In this regard, the locally thickened portion may have fan-shaped divergence between the mid-region of the front wall and the heel of the head, at the rear side off the front wall.

It is another object to provide an improved head incorporating the above, in relation to a hosel integrated into the bead interior, and such club head having:

a) a substantially continuous hollow, metallic tube extending lengthwise along a shell wall from the shell top portion to the shell bottom portion, the tube being integral with and terminating proximate the metal shell top portion and having a bore,

b) the tube bore receiving the shaft throughout a major length of the tube, the first end of the shaft being configured to extend into proximity with the bottom surface of the shell bottom portion,

c) the shaft periphery connected to the tube bore, and the tube bore having an upper end terminating proximate the shell top portion,

d) the tube having a lengthwise extending wall integrated along its length with the shell wall so that the shell supports the tube along its length, and whereby metal otherwise required for the tube is instead used in the shell at locations between the tube and the toe portion, to enhance the club head size,

e) and the head front wall having variable thickness, as referred to.

In its method aspect, the invention includes supplying fluid metal (during head casting) via a zone defined by that locally thickened portion, to form head walls including the front wall, the metal cooling in situ at the walls. In thus flowing to the front wall mid-region via the fan-shaped mold cavity (corresponding to the fan-shape of the resultant locally thickened portion of the head front wall), the metal sustains minimum cooling, and is thus able to penetrate with greater flowability to remote wall regions of reduced thickness.

These and other objects and advantages of the invention, as well as the details of an illustrative embodiment, will be more fully understood from the following specification and drawings, in which:

DRAWING DESCRIPTION

Fig. 1 is a plan view looking upwardly into a hollow metal wood head;

Fig. 2 is an elevation looking toward the front face of the Fig. 1 head;

Fig. 3 is a fragmentary section taken on lines 3-3 of Fig. 1;

Fig. 4 is an enlarged fragmentary section taken on lines 4-4 of Fig. 1;

Figs. 4a and 4b are fragmentary sections taken on lines 4a-4a and 4b-4b of Fig. 1, respectively;

Fig. 5 is a view like Fig. 1 showing a modified head construction;

Fig. 6 is an elevation looking toward the front face of the Fig. 5 head;

Fig. 6a is a fragmentary section taken on lines 6a-6a of Fig. 5;

Fig. 6b is an enlarged section taken on lines 6b-6b of Fig. 5;

Fig. 7 is a front elevational view of a metal wood golf club in accordance with a preferred embodiment of the present invention, showing the head and the lower portion of the shaft;

Fig. 8 is a bottom plan view of the golf club shown in Fig. 7;

Fig. 9 is a cross-sectional view taken along lines 9-9 of Fig. 8;

Fig. 10 is a cross-sectional view taken along lines 10-10 of Fig. 8;

Fig. 11 is a front view of a golf club head, like that of Fig. 7, and showing locations of vertical planes extending front-to-rear through the head front wall, as well as the location of a fan-shaped protrusion or thickened portion;

Fig. 12 is a section taken on lines 12-12 of Fig. 11;

Figs. 13(a)--13(m) are enlarged partial sections corresponding to the locations of the front to rear vertical planes indicated in Fig. 11;

Fig. 14 is a horizontal section taken on lines 14-14 of Fig. 11;

Fig. 15 is a horizontal section taken on lines 15-15 of Fig. 11; and

Fig. 16 is a horizontal section taken through a cast head showing the relationship between the locally thickened front wall, as per Figs. 13(a)--13(m), and a hosel tube integrated into the head interior.

DETAILED DESCRIPTION

In Figs. 1-8, the golf club 10 comprises a head in the form of a thin metallic body 11 typically cast, and having a metallic sole plate 12. These elements may consist of steel, stainless steel, or other material, and formed by processes other than investment casting. The hollow body includes a front wall or faceplate 13 having a front surface 13a adapted to strike a golf ball, as well as top wall 14, rear wall 15, and toe and heel walls 16 and 17. As will be seen, the front wall or faceplate advantageously has variable thickness. A hosel 118 extends downwardly into the hollow interior 19' of the heel portion of the head and is adapted to receive a shaft 120'. Thus, the weight of the hosel is concentrated more directly behind, or close to, the rear side 13b of front wall 13, near the heel, to contribute to the ball-striking mass of the front wall. Also, the hosel cylindrical wall 118a reinforces the junction of the variable thickness front wall, bottom wall and heel wall 17, at locus 17a. See also hosel webbing or filleting at 118b, and hosel bore 118c receiving shaft 120. Shaft lower end 120a is shown flush with the bottom surface 118d of the hosel.

In accordance with an important aspect of the invention, a first group or set of narrow, metallic dendrites is provided to extend from the front wall 13 generally rearwardly adjacent the underside 14a of the top or upper wall 14 and integral therewith. See in the example dendrites 18-22 spaced apart in a transverse direction indicated by arrows 20, the dendrites having forward ends 18a--22a merging into the front wall at its junctions with the top wall, the dendrites extending downwardly at locations 18aa--21aa to provide variable front wall thickness. Note the possible widening of the dendrites as they merge with front wall 13 and locally vary the front wall thickness. Such variable thickness of the front wall serves the purpose of distributing impact produced shock waves from the front wall to the top wall, together with junction 23, especially when a ball is hit high on the front wall or face. This in turn serves to prevent cracking and buckling of the thin metal wall 14. Note that the dendrites are spaced apart, i.e., branch at intervals of about 1/2 to 3/4 inch; and that the rearward ends off the dendrites at 18b--22b are transversely spaced apart. The vertical dimension "d" of the dendrites lies within the range 0.127 to 0.254 cms (0.050 to 0.100 inch); and the dendrites are generally convex at 25 toward the interior off the head, along their lengths, and have concave opposite sides at 26 and 27 (see Fig. 4). In this regard, the thickness of the front wall is typically substantially greater than the thickness off the other walls, to strengthen it and prevent cracking under high impact loads. Typical wall approximate thicknesses are: front wall about 0.267 cms (0.105 inches) at locations offset from 18aa--21aa, sole plate 0.089 cms (0.035 inches), and top wall 0.071 cms (0.028 inches). These dimensions are less than current state off the art standard thicknesses, allowing for a larger head and a larger moment of inertia of the head proper for a given total weight. This in turn allows a greater "forgiveness effect" as regards off-center ball strikes.

Also shown is at least one additional dendrite, as at 30, extending from the hosel wall or structure generally rearwardly and transversely, adjacent the upwardly arching underside 14a of the top wall and integral therewith. It is sized in cross section, the same as dendrites 18-22, all of such dendrites having about the same cross sectional dimensions. Dendrite 30 distributes impact force or shock waves from the hosel rearwardly and transversely, along its length and to the upper wall 14. Thus, shock waves are well distributed in their transfer to upper wall 14, as by the dendrites, to minimize risk of head cracking and buckling, especially along the angled junction 23.

Further, the conformation of the dendrites (see Fig. 4a) along their lengths, to head interior wall shape, contributes to shock wave distribution across the upper wall 14. Note that wall 14 may be upwardly crowned, i.e., upwardly shallowly convex.

Another aspect of the invention includes the provision of a second set or group of narrow, metallic dendrites extending generally rearwardly adjacent the underside of the top wall and integral therewith, the second set also including a transversely extending dendrite intersecting the generally rearwardly extending dendrites of the second set. The dendrites of the second set are located further from the head front wall than the first set of dendrites; the rearwardly extending dendrites of the second set being spaced apart, or branching, in transverse direction. The vertical dimensions of the second set dendrites also being between 0.127 and 0.254 cms (0.050 and 0.100 inches). See for example the four dendrites, 38-41, that have fan configuration, radiating rearwardly from different points along the single dendrite 42 spaced rearwardly from

dendrites 18-21. Dendrites 38-41 extend generally rearward to merge with the generally curved rear wall 15 of the head, to direct or transfer such rearward loading to that wall as the dendrites pick up loading from top wall 14. Such rear dendrites provide the rear wall with varying thickness along its toe-to-heel rearward dimensions. Dendrites 38-42 have generally the same configuration and dimensions as dendrites 18-22 and 30. Accordingly, they serve the same shock wave transfer distributing functions to minimize cracking and buckling of the thinned top wall at its junction at 46 with the rear wall. Note also that dendrites 38-42 conform to top wall shape along their lengths. See Fig. 4b. In addition, the rearward ends of the dendrites 38-41 turn downwardly adjacent the inner side of wall 15, as seen at 39a in Fig. 4b, for example.

In Fig. 5, the head itself is the same as in Figs. 1-4 and the same identifying members are used. Forward dendrites 48-51 correspond to dendrites 18-22, but their transverse spacing "s" is greater, being about 1.905 to 2.54 cms (3/4 inch to 1 inch). See spacings s_1 and s_2. Dendrites 48-51 have the same cross-sectional dimensions, and a generally convex-concave surface configuration, as do dendrites 18-22. Dendrite 53 corresponds to dendrite 30 in Fig. 1. All dendrites may, for example, have maximum height dimensions (below the top wall) of about 0.152 cms (0.060 inches).

The five rearward dendrites 68-72 extend or fan rearwardly from a transverse dendrite 73, that corresponds to dendrite 42 in Fig. 1; and they intersect the rearward wall 15 of the head, at intersections along the junction line 76.

Dendrites 48-51 transfer loading from the front wall 13 to the top wall 14; and dendrites 68-72 transfer shock waves from the top wall to the rear wall 15. Dendrite 73 assists this function. Dendrite 53 transfers shock waves from the hosel to the top wall 14.

The number and position of dendrites may vary according to the various head sizes and shapes.

The fact that the dendrites enable head wall thinning allows use of heavier density metallic compositions in the head walls, without reducing the head size below the sizes of standard hollow metal heads made of steel. For example, compositions such as beryllium copper, tungsten, surgical steel alloys, and cobalt alloys can be used. In the past, such heavier metal compositions could not be used without reducing head size.

The provision for variable thickness of the front wall, to strengthen the front wall and its zone of merger with the top wall, together with dendrite strengthening off the rear wall, as by provision of rearwardly and downwardly extending dendrites (as in Fig. 4b for example) provide a double-strengthened head effect, allowing for yet further thinning of other walls, and yet greater enlargement of the overall head.

Referring now to Figs. 7-10, a golf club 110 includes a shaft 112 (only the lower portion of which is shown), which is attached to a head 114. The head 114 is in the configuration of a "wood" club, although it is made of metal. As shown in Figs. 9 and 10, the head comprises a hollow metal shell 116, which is filled with a plastic foam filling 118', preferably polyurethane.

The shell 116 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 116 is formed in two pieces: a main portion 120, and a sole plate 122 that is welded to the main portion 120.

The main shell portion 120 has a top surface 124, a rear surface 126, and a striking surface or face 128 opposite the rear surface 126. The face 128 is angled with respect to the vertical with a specified "pitch" that is determined by the type of club and the amount of loft desired. The end portion of the head 114 proximate the shaft 112 is commonly termed the "heel" 130, while the end portion opposite the heel 130 is termed the "toe" 132. As shown in Fig. 8, the face 128 is typically curved from the heel 130 to the toe 132. The main shell portion 120 has a bottom corner portion 134 (shown in cross-section in Fig. 9) that is flush with the sole plate 122, and that forms a bottom surface or sole in combination with the sole plate 122 when the two shell portions are welded together.

Referring now to Fig. 9, the heel portion 130 of the shell 116 is provided with a substantially continuous hollow tube 136 that extends from an upper opening 138 in the top surface 124 to a lower opening 140 in the bottom surface or sole through the bottom corner portion 134 of the main shell portion 120. The tube 136 is of substantially uniform internal diameter, and its side wall is interrupted by an internal orifice 142 that opens into the interior of the shell. The orifice 142 provides an entrance for the introduction of the foam material 118 into the shell interior during the manufacturing process.

The tube 136 is dimensioned to receive the lower part of the shaft 112 with a snug fit. The upper opening 138 is provided with a radiused lip 143, as shown in Fig. 9, 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 136, extending downwardly from the upper opening 138, is configured to provide a "glue lock" for better bonding of the shaft in the tube, as will be described below. The lip 143 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 defined by the highest point of the club head top surface 124.

The shaft 112 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 stainless steel, the exterior of the shaft may be chrome-plated to minimize corrosion. The lower part of the shaft is fitted with a plug 146 to prevent the entry of moisture into the interior of the shaft. The plug 146 may be of any suitable resilient material, such as Nylon, epoxy, polyurethane, or Delrin. The plug 146 may be retained in the shaft by an annular crimp 148 in the shaft wall. The crimp 148 also serves as a glue lock, as will be discussed below. A locator ring 150, for example of glass fiber-reinforced Nylon, is adhesively bonded to the shaft at a distance above the bottom end 152 of the shaft approximately equal to the maximum length of the tube 136.

The shaft 112 may be attached to the head 114 by a suitable epoxy adhesive, "glue locks", as mentioned above, being provided 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 136 until the locator ring 150 abuts against the radiused lip 143 at the upper tube opening 138. The bottom end 152 of the shaft 112 then extends slightly beyond the lower tube opening 140. This bottom end 152 is then cut and ground so as to be flush with the sole of the head, as shown in Figs. 8 and 9.

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 transfer of energy from the player to the ball, with little or no "deadweight" to reduce the attainable club head velocity. By increasing the effective mass of the club head without reducing the attainable velocity, there is a more effective transfer of energy to the ball from the player, yielding increased shot distance without an increase in effort on the part of the player.

Moreover, without a hosel, the lower part of the shaft extends all the way through the head, with the bottom end 152 of the shaft terminating flush with the sole. Thus, by eliminating the hosel, the shaft both enters and exits the head within the area defined between the top and bottom of the face of the club head, which area is sometimes called the "ball control zone". By bringing the lower end of the shaft within the ball control zone and extending the shaft through to the sole of the club head, the tactile sense of the location of the club 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 club head, plus the rigid support for the lower end of the shaft provided by the internal tube 136 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 club head where it can contribute to the effective mass and movement of intertia of the head without increasing the total head mass.

Still another advantage of eliminating the external hosel is that there is a more even cooling of the club head in the mold. Where there is an external hosel, by comparison, the hosel and the rest of the club 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.

The sole configuration includes a trailing edge, flat 156, which is a relieved, upwardly-angled flattened portion extending upwardly from a point approximately midway between the center of the sole and a trailing edge 158 at the juncture between the rear surface 126 of the club head and the sole plate 122. The lowermost part of the trailing edge flat 156 is contiguous with the interior end of a rounded rail 160 that extends forward to the bottom edge of the face 128 of the club head. Extending upwardly from one side of the rail 160 to the toe end 132 of the club head is a second relieved and flattened portion of the sole that may be termed a toe flat 162. Similarly, extending upwardly from the other side of the rail 160 to the heel end 130 of the club head is a third relieved and flattened portion that may be termed a heel flat 164.

The trailing edge flat 156 is preferably at an angle A of approximately 18° with respect to the horizontal, while the toe flat 162 and the heel flat 164 are preferably at an angle B of approximately 19° with respect to the horizontal. The angles A and B may be varied by plus or minus up to 5°, depending on the type of club and the preference of the player.

The purpose of the three flats--156, 162 and 164--and of the rail 160 is as follows: the rail 160 guides the club head in a straight line through impact with the ball, even if the ball is hit slightly "fat", or is hit out of the rough or sand. The trailing edge flat 156 minimizes the club head's closing, or "hooding", when the ball is hit fat, while reducing the overall aerodynamic drag of the club head to maximize its attainable velocity during the swing. The toe flat 162 and the heel flat 164 facilitate shots from sidehill and uneven lies.

From the foregoing description, it will be appreciated that a golf club head, in accordance with the present invention, offers a number of significant advantages over prior art "metal woods". For example, the effective club head mass is increased to nearly 100 per cent of the total club head mass, thereby

maximizing the efficiency of energy transfer from the player to the ball. By maximizing the effective club head mass, and by bringing the lower end of the shaft down through the entire club head and into the sole through an internal tube in the club head, "head feel" is dramatically increased to the point where it is comparable to that attainable with high quality persimmon woods. Greater uniformity in club head shape can be achieved by reducing warpage in the mold from unequal cooling of the hosel as compared to the rest of the shell. The shape of the sole helps to increase shot accuracy from uneven lies, the rough, and sand traps, while minimizing the deleterious effects on shot accuracy resulting from hitting the ball fat, and while also providing excellent aerodynamic qualities for the club head to maximize attainable club head velocity during the swing.

Referring now to Figs. 11-13, it will be noted that the front wall 254 of the cast metallic head has locally varying thickness. It includes a locally rearwardly thickened portion 200 which extends in a direction from a mid-region 201 of the front wall, toward a peripheral region of the head, near the heel 130. Thickened portion 200 projects throughout its elongated length toward the interior of the head, as is seen from both Fig. 12 and the sections (a)--(g) of Fig. 13. Note also that the thickened portion 200 has upright width "w" which progressively increases in the direction designated by the arrow 202 in Fig. 11. The thickened portion is rearwardly generally dome-shaped in upright planes which extend rearwardly, as for example are represented by sections 13(b)--13(f), and as viewed in Fig. 12. The thickened portion 200 has fan-shaped divergence or flare between the mid-region 201 of the front wall and the heel 130 of the head, and at the rear side of front wall 254. Note that the bottom edge region 200a of the thickened portion 200 is concave rearwardly in Fig. 12, and slopes downwardly and rightwardly in Fig. 11, as is also clear from Figs. 13-(a)--13(g). The upper edge region 200b of the thickened portion 200 is rearwardly and upwardly concave in Fig. 12, and remains at about the same level in direction 202 in Fig. 11.

The thickened region facilitates flow of hot metal during casting, into the space 200' seen in Fig. 15 between mold sections 210 and 211, and as indicated by arrow 212, from a metal supply gate 213, necked at region 213a, with minimum cooling. This, then, facilitates flow of metal to the entire variable thickness front wall 254, and to the reduced thickness top, rear, toe, and heel walls, without such metal cooling and thickening as would prevent or impede metal flow to the entireties of the head shell walls.

A further feature is the provision of front wall decreasing (varying) thickness t_1, in a direction from the mid-region 201 toward the heel, and at locations offset from the locally thickened portions 200'. See Figs. 13(a)-- 13(g) in this regard. Representative thicknesses t_1 in inches are indicated, but these can vary. Similarly, the front wall has decreasing (varying) thickness t_2 in a direction from the mid-region 201 toward the toe of the head, as seen at sections 13(a)--13(m). Again, representative thicknesses are indicated, but these can vary. Such head front wall thickness tapers toward both the heel and toe, and provides for maximum strength near the ball striking mid-region or sweet-spot 201 of the front wall, in a head wherein the other walls (top, rear, heel, and toe) are of relatively reduced thickness. Strengthening of the front wall is additionally increased by the thickened portion 200 described. Representative wall thicknesses are as follows:

wall	thickness size, in cms (inches)
top	0.071 - 0.089 (.028 - .035)
rear	0.071 - 0.089 (.028 - .035)
heel	0.071 - 0.089 (.028 - .035)
toe	0.071 - 0.089 (.028 - .035)

Fig. 16 illustrates the relative positions of the fan-shaped locally thickened portion 200 and the internal hosel tube 136, as seen in a head of Figs. 7-11 type. Note that the thickened portion 200 merges with that hosel, along its length, and locally of the forward extent of the hosel tube. Added strengthening of the head results, as well as assured flow of hot metal, during casting, from the gate to the hosel spaces provided in the mold.

Note also in Fig. 16 the forward dendrites 18-22, with forward portions 18aa--21aa (as referred to above) merging with the front wall and contributing to variable wall thickness, as referred to in the discussion of Figs. 1-6. See also rear dendrites 39'--41'.

Fig. 12 shows the forward dendrite portions, as at 20aa, extending well downwardly adjacent the rear side off the variable thickness front wall 254' to buttress and strengthen that wall; and also the rear dendrites extending downwardly as at 39aa adjacent rear wall 115, to strengthen same and provide the rear wall with variable thickness along its length. Accordingly, a dual-strengthening (front and rear of the head) effect is thereby significantly achieved.

Claims

1. A metallic golf club head having a hollow interior, comprising
   a) a ball-striking front wall (13), and the head having walls at the top (14), bottom (12), rear (15), heel (17), and toe (16) of the head,
   b) said front wall (13) having variable thickness (18aa-21aa) that varies between the heel (17) and toe (16) to transmit golf striking impact forces from the head front wall (13) to said top wall (14) without cracking or buckling of said front wall (13) or top wall (14), said variable thickness locally decreasing in a direction toward said toe (16), and also locally decreasing in a direction toward said heel (17), characterised in
   c) said front wall (13) also having an additional locally rearwardly thickened bulging portion (200) which extends in a direction toward the heel (17) from a mid-region (201) of the front wall (13) toward a peripheral region of the front wall (13), and
   d) the locally rearwardly thickened and bulging portion (200) also being metallically integral with said front face (13) directly forwardly of said bulging portion (200).

2. A head as claimed in claim 1, wherein said variable thickness is measured in vertical planes normal to said front wall (13) and spaced apart between said toe (16) and heel (17).

3. A head as claimed in any preceeding claim, including a metallic hosel (118) integral with the head and located within the interior thereof and proximate said variable thickness front wall (13).

4. A head as claimed in any preceeding claim, wherein said variable thickness exists at locations proximate a merging interconnection of said front wall (13) and said top wall (14).

5. A head as claimed in claim 4, including
   e) a first group of narrow, metallic, shock wave distributing dendrites (18-22) extending from said variable thickness front wall (13) generally rearwardly adjacent the underside of the top wall (14) and integral therewith,
   f) the dendrites (18-22) being spaced apart by amounts greater than their widths, the maximum height dimensions of the dendrites (18-22) below the underside of the top wall (14) being between 0.127 and 0.254 cms (0.050 and 0.100 inches) and the dendrites (18-22) being generally downwardly convex in cross-section.

6. A head as claimed in claim 5, wherein the dendrites (18-22), metallic hosel (118) within the head interior, and said variable thickness front wall (13) all comprise part of a single metallic casting.

7. A head as claimed in claim 5 or claim 6, wherein the front wall (13) has local thickness substantially greater than the thickness of the top wall (14), and said dendrites (18-22) of the first group merge with the inner side of said variable thickness front wall (13).

8. A head as claimed in any preceeding claim, including a second group of narrow metallic dendrites (38-41) which are integral with said rear wall (15) and extend downwardly at the inner side of said rear wall (15).

9. A head as claimed in claim 8, wherein the dendrites (38-41) of the second group also extend beneath said top wall (14) and are spaced apart in a transverse direction, the maximum height dimensions of the second group dendrites (38-41) being between 0.127 and 0.254 cms (0.050 and 0.100 inches).

10. A head as claimed in any preceding claim, wherein said thickened portion (200) projects into the hollow interior of the head.

11. A head as claimed in any preceding claim, wherein said locally thickened portion (200) has upright width which progressively increases forward the periphery of the front wall (13).

12. A head as claimed in claim 10 or claim 11, wherein said thickened portion (200) is rearwardly generally dome-shaped in upright planes which extend rearwardly.

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13. A head as claimed in any preceding claim, wherein said front wall (13) has decreasing thickness in a direction from said mid-region toward said toe (16).

14. A head as claimed in any preceding claim, wherein said front wall (13) has decreasing thickness in a direction from said mid-region toward said heel (17), and at locations offset from said locally thickened portion (200).

15. A head as claimed in claim 11, wherein said locally thickened portion has fan-shaped divergence (200) between said mid-region (201) of the front wall (13) and the heel (130) of the head, and at the rear side of the front wall (254).

16. A method of casting the head of any preceding claim, wherein fluid metal is supplied via a zone defined by said locally thickened portion to form head walls including said front wall (13) wherein said metal cools in situ at said walls.

17. A golf club of the type comprising a head as claimed in any of claims 1 to 15, and a shaft (112) with a first end, a portion of the shaft (112) proximate said first end being attached to a head (114), the head (114) comprising a hollow metal shell (116) with said top wall (14) being substantially continuous from said toe (16) to said heel (17), a substantially continuous hollow, metallic tube (136) extending lengthwise along a shell wall from the shell top (124) to the shell bottom, said tube (136) being integral with and terminating proximate said metal shell top (124) and having a bore,

a) the tube bore receiving the shaft (112) throughout a major length of the tube (136), the first end of the shaft (112) being configured to extend into proximity with the bottom surface of the shell bottom,

b) the shaft periphery, connected to the tube bore, and the tube bore having an upper end terminating proximate said shell top (124),

c) the tube (136) having a lengthwise extending wall integrated along its length with said shell wall so that the shell supports the tube (136) along its length, and whereby metal otherwise required for the tube (136) is used in the shell at locations between the tube (136) and said toe,

d) said front wall having variable thickness between the heel and the toe.

18. A golf club as claimed in claim 17, wherein said locally thickened portion (200) flares generally toward said tube (136).

19. A golf club comprising a head as claimed in any of claims 1 to 15, and a shaft (112) with a first end, a portion of the shaft (112) proximate said first end, being attached to a head, a substantially continuous hollow, metallic hosel tube (136) extending within said metal shell (120) at the heel portion (130) from the shell top wall (124) to the shell bottom wall, said tube (136) being integral with and terminating proximate said metal shell top wall (124), and having a bore, said heel portion (130) including a heel wall merged with a rearwardmost extent of said tube (136), the tube bore receiving a portion of the first end of the shaft (112), and there being means connecting the shaft periphery to the tube bore, said front wall (13) having variable thickness between said toe portion (16) and said heel portion (130).

20. A golf club comprising a metal golf club head as claimed in any of claims 1 to 15 and having a substantially continuous hollow tube (136) extending between the top surface, the bottom surface near the heel end, said tube (136) being formed to have an upper end terminating proximate the level of said uppermost extent of said striking surface, to have an uppermost rearward end defining an uppermost extent of said heel (130), and a shaft (112) fixed to said head.

21. A method of fabricating a metal golf club as claimed in claim 20 comprising the steps of:

a) providing a metal golf club head as claimed in any of claims 1 to 18 and having a substantially continuous hollow tube (136) extending between the top surface, the bottom surface near the heel end (130), said tube (136) being formed to have an upper end terminating proximate the level of said uppermost extent of said striking surface, to have an uppermost rearward end defining an uppermost extent of said heel (130), and

b) inserting the first end of the shaft (112) into the tube (136) with an adhesive material applied between the exterior surface of the shaft (112) and the interior wall of the tube (136), the shaft (112) being inserted so that the first end of the shaft (112) extends proximate said bottom surface.

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Patentansprüche

1. Metallischer Golfschlägerkopf mit einem hohlen Inneren, der folgendes aufweist:
   a) eine Vorderwand (13) zum Schlagen des Balls, wobei der Kopf Wände an der Oberseite (14), der Unterseite (12), der Rückseite (15), der Ferse (17) und dem Löffel (16) des Kopfs hat,
   b) wobei die Vorderwand (13) eine veränderliche Dicke (18aa-21aa) hat, die zwischen der Ferse (17) und dem Löffel (16) veränderlich ist, um Golfabschlagkräfte von der Vorderwand (13) des Kopfs zu der oberen Wand (14) ohne Rißbildung oder Knicken der Vorderwand (13) oder der oberen Wand (14) zu übertragen, wobei die veränderliche Dicke lokal in einer Richtung zu dem Löffel (16) abnimmt und außerdem lokal in einer Richtung zu der Ferse (17) abnimmt,
   dadurch gekennzeichnet, daß
   c) die Vorderwand (13) außerdem einen zusätzlichen, lokal nach rückwärts verdickten Ausbauchungsbereich (200) hat, der in einer Richtung zu der Ferse (17) ausgehend von einem Mittelbereich (201) der Vorderwand (13) zu einem Umfangsbereich der Vorderwand (13) verläuft, und
   d) der lokal nach rückwärts verdickte Ausbauchungsbereich (200) außerdem mit der Vorderfläche (13) unmittelbar vor dem Ausbauchungsbereich (200) metallisch integral ist.

2. Kopf nach Anspruch 1, wobei die veränderliche Dicke in vertikalen Ebenen gemessen ist, die zu der Vorderwand (13) normal und zwischen dem Löffel (16) und der Ferse (17) voneinander beabstandet sind.

3. Kopf nach einem der vorhergehenden Ansprüche, der eine metallische Buchse (118) aufweist, die mit dem Kopf integral und in dessen Innerem und nahe der Vorderwand (13) veränderlicher Dicke angeordnet ist.

4. Kopf nach einem der vorhergehenden Ansprüche, wobei die veränderliche Dicke an Stellen existiert, die sich nahe einer ineinanderführenden Verbindung zwischen der Vorderwand (13) und der oberen Wand (14) befinden.

5. Kopf nach Anspruch 4, der folgendes aufweist:
   e) eine erste Gruppe von schmalen, metallischen, Stoßwellen verteilenden Dendriten (18-22), die von der Vorderwand (13) veränderlicher Dicke im allgemeinen rückwärts angrenzend an die Unterseite der oberen Wand (14) und damit integral verlaufen,
   f) wobei die Dendriten (18-22) um Strecken, die größer als ihre Breiten sind, voneinander beabstandet sind, die maximalen Höhenabmessungen der Dendriten (18-22) unterhalb der Unterseite der oberen Wand (14) zwischen 0,127 und 0,254 cm (0,050 und 0,100 inch) liegen und die Dendriten (18-22) im Querschnitt allgemein nach unten konvex sind.

6. Kopf nach Anspruch 5, wobei die Dendriten (18-22), die metallische Buchse (118) im Inneren des Kopfs und die Vorderwand (13) veränderlicher Dicke Teil eines einzigen metallischen Gußstücks bilden.

7. Kopf nach Anspruch 5 oder Anspruch 6, wobei die Vorderwand (13) eine lokale Dicke hat, die erheblich größer als die Dicke der oberen Wand (14) ist, und die Dendriten (18-22) der ersten Gruppe in die Innenseite der Vorderwand (13) veränderlicher Dicke übergehen.

8. Kopf nach einem der vorhergehenden Ansprüche, der eine zweite Gruppe von schmalen metallischen Dendriten (38-41) aufweist, die mit der hinteren Wand (15) integral sind und an der Innenseite der hinteren Wand (15) nach unten verlaufen.

9. Kopf nach Anspruch 8, wobei die Dendriten (38-41) der zweiten Gruppe außerdem unterhalb der oberen Wand (14) verlaufen und in einer Querrichtung voneinander beabstandet sind, wobei die maximalen Höhenabmessungen der Dendriten (38-41) der zweiten Gruppe zwischen 0,127 und 0,254 cm (0,050 und 0,100 inch) liegen.

10. Kopf nach einem der vorhergehenden Ansprüche, wobei der verdickte Bereich (200) in das hohle Innere des Kopfs ragt.

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11. Kopf nach einem der vorhergehenden Ansprüche, wobei der lokal verdickte Bereich (200) eine Breite in Vertikalrichtung hat, die zum Umfang der Vorderwand (13) hin progressiv zunimmt.

12. Kopf nach Anspruch 10 oder Anspruch 11, wobei der verdickte Bereich (200) in vertikalen Ebenen, die nach rückwärts verlaufen, nach rückwärts allgemein kuppelförmig ist.

13. Kopf nach einem der vorhergehenden Ansprüche, wobei die Vorderwand (13) in einer Richtung von dem Mittelbereich zu dem Löffel (16) hin abnehmende Dicke hat.

14. Kopf nach einem der vorhergehenden Ansprüche, wobei die Vorderwand (13) in einer Richtung von dem Mittelbereich zu der Ferse (17) hin und an Stellen, die von dem lokal verdickten Bereich (200) versetzt sind, abnehmende Dicke hat.

15. Kopf nach Anspruch 11, wobei der lokal verdickte Bereich fächerförmige Divergenz (200) zwischen dem Mittelbereich (201) der Vorderwand (13) und der Ferse (130) des Kopfs und an der Rückseite der Vorderwand (254) hat.

16. Verfahrem zum Gießen des Kopfs nach einem der vorhergehenden Ansprüche, wobei flüssiges Metall über eine Zone, die von dem lokal verdickten Bereich definiert ist, zugeführt wird, um Wände des Kopfs einschließlich der Vorderwand (13) zu bilden, wobei das Metall an diesen Wänden in situ abkühlt.

17. Golfschläger des Typs, der einen Kopf nach einem der Ansprüche 1 bis 15 sowie einen Schaft (112) mit einem ersten Ende aufweist, wobei ein Teil des Schafts (112) nahe dem ersten Ende an einem Kopf (114) befestigt ist, wobei der Kopf (114) aufweist: ein hohles Metallgehäuse (116), wobei die obere Wand (14) von dem Löffel (16) zu der Ferse (17) im wesentlichen kontinuierlich ist, ein im wesentlichen kontinuierliches, hohles, metallisches Rohr (136), das in Längsrichtung entlang einer Gehäusewand von der Gehäuseoberseite (124) zum Gehäuseboden verläuft, wobei das Rohr (136) mit der Oberseite (124) des Metallgehäuses integral ist und nahe dieser Oberseite endet und eine Bohrung hat,
    a) wobei die Rohrbohrung den Schaft (112) über eine Hauptlänge des Rohrs (136) aufnimmt, wobei das erste Ende des Schafts (112) so ausgebildet ist, daß es sich in die Nähe der Bodenfläche des Gehäusebodens erstreckt,
    b) wobei der Schaftumfang, der mit der Rohrbohrung verbunden ist, und die Rohrbohrung ein oberes Ende haben, das nahe dem Gehäuseoberende (124) endet,
    c) wobei das Rohr (136) eine in Längsrichtung verlaufende Wand hat, die entlang ihrer Länge mit der Gehäusewand integral ist, so daß das Gehäuse das Rohr (136) entlang seiner Länge abstützt, wobei Metall, das ansonsten für das Rohr (136) erforderlich ist, in dem Gehäuse an Stellen zwischen dem Rohr (136) und dem Löffel verwendet wird,
    d) wobei die Vorderwand zwischen der Ferse und dem Löffel veränderliche Dicke hat.

18. Golfschläger nach Anspruch 17, wobei der lokal verdickte Bereich (200) sich allgemein in Richtung zu dem Rohr (136) erweitert.

19. Golfschläger, der einen Kopf nach einem der Ansprüche 1 bis 15 und einen Schaft (112) mit einem ersten Ende aufweist, wobei ein Teil des Schafts (112) nahe dem ersten Ende an einem Kopf befestigt ist, wobei sich ein im wesentlichen kontinuierliches, hohles, metallisches Buchsenrohr (136) in dem Metallgehäuse (120) an dem Fersenbereich (130) von der oberen Wand (124) des Gehäuses zu der Bodenwand des Gehäuses erstreckt, wobei das Rohr (136) mit der oberen Wand (124) des Metallgehäuses integral ist und in deren Nähe endet und eine Bohrung hat, wobei der Fersenbereich (130) eine Fersenwand hat, die in eine am weitesten rückwärts liegende Erstreckung des Rohrs (136) übergeht, wobei die Rohrbohrung einen Bereich des ersten Endes des Schafts (112) aufnimmt, und wobei Mittel vorgesehen sind, die den Schaftumfang mit der Rohrbohrung verbinden, wobei die Vorderwand (13) zwischen dem Löffelbereich (16) und dem Fersenbereich (130) veränderliche Dicke hat.

20. Golfschläger, der einen metallischen Golfschlägerkopf nach einem der Ansprüche 1 bis 15 aufweist und ein im wesentlichen kontinuierliches, hohles Rohr (136) hat, das sich zwischen der oberen Oberfläche und der unteren Oberfläche nahe dem Fersenende erstreckt, wobei das Rohr (136) so geformt ist, daß es ein oberes Ende hat, das nahe dem Niveau der obersten Erstreckung der Schlagfläche endet, so daß es ein oberstes hinteres Ende, das eine oberste Erstreckung der Ferse (130) definiert, und einen

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an dem Kopf (112) befestigten Schaft (112) hat.

21. Verfahren zum Herstellen eines metallischen Golfschlägers nach Anspruch 20, das die folgenden Schritte aufweist:
    a) Bereitstellen eines metallischen Golfschlägerkopfs nach einem der Ansprüche 1 bis 15, der ein im wesentlichen kontinuierliches hohles Rohr (136) hat, das zwischen der oberen Oberfläche und der unteren Oberfläche nahe dem Fersenende (130) verläuft, wobei das Rohr (136) so geformt ist, daß es ein oberes Ende hat, das nahe dem Niveau der obersten Erstreckung der Schlagfläche endet, so daß es ein oberstes hinteres Ende hat, das eine oberste Erstreckung der Ferse (130) definiert, und
    b) Einsetzen des ersten Endes des Schafts (112) in das Rohr (136) mit einem zwischen der Außenfläche des Schafts (112) und der Innenwand des Rohrs (136) aufgebrachten Klebstoffmaterial, wobei der Schaft (112) so eingesetzt wird, daß das erste Ende des Schafts (112) sich nahe der Bodenfläche erstreckt.

Revendications

1. Tête de canne de golf métallique dont l'intérieur est creux, comprenant
    a) une paroi frontale pour frapper la balle (13), la tête disposant de parois dans la partie supérieure (14), inférieure (12), arrière (15), de talon (17), et de bout (16) de la tête,
    b) ladite paroi frontale (13) ayant une épaisseur variable (18aa - 21aa) qui varie entre le talon (17) et le bout (16) afin de transmettre les forces d'impact de frappe de la balle de golf qui proviennent de la paroi frontale (13) de la tête à ladite paroi supérieure (14), sans fendillement ni gauchissement de ladite paroi frontale (13) ou de ladite paroi supérieure (14), ladite épaisseur variable décroissant localement dans une direction orientée vers ledit bout (16), et décroissant également localement dans une direction orientée vers ledit talon (17), caractérisée en ce que
    c) ladite paroi frontale (13) a également une partie supplémentaire de renflement qui est localement épaissie vers l'arrière (200) et qui s'avance dans une direction orientée vers le talon (17) depuis une région médiane (201) de la paroi frontale (13) vers une région périphérique de la paroi frontale (13), et
    d) la partie de renflement localement épaissie vers l'arrière (200) est également intégrée métallurgiquement à ladite paroi frontale (13) directement en avant de ladite partie de renflement (200).

2. Tête selon la revendication 1, dans laquelle ladite épaisseur variable est mesurée dans des plans verticaux normaux à ladite paroi frontale (13) et espacés entre ledit bout et ledit talon (17).

3. Tête selon l'une quelconque des revendications précédentes, comprenant un tube métallique (118) intégré à la tête et situé à l'intérieur de celle-ci et à proximité de ladite paroi frontale d'épaisseur variable (13).

4. Tête selon l'une quelconque des revendications précédentes, dans laquelle ladite épaisseur variable est présente en des emplacements proches d'une liaison par fusion de ladite paroi frontale (13) et de ladite paroi supérieure (14).

5. Tête selon la revendication 4, comprenant
    e) un premier groupe de dendrites de distribution d'ondes de choc étroites, métalliques (18 - 22) s'avançant à partir de ladite paroi frontale d'épaisseur variable (13), généralement adjacentes vers l'arrière au dessous de la paroi supérieure (14) et intégrées à celle -ci,
    f) les dendrites (18 - 22) étant espacées avec des valeurs d'écartement supérieures à leur largeur, les dimensions maximum en hauteur des dendrites (18 - 22) au dessous de la paroi supérieure (14) étant comprises entre 0,127 et 0,254 cm (0,050 et 0,100 pouce) et les dendrites (18 - 22) ayant généralement une section transversale convexe orientée vers le bas.

6. Tête selon la revendication 5, dans laquelle les dendrites (18 - 22), le tube métallique (118) placé à l'intérieur de la tête, et ladite paroi frontale d'épaisseur variable (13) font tous partie d'une seule coulée métallique.

7. Tête selon la revendication 5 ou la revendication 6, dans laquelle la paroi frontale (13) a une épaisseur qui est localement sensiblement supérieure à l'épaisseur de la paroi supérieure (14), et lesdites

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dendrites (18 - 22) du premier groupe sont fusionnées avec le côté intérieur de ladite paroi frontale d'épaisseur variable (13).

8. Tête selon l'une quelconque des revendications précédentes, comprenant un second groupe de dendrites métalliques étroites (38 - 41) qui sont venues de matière avec ladite paroi arrière (15) et qui s'étend vers le bas sur le côté intérieur de ladite paroi arrière (15).

9. Tête selon la revendication 8, dans laquelle les dendrites (38 - 41) du second groupe s'étendent également sous ladite paroi supérieure (14) et sont espacées dans une direction transversale, les dimensions maximum en hauteur du second groupe de dendrites (38 - 41) étant comprises entre 0,127 et 0,254 cm (0,050 et 0,100 pouce).

10. Tête selon l'une quelconque des revendications précédentes, dans laquelle ladite partie épaissie localement (200) fait saillie dans l'intérieur creux de la tête.

11. Tête selon l'une quelconque des revendications précédentes, dans laquelle ladite partie épaissie localement (200) a une largeur dans un plan debout qui augmente progressivement vers le pourtour de la paroi frontale (13).

12. Tête selon la revendication 10 ou la revendication 11, dans laquelle ladite partie épaissie localement (200) a en général une forme bombée vers l'arrière dans des plans debout orientés vers l'arrière.

13. Tête selon l'une quelconque des revendications précédentes, dans laquelle ladite paroi frontale (13) est d'épaisseur décroissante dans une direction orientée vers ledit bout (16) à partir de ladite région médiane.

14. Tête selon l'une quelconque des revendications précédentes, dans laquelle ladite paroi frontale (13) est d'épaisseur décroissante dans une direction orientée vers ledit talon (17) à partir de ladite région médiane, et en des emplacements décalés par rapport à ladite partie épaissie localement (200).

15. Tête selon la revendication 11, dans laquelle ladite partie épaissie localement présente une divergence en éventail (200) entre ladite région médiane (201) de la paroi frontale (13) et le talon (130) de la tête, et à l'arrière de la paroi frontale (254).

16. Procédé de coulage de la tête selon l'une quelconque des revendications précédentes, dans lequel le métal liquide est fourni via une zone formée par ladite partie épaissie localement pour constituer les parois de la tête comprenant ladite paroi frontale (13), ledit métal se refroidissant in situ dans lesdites parois.

17. Canne de golf du type comprenant une tête selon l'une quelconque des revendications 1 à 15, et un arbre (112) qui a une première extrémité, une partie de l'arbre (112) proche de ladite première extrémité étant fixée à une tête (114), la tête (114) comprenant une coque métallique creuse (116) et ladite paroi supérieure (14) étant sensiblement continue depuis ledit bout (16) jusqu'au dit talon (17), un tube métallique creux sensiblement continu (136) étant disposé en longueur le long de la paroi de la coque depuis la partie supérieure de la coque (124) jusqu'à la partie inférieure de la coque, ledit tube (136) étant venu de matière avec et se terminant à proximité de ladite partie supérieure de la coque métallique (124) et ayant un alésage

a) l'alésage du tube recevant l'arbre (112) sur une grande longueur du tube (136), la première extrémité de l'arbre (112) étant configurée de façon à s'étendre jusqu'à proximité de la surface inférieure de la partie inférieure de la coque

b) le pourtour de l'arbre, relié à l'alésage du tube, et l'alésage du tube ayant une extrémité supérieure qui se termine à proximité de ladite partie supérieure de la coque (124)

c) le tube (136) ayant une paroi longitudinale qui est intégrée dans sa longueur avec ladite paroi de la coque de façon à ce que la coque supporte le tube (136) dans sa longueur, ce qui permet d'utiliser le métal qui serait autrement nécessaire pour le tube dans des emplacements de la coque qui sont situés entre le tube (136) et ledit bout,

d) ladite paroi frontale ayant une épaisseur variable entre le talon et le bout.

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18. Canne de golf selon la revendication 17, dans laquelle ladite partie épaissie localement (200) s'évase généralement vers ledit tube (136).

19. Canne de golf comprenant une tête selon l'une quelconque des revendications 1 à 15, et un arbre (112) qui a une première extrémité, une partie de l'arbre (112) proche de ladite première extrémité étant fixée à une tête, un tube métallique creux sensiblement continu (136) s'étendant à l'intérieur de ladite coque métallique (120) sur la partie de talon (130) depuis la paroi supérieure de la coque (124) jusqu'à la paroi inférieure de la coque, ledit tube (136) étant venu de matière avec et se terminant à proximité de ladite paroi supérieure de la coque métallique (124) et ayant un alésage, ladite partie de talon (130) comprenant une paroi de talon fusionnée avec un prolongement arrière dudit tube (136), l'alésage du tube recevant une partie de la première extrémité de l'arbre (112), et qui comprend un moyen permettant de relier le pourtour de l'arbre à l'alésage du tube, ladite paroi frontale (13) ayant une épaisseur variable entre ladite partie de bout (16) et ladite partie de talon (130).

20. Canne de golf comprenant une tête de canne de golf métallique selon l'une quelconque des revendications 1 à 15 et disposant d'un tube creux sensiblement continu (136) s'étendant entre la surface supérieure et la surface inférieure située à proximité de l'extrémité de talon, ledit tube (136) étant constitué de façon à avoir une extrémité supérieure se terminant à proximité du niveau dudit prolongement supérieur de ladite surface de frappe, et à avoir une extrémité arrière supérieure formant un prolongement supérieur dudit talon (130), et un arbre (112) fixé à ladite tête.

21. Procédé de fabrication d'une canne de golf métallique selon la revendication 20, comprenant les étapes consistant à :

a) fournir une tête de canne de golf métallique selon l'une quelconque des revendications 1 à 18 et disposant d'un tube creux sensiblement continu (136) s'étendant entre la surface supérieure et la surface inférieure située à proximité de l'extrémité de talon (130), ledit tube (136) étant constitué de façon à avoir une extrémité supérieure se terminant à proximité du niveau dudit prolongement supérieur de ladite surface de frappe, et à avoir une extrémité arrière supérieure formant un prolongement supérieur dudit talon (130), et

b) insérer la première extrémité de l'arbre (112) dans le tube (136), un matériau adhésif étant appliqué entre la surface extérieure de l'arbre (112) et la paroi intérieure du tube (136), et l'arbre (112) étant inséré de façon à ce que la première extrémité de l'arbre (112) s'étende jusqu'à proximité de ladite surface inférieure.