(12) UK Patent Application (19) GB (11) 2 280 380 (13) A

(43) Date of A Publication 01.02.1995

(21) Application No 9415103.2

(22) Date of Filing 27.07.1994

(30) Priority Data
(31) 9315607 (32) 28.07.1993 (33) GB

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(51) INT CL^6
A63B 53/04

(52) UK CL (Edition N)
A6D D23B

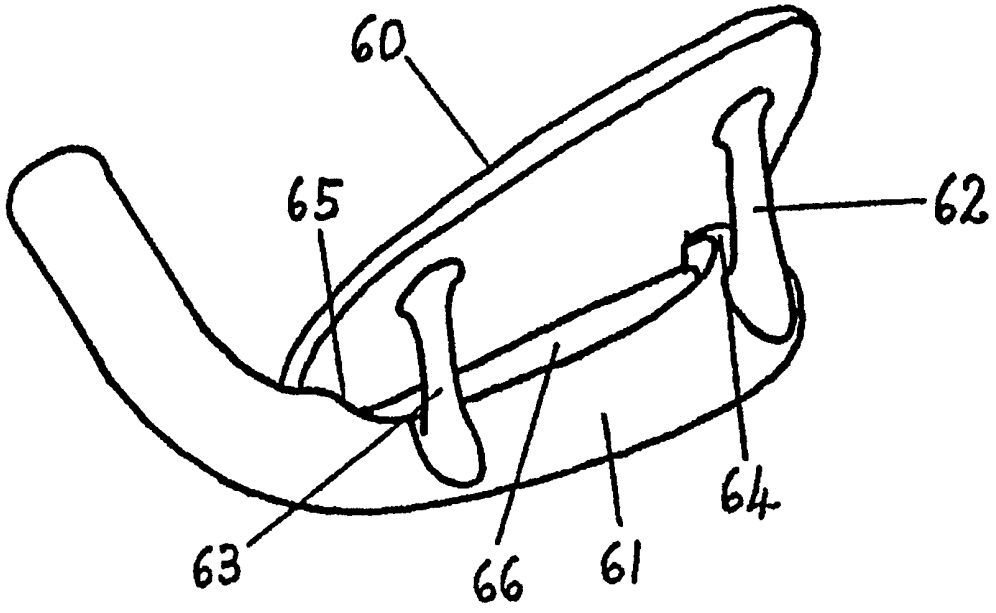
(56) Documents Cited
GB 2218340 A US 4919428 A US 1250296 A

(58) Field of Search
UK CL (Edition M) A6D D23A D23B
INT CL^5 A63B 53/00 53/02 53/04 53/06
ONLINE DATABASES WPI

(54) Golf club heads

(57) In a golf club head, particularly an 'iron' or 'wood' head, the face is attached in a manner such that its stress wave transmission characteristics can be established relatively independently of the sole and/or hosel components. The face suitably is in the form of a plate (60) which is not attached directly to the hosel and which is attached to the sole preferably at one or more discrete attachment points such as at sole lugs (64, 65) and/or by one or more struts (62, 63).

Fig. 6B



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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

This print takes account of replacement documents submitted after the date of filing to enable the application to comply with the formal requirements of the Patents Rules 1990.

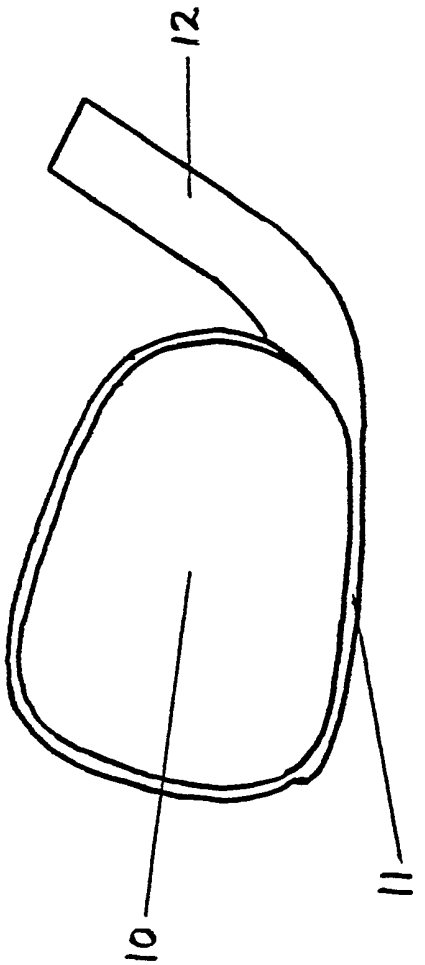


Fig. 1A

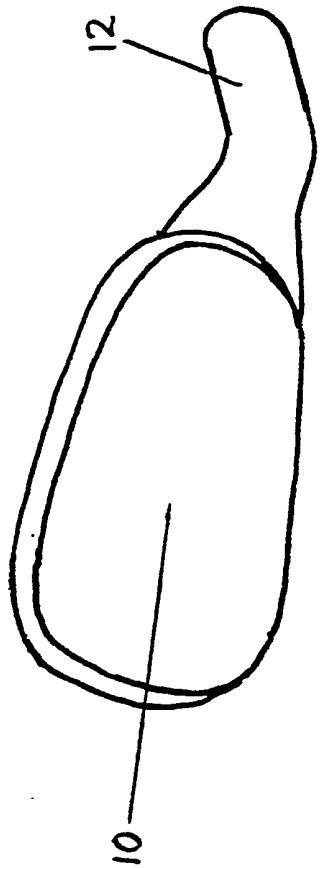


Fig. 1B

Fig. 2A

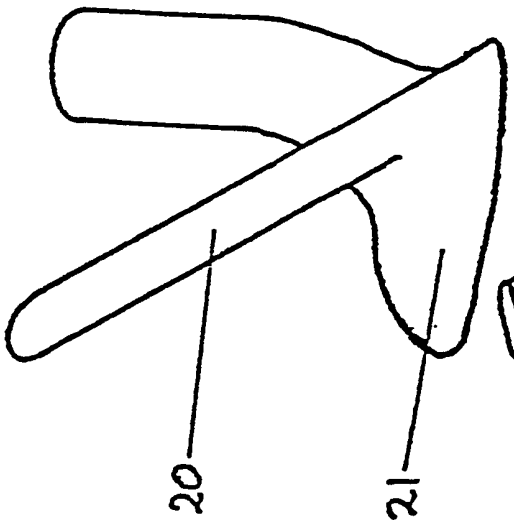
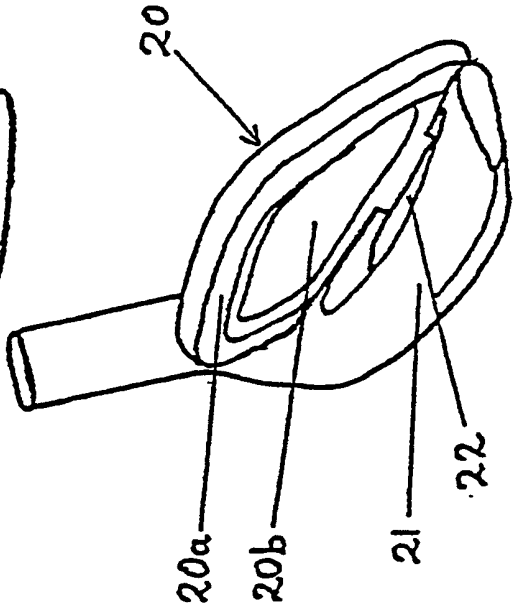


Fig. 2B



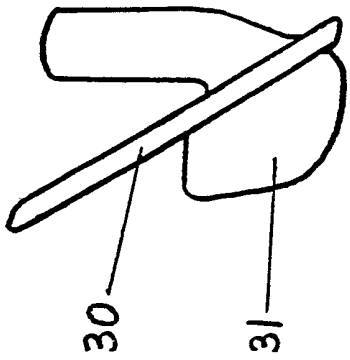


Fig. 3A

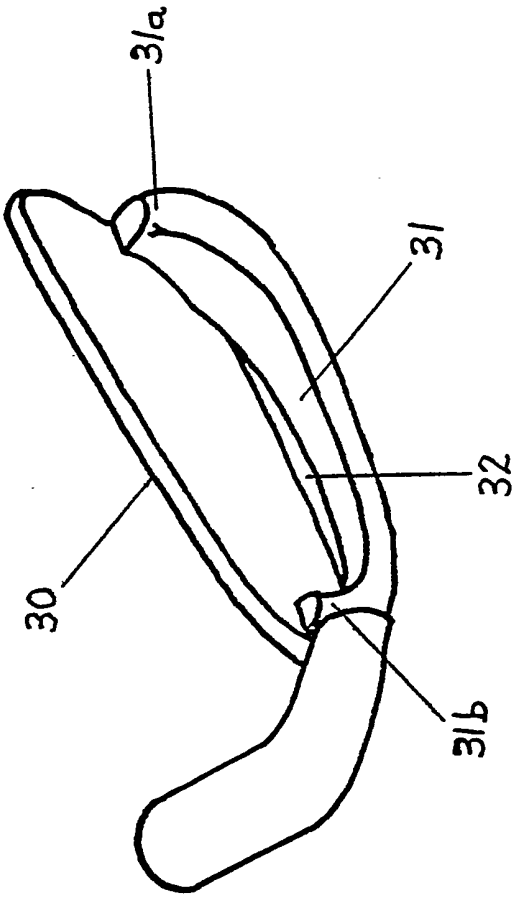


Fig. 3B

Fig. 4A

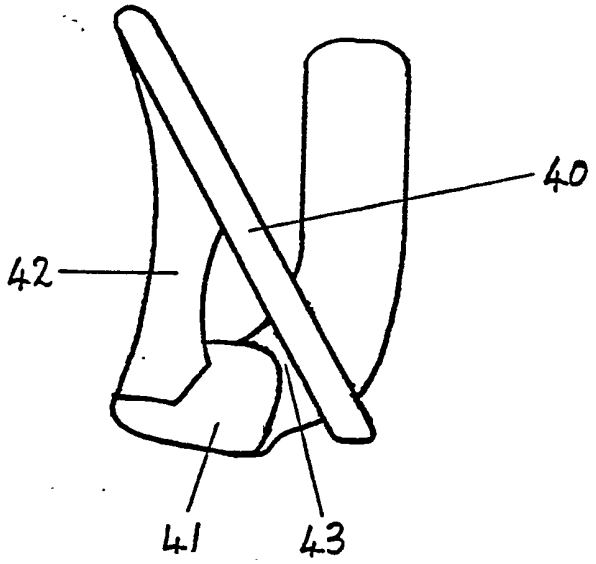
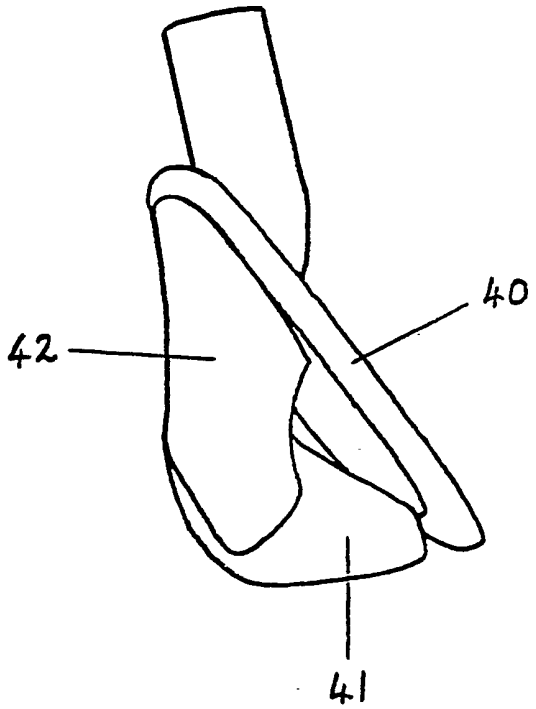


Fig. 4B



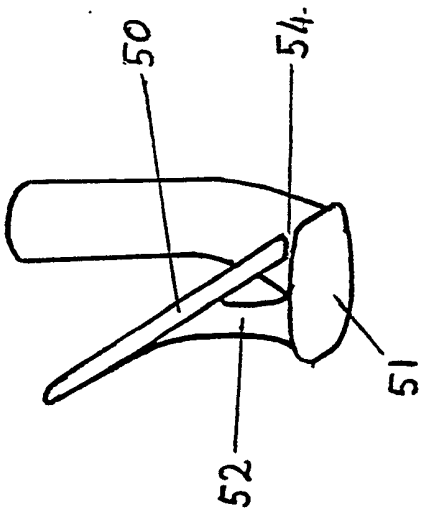


Fig. 5A

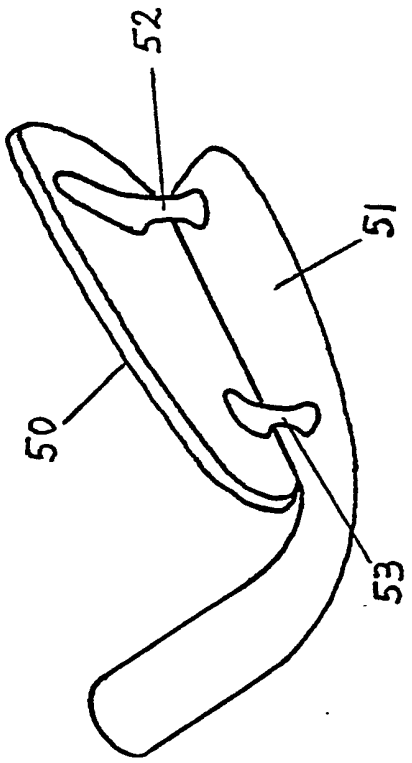


Fig. 5B

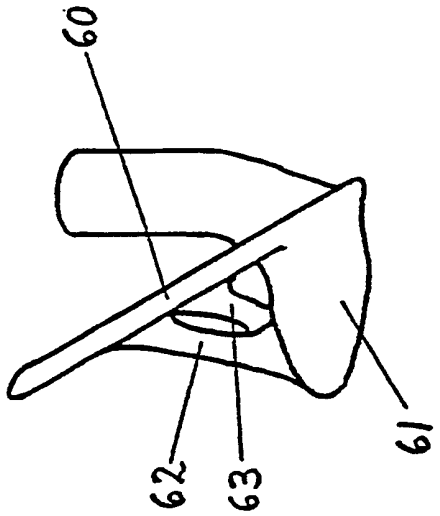


Fig. 6A

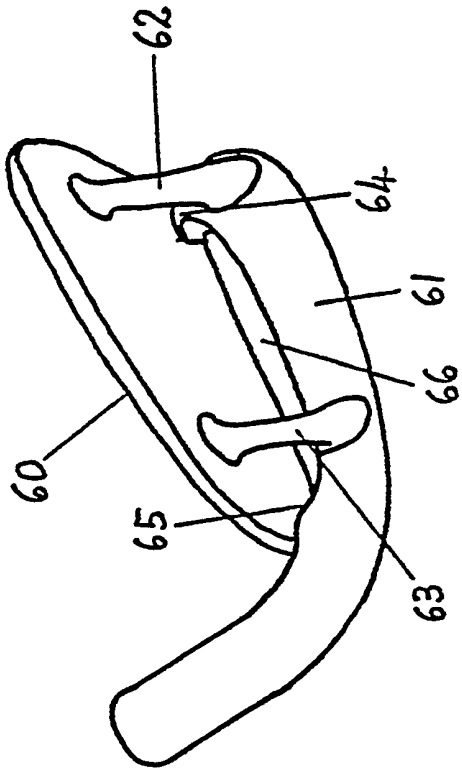
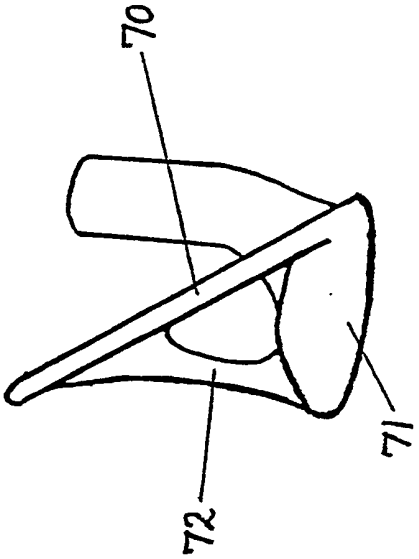


Fig. 6B



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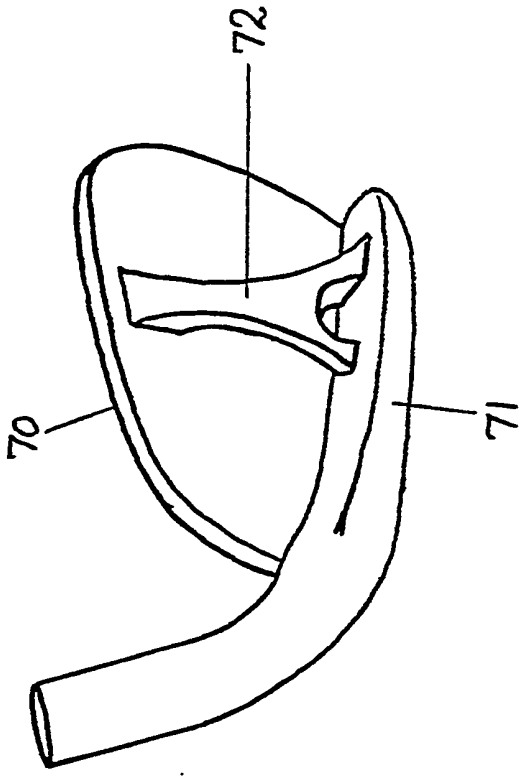


Fig. 7B

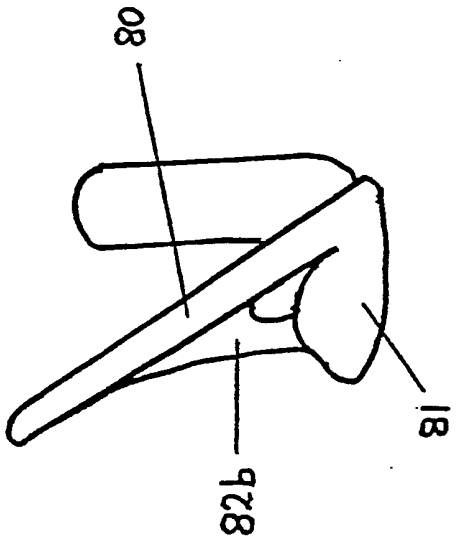


Fig. 8A

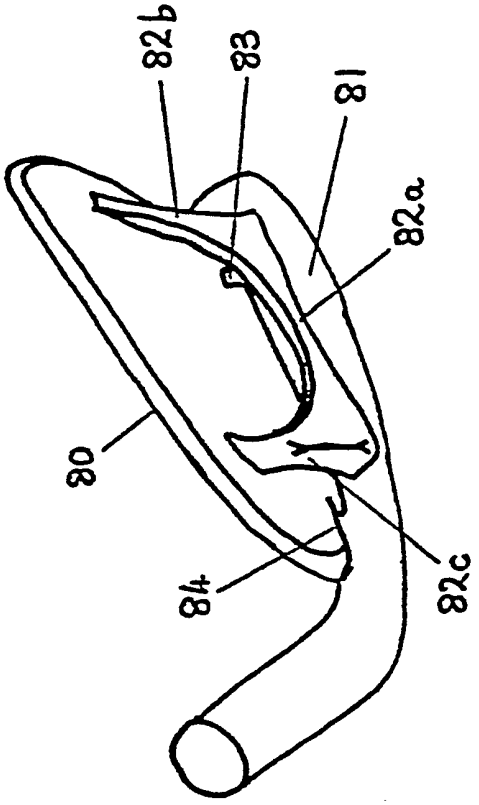
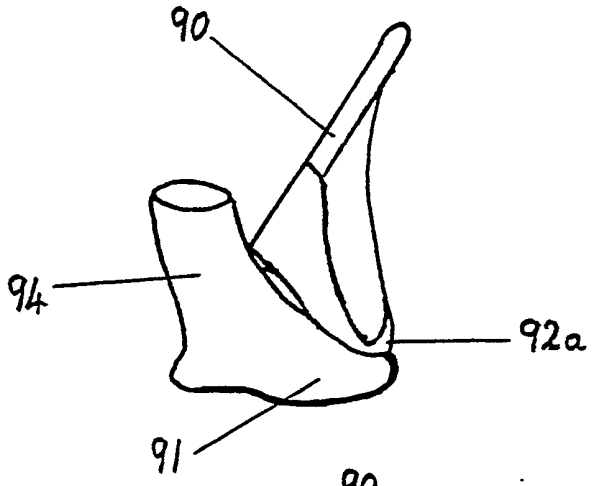


Fig. 8B



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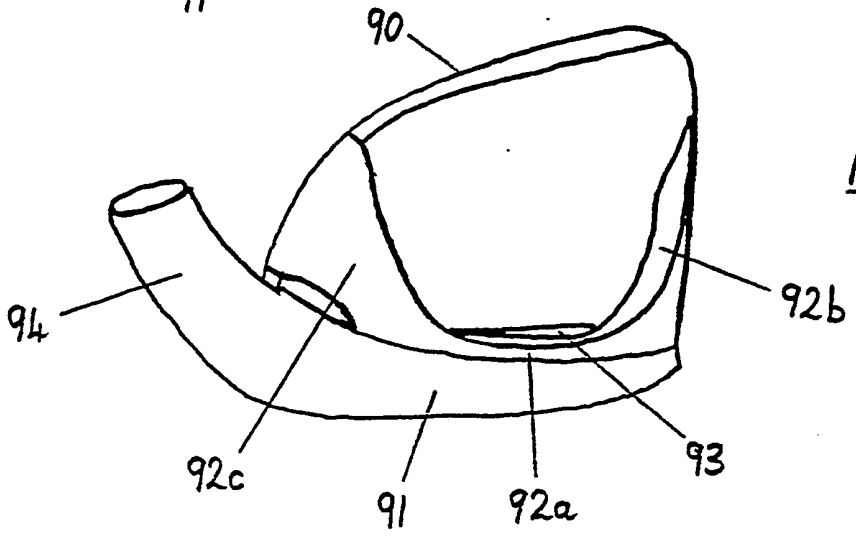
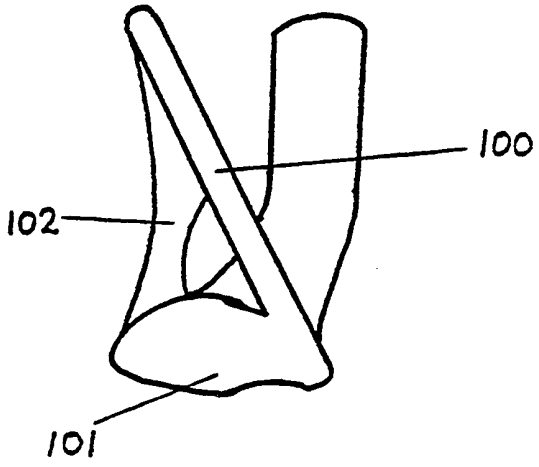


Fig. 9B

Fig. 10A



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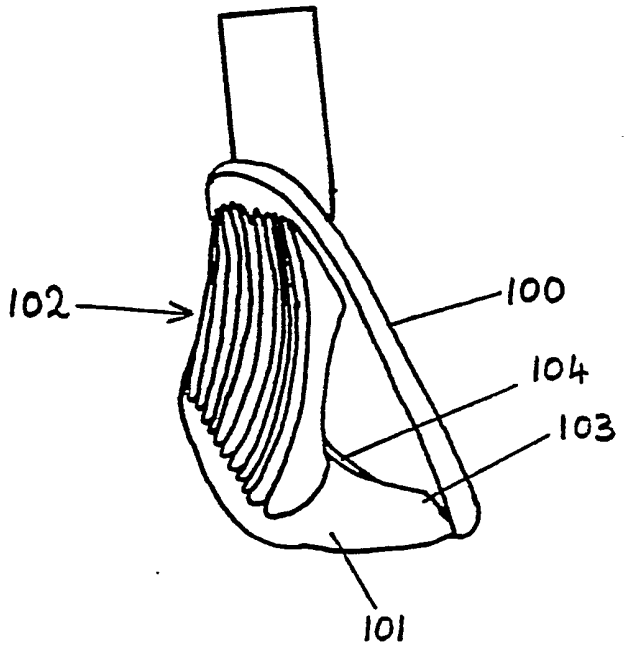

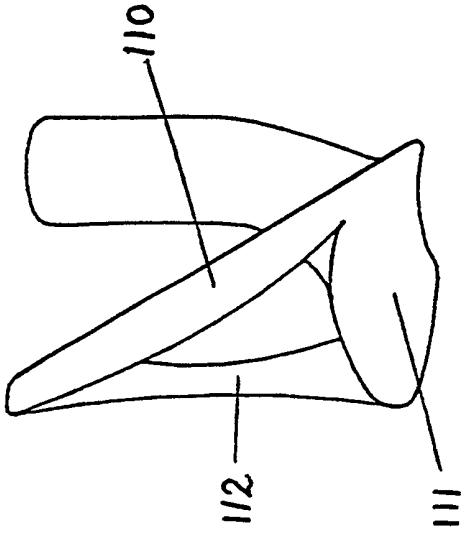

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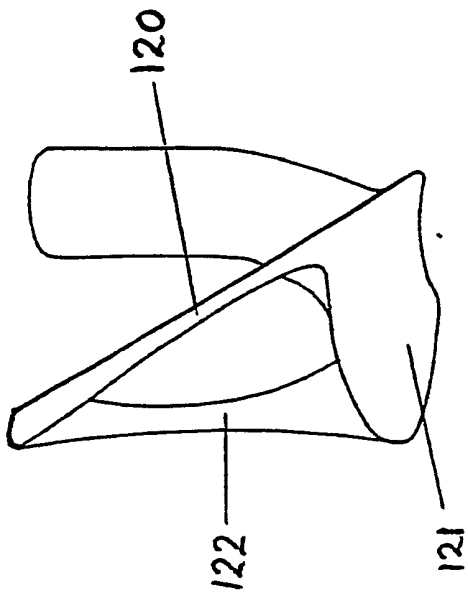

Fig. 12

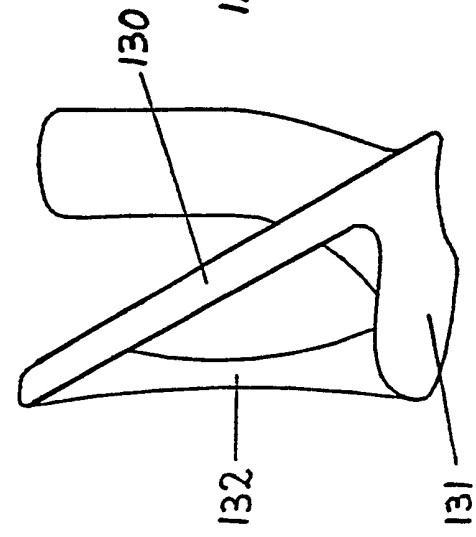

Fig. 13

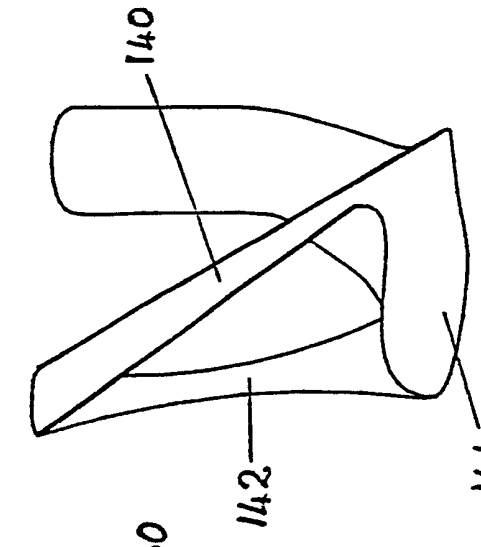

Fig. 14

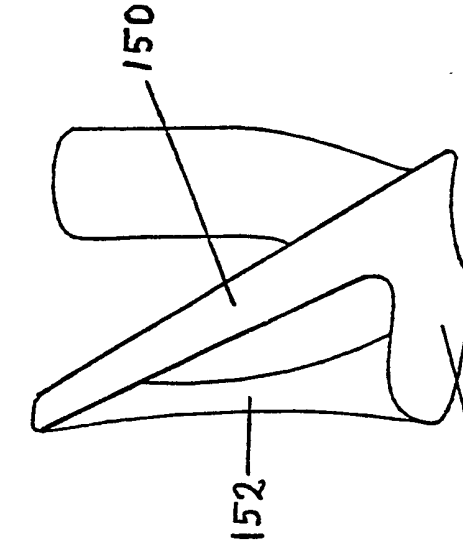

Fig. 15

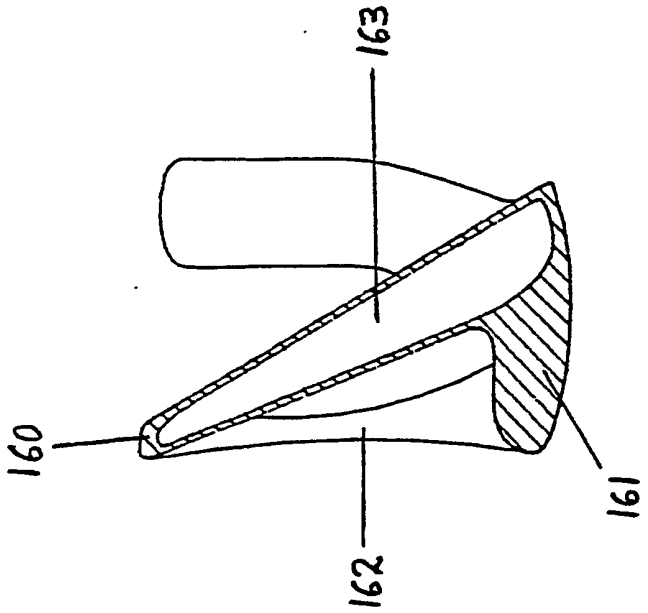

Fig. 16

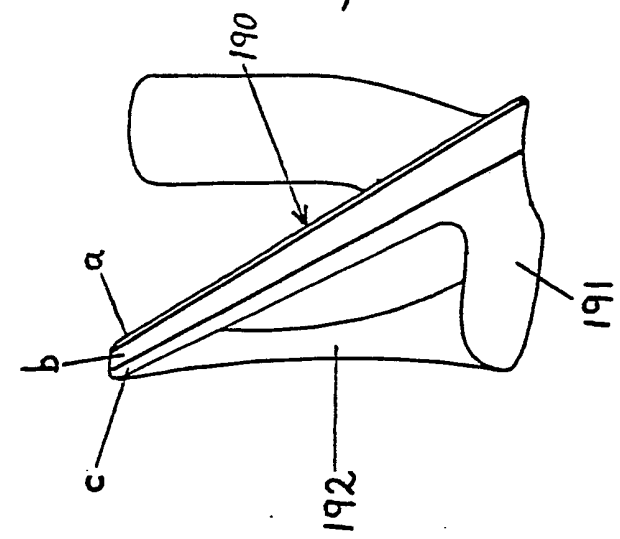

Fig. 19

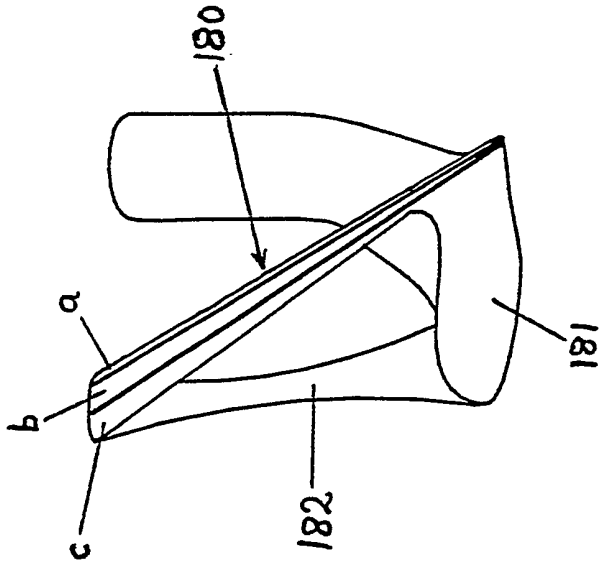

Fig. 18

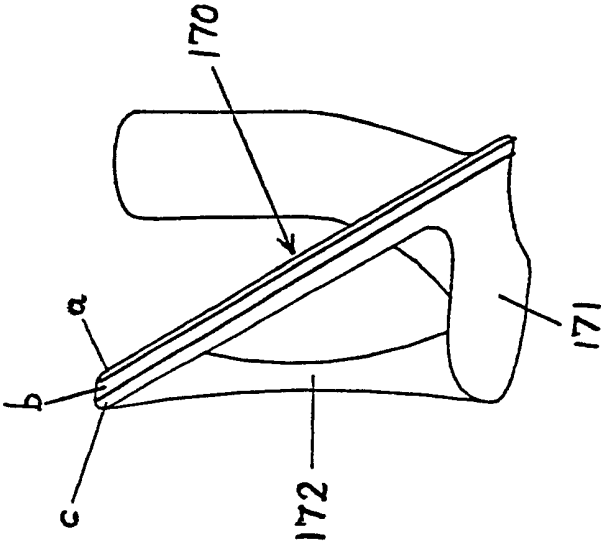

Fig. 17

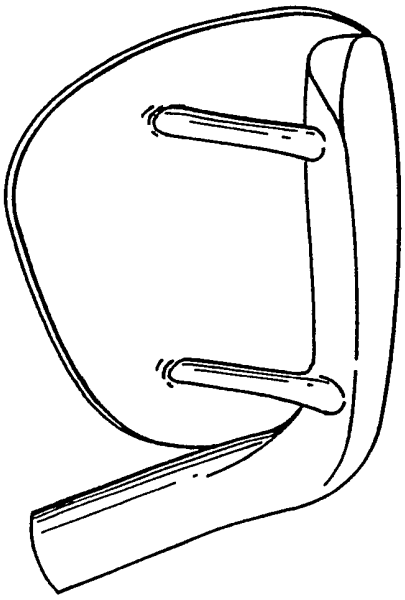

Fig. 20B

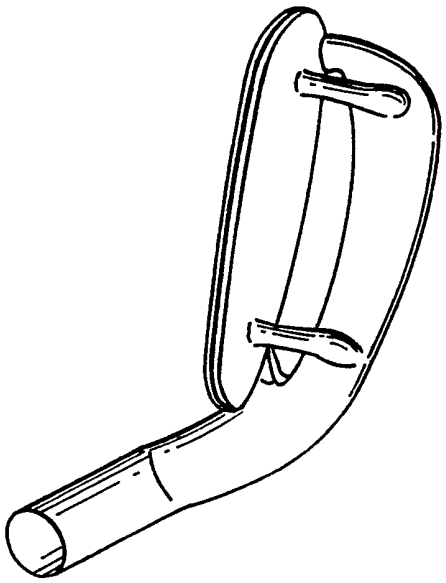

Fig. 20D

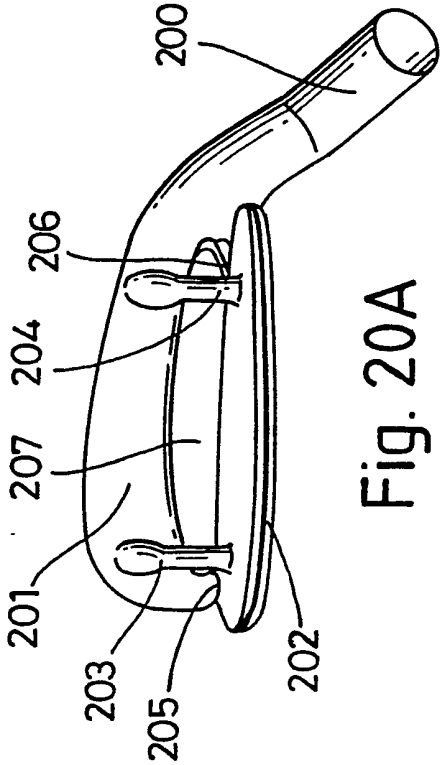

Fig. 20A

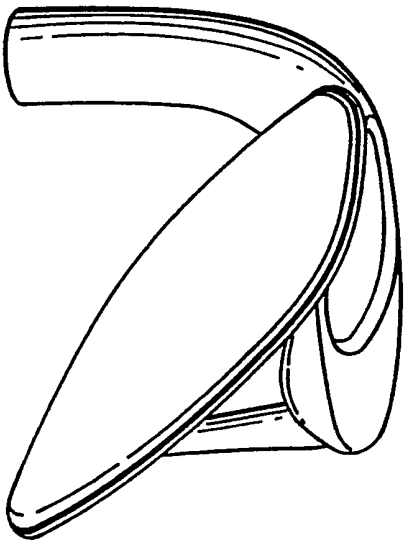

Fig. 20C

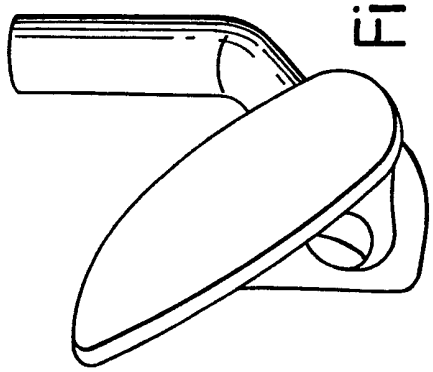

Fig. 21A

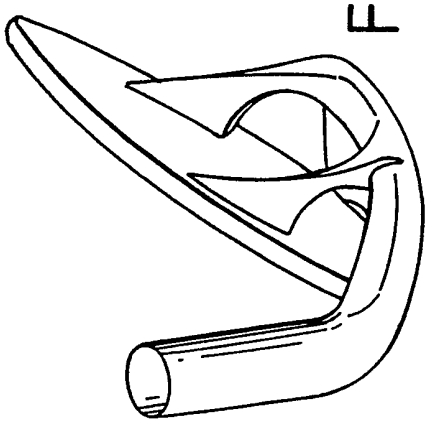

Fig. 21B

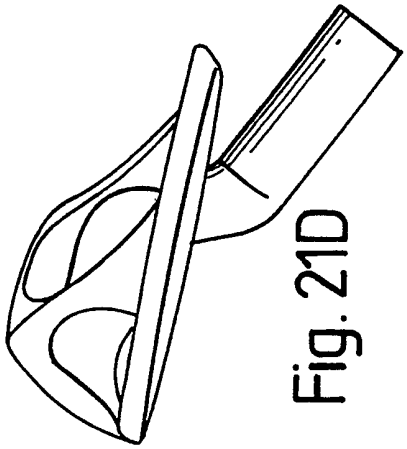

Fig. 21D

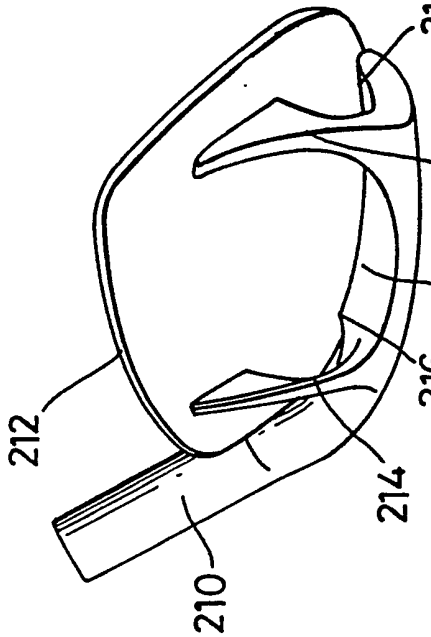

Fig. 21C

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IMPROVEMENTS IN GOLF CLUB HEADS

This invention relates to golf club heads.

Conventionally, golf club head designs are of relatively unitary construction wherein the face is integral with both the sole and the hosel of the head. Improvements in playing performance of the head have been achieved by careful selection of materials and the geometry such as size, shape, thickness, traditional blade or cavity back, weight distribution and face progression.

During striking impact of a club head face with a golf ball, the impact forces generated often can be very large and the ball deforms very significantly before leaving contact with the head face. This happens very quickly, typically in less than 0.0005 seconds. During this period there is a massive transfer of energy from the club head to the ball. Energy is lost in the collision since the system is not perfectly elastic, and stress waves are transmitted through the ball and the club.

In conventionally designed heads, the stress wave transmission cannot be adjusted controllably from one head to another owing to the integral attachment of the face to both the sole and the hosel. Accordingly, optimising of the stress wave transmission of the ball and the club is substantially uncontrolled.

An object of the present invention is to provide a golf club head construction for 'irons' and 'woods' which enables utilisation of stress wave transmission characteristics (as evidenced in the shape, frequency and amplitude of vibration) of the head face as a controllably variable parameter to influence ball behaviour and to improve playing performance.

According to one aspect of the present invention, there is provided a golf club head in which the head face is attached in a manner such that stress wave transmission characteristics of the face can be established relatively independently of the sole and/or hosel components of the head.

According to another aspect of the invention, there is provided a golf club head in which the stress wave transmission characteristics of the face are substantially unrestricted by the presence of the hosel of the head.

In accordance with a further aspect of the invention, there is provided a golf club head comprising a face, a sole and a hosel, wherein the hosel is located substantially at the heel side of the head and wherein the face is in the form of a face plate which is attached in the head in a manner such that the stress wave transmission characteristics of the face plate are substantially independent of the hosel and/or sole.

In accordance with a further aspect of the invention, there is provided a golf club head comprising a face, a sole and a hosel, wherein the face is in the form of a face plate which is attached to the sole and is not attached directly to the hosel.

According to a further aspect of the invention, there is provided a golf club head as defined in the immediately preceding paragraph wherein the hosel is located substantially at the heel side of the head and wherein there is a space separating the face plate and the hosel.

Such a golf club head may be in the form of a modular structure.

In this specification, the term "hosel" is used to include integral and detachable hosels and the club shaft connection portion of 'hosel-less' heads.

The invention is applicable to both 'wood' and 'iron' club heads, and may be applied to all heads of a set of clubs. However, the invention is especially suitable for 'iron' club heads.

By means of the invention, the face of the club head can be given prescribed stress wave transmission characteristics by selection of its material and geometry and the manner of its attachment in the head, which are substantially free of significant restraint by the characteristics of the rest of the head.

Similarly, in designing a club head to have desired stress wave transmission characteristics, the sole and the hosel of the head may be selected substantially independently of the face material, except for compatibility in the attachment of the face in the head.

The geometry of the face may be selected according to the properties of the face material in order to provide the desired stress wave transmission characteristics.

The face suitably is in the form of a distinct face plate, typically having a blade-like shape.

The face plate may be of a single material or of two or more materials which may be layered, e g laminated. In a layered construction the layers may be selected for their inherent properties to attain optimum characteristics in the face plate.

The face plate thickness may or may not be uniform. For instance, the face plate may have a thickness which increases or decreases towards any or all of the sole, top, toe and heel sides of the head. Furthermore, the rear surface of the face plate may be at least partially shaped to regulate stress wave transmission.

The face plate may be of solid or hollow construction. For instance, in a layered face plate there may be a gap or cavity between two or more layers.

Material for the face plate may be selected on the basis of properties such as hardness, Young's modulus, specific gravity, strength, abrasion resistance and frictional properties. The appearance of the material also may be a selection factor.

Examples of materials for the face plate are plastics, plastics composites, ceramics, metals, metal alloys and metal matrix composites. The plastics may be thermoset or thermoplastic and may contain fibre reinforcement and/or toughening material. By way of illustration only, examples of reinforcement materials include carbon, glass, aramid and metal, and examples of the or a metal for the face plate or a layer thereof include steel, titanium, aluminium

and copper.

Examples of means for securing layers together in a layered face plate include: adhesive bonding, welding, mechanical securing means, and producing a layer in situ by coating with a layer-forming composition and/or by moulding-on.

Two or more layers of a layered face plate may be secured throughout their interface or only at one or more selected positions. For instance, two or more layers may be secured together at or adjacent to the periphery of at least one of the layers.

By way of example only, the face plate may comprise a backing layer of metal, for instance steel (e g stainless steel), secured to one or more layers of different material(s).

The face plate is attached to the sole of the head in a manner which allows maximum utilisation and control of the stress wave transmission characteristics of the face. Accurate engineering of the attachment means may be employed to achieve the stress wave transmission characteristics desired for the specific club head being designed.

Advantageously, the face plate is attached directly to the sole at one or more attachment points located in the lower part of the face plate, and/or is attached in the head by means of one or more struts extending from the rear surface and/or edge of the face plate.

The direct attachment preferably is at the bottom edge and/or the lower side edges of the face plate, and/or at the rear surface of the face plate near to the bottom edge and/or lower side edges.

The direct attachment may be in the form of a continuous or a discontinuous junction with the sole. A discontinuous junction may consist of two or more discrete attachment points. When two direct attachment points are employed, they may be located substantially equidistant from the normal or optimum impact point (sometimes referred

to as the 'sweet spot') of the face.

The face plate and sole may be integral at the direct attachment or may be separate integers joined by means such as adhesive bonding, welding, moulding-on, interlocking formations and/or mechanical securing means.

Additionally or alternatively to the direct attachment of the face plate to the sole, the face plate may be attached to the sole and/or to the hosel by one or more struts. One or more struts may extend from the sole and/or the hosel to the rear surface of the face plate. Alternatively or additionally one or more struts may extend from the sole and/or hosel to the edge of the face plate, for instance one to the toe-side edge and one to the heel-side edge of the face plate and/or one or more to the top edge of the face plate.

The positions at which the strut or struts join the face plate and sole and/or hosel may be selected to optimise the desired stress wave transmission characteristics of the face.

The strut shape may take a variety of forms. The cross-sectional shape may be curved (e g circular or ellipsoidal) or angular (e g triangular or quadrilateral) or a combination thereof. The strut shape and thickness may be uniform or non-uniform along the strut length. For instance, the strut thickness may increase towards the junction of the strut with the sole and/or hosel and/or with the face plate.

A strut may be furcate or non-furcate. For instance, a strut may be bifurcate at its junction with the sole and/or hosel and/or at its junction with the face plate.

A strut may be of a single piece of material or of two or more pieces of material. For instance, a strut may be of layered, e g laminated, construction. By way of example, a strut may have a core of material embraced by a sleeve of another material.

A strut may be solid or at least partially hollow. When a hollow strut, for instance a tubular strut, is

employed, the hollow cavity may be left empty or may contain another material to confer or enhance a desired property of the strut. By way of example, resilient material, e g cellular elastomer, may be present in a cavity in a strut.

When two or more struts are employed they may or may not be parallel and may have the same or different shapes, and when three or more struts are employed they may or may not be equidistantly spaced.

The material(s) of the strut or struts may be the same as or different to the material(s) of the sole and/or hosel and/or face plate. When two or more struts are employed, they may be of the same or different material(s).

A strut may be joined to the sole and/or hosel and to the face plate by means such as welding, adhesive bonding, moulding-on, interlocking formations and/or mechanical securing means (e g screw or rivet means). Alternatively, a strut may be integral with the sole and/or hosel and/or face plate.

According to one preferred embodiment of the invention, the face plate is attached only to the sole, whether by direct attachment at one or more attachment points or by means of one or more struts, or both. By way of example only, when strut attachment is employed, there may be a single strut extending from the sole to the rear surface or top edge of the face plate, or there may be two or more struts extending from the sole to the rear surface and/or the side edges of the face plate, with or without one or more direct attachment points to the sole at or near to the bottom edge of the face plate.

Additionally or alternatively, there may be one or more struts extending between the face plate and the hosel.

The bottom edge of the face plate may be in front of and/or above the sole, and there may be a gap between the face plate and the sole.

In one preferred embodiment wherein the face plate is directly attached to the sole, the sole is shaped to

provide one or more lugs each of which provides a direct attachment point for the face plate. Such lugs may extend forwardly and/or upwardly of the sole. For instance there may be a lug at or near the toe side and/or heel side of the sole, and/or intermediate thereof.

If desired, the sole may have front and rear sole portions with an aperture between them, the front sole portion providing a surface for direct attachment to the face plate and the rear sole portion providing a surface for the junction of one or more struts.

The sole may be of a single piece of material or of two or more pieces of material, for instance of laminated construction. It may be of solid or hollow construction. If desired, it may have one or more cavities which may be left empty or may be at least partially filled with another material, for instance to confer or enhance desired weight distribution in the head.

The head construction of the invention permits segregation of features and forms which constitute the structure of the head and thereby increases the latitude for new head design.

Some improvements in club head design and performance which may be achieved by means of the present invention are as follows:-

(a) Increased distance by matching face stress wave transmission characteristics to ball stress wave transmission characteristics;

(b) Improved ball spin and control in clubs, for instance lower spin rate for woods and long irons and higher spin rate for wedges;

(c) Improved feel, for instance higher damping of transmission of impact vibration to the club shaft;

(d) Improved optimisation of the hitting area of the face by controlling stress wave transmission characteristics across the face;

(e) Greater latitude in weight distribution, for instance provision of higher weight at the heel and toe and/or

periphery of the head to improve accuracy of shots hit outside the 'sweet spot', and/or to lower the centre of gravity of the head for easier playability;

(f) Customisation of clubs based on matching face vibration frequency to swing speed.

Embodiments of the invention are shown, by way of example only, in the accompanying drawings, wherein:-

Figures 1A and 1B show, respectively, front and overhead (ball address) views of a golf club head;

Figures 2A to 8A and 2B to 8B, and Figures 10A and 10B, show toe end (A) and rear perspective (B) views of club heads illustrating various forms of attachment of the face plate to the sole;

Figures 9A and 9B show, respectively, heel end and rear views of a club head;

Figures 11 to 15 show toe end views of club heads illustrating various shapes of face plate;

Figure 16 shows a vertical section through a club head illustrating a hollow face plate;

Figures 17 to 19 show toe end views of club heads illustrating layered face plates;

Figures 20A to 20D and Figures 21A to 21D show, respectively, four perspective views of two club heads.

The head shown in Figures 1A and 1B has a face plate 10 attached to the sole 11, and a hosel 12 which is remote from the face plate.

The head shown in Figures 2A and 2B has a face plate 20 directly attached to the sole 21. There is a gap 22 between the face plate and the rear portion of the sole. The rear surface of the face plate is shown to have a peripheral portion 20a which is thicker than the central area 20b. The attachment of the face plate in the head is only by direct attachment to the sole; there is no strut attachment.

The head shown in Figures 3A and 3B has a face plate 30 directly attached to the sole 31 at upstanding toe-side sole lug 31a and upstanding heel-side sole lug 31b. There is a gap 32 between the face plate and the sole.

The head shown in Figures 4A and 4B has a face plate 40 attached to the sole 41 only by means of a single strut 42 extending between the sole and the rear surface of the face plate; there is no direct attachment of the face plate in the head. The face plate projects in front of the sole and there is a gap 43 between them.

The head shown in Figures 5A and 5B has a face plate 50 attached to the sole 51 only by means of two struts 52,53, which are of different dimensions. The face plate is suspended above the sole such that there is a small gap 54 between them.

The head shown in Figures 6A and 6B has a face plate 60 attached to the sole 61 by means of two struts 62,63, which are of different dimensions, and by direct attachment to two forwardly extending lugs 64,65 formed on the sole. There is a gap 66 between the face plate and the sole.

The head shown in Figures 7A and 7B has a face plate 70 attached to the sole 71 by means of a single strut 72 which is bifurcate at its junction with the sole, and by direct attachment to the front of the sole.

The head shown in Figures 8A and 8B has a face plate 80 attached to the sole 81 by means of a bifurcate strut construction having an elongate base portion 82a attached to the sole and two strut portions 82b,82c which are integral with the base portion 82a and which are attached to the rear surface of the face plate. The face plate is attached to the sole also by direct attachment to two forwardly extending lugs 83,84 formed on the sole.

The head shown in Figures 9A and 9B has a face plate 90 attached to the sole 91 by means of a bifurcate strut construction having an elongate base portion 92a attached to the sole and two strut portions 92b,92c integral with the base portion 92a. One of the strut portions 92b is

attached to the toe-side of the rear surface of the face plate, and the other strut portion 92c is attached to the heel-side edge of the face plate. There is a gap 93 between the face plate and the sole, and the head has a hosel 94 of significantly reduced length approaching a 'hosel-less' construction.

The head shown in Figures 10A and 10B has a face plate 100 attached to the sole 101 by means of a multitude of struts 102 extending between the sole and the rear surface of the face plate. The face plate also is attached to the front of the sole at one or more forwardly extending lugs, one of which is shown 103, with a gap 104 between the face plate and the sole.

Figures 11 to 15 each shows a head having a face plate 110,120,130,140,150, a sole 111,121,131,141,151, and a strut 112,122,132,142,152 extending from the sole to the top of the rear surface of the face plate. Each of the face plates has a different shape, namely: convexly shaped rear surface 110; concavely shaped rear surface 120; parallel front and rear surfaces 130; tapering thickness decreasing in the top-to-sole direction 140; and tapering thickness increasing in the top-to-sole direction 150.

The head shown in Figure 16 has a hollow face plate 160, a sole 161 and a strut 162 extending from the sole to the top of the rear surface of the face plate. The base of the face plate is integral with the sole, and incorporates a hollow cavity 163.

Figures 17 to 19 each shows a head having a layered face plate 170,180,190, a sole 171,181,191 and a strut 172,182,192 extending from the sole to the top of the rear surface of the face plate. Each of the face plates comprises three layers a, b, c. In face plate 170, layers a and b are of substantially uniform thickness and layer c has a thickness which increases in the top-to-sole direction. In face plate 180, layer a is of substantially uniform thickness and layers b and c have thicknesses which decrease in the top-to-sole direction. In face plate 190,

layer a is of substantially uniform thickness and layers b and c have thicknesses which increase in the top-to-sole direction.

Figures 20A to 20D show a head comprising a hosel 200, a sole 201, a face plate 202 and two struts 203,204 extending between the sole and the rear surface of the face plate. In addition to the strut attachment, the face plate is attached directly to the sole at forwardly extending lugs 205,206 formed on the sole. There is a gap 207 between the sole and the face plate.

Figures 21A to 21D show a head having a hosel 210, a sole 211, a face plate 212 and two struts 213,214 integral with the sole and extending to the rear surface of the face plate. The sole has a greater front-to-back surface than that of Figures 20A to 20D and provides small lugs 215,216 at which the face plate is directly attached.

In the golf club head structures wherein there is a through-hole in the head such as a gap between the face plate and the sole or an aperture between the front and rear portions of the sole, such a hole may be closed by means of a suitable element if desired, especially when retention of such a through-hole would contravene the rules of the game of golf.

The element for closing the hole may be selected to have substantially no modifying effects on the performance or physical properties of the club head or may be selected to have some modifying effect. For instance, an element for closing a gap between the face plate and the sole may be selected to enhance or regulate the stress wave transmission characteristics of the face plate.

Examples of suitable materials for the elements include plastics (thermoplastic or thermoset), plastic composites, ceramics, metals, metal alloys, metal matrix composites, resins and elastomers. The material may contain fibre reinforcement and may be solid or cavitous. The element may be based on a single material or may comprise two or more materials. For instance, it may

comprise two or more adjoining materials extending across the hole.

Structural features of the element, such as its shape, geometry, thickness, profile and internal structure, may be conferred to suit the desired overall shape of the head and/or to enhance or otherwise modify playing characteristics of the head.

The element may be in a pre-shaped form which is secured in the hole such as by mechanical, welding or adhesive means. Alternatively, where appropriate, at least part of the element may be produced in situ by means such as casting or injection moulding.

By way of example, a gap between the face plate and the sole may be closed by means of an element comprising a resilient material such as a cellular polyurethane. Such a resilient material may be utilised to absorb or dampen shock vibration occurring during impact of the head with a golf ball. The element may also comprise, at least at the base of the gap, a surface cover of durable, damage-resistant, material to protect the cellular polyurethane during play.

In a further example, a gap between the face plate and the sole may be closed by means of a metal element of shape and thickness selected to regulate the stress wave transmission of the face plate.

In a further example, the element may have an internal structure comprising an internal cavity having tooth-like projections, which may be of various lengths, extending into the cavity in the face plate to sole direction.

It is to be understood that the embodiments described herein are solely by way of example and that the present invention as defined embraces a multitude of alternative embodiments.

CLAIMS:

1. Head for a golf club, in which the face of the head is attached in the head in a manner such that stress wave transmission characteristics of the face can be established relatively independently of the sole and/or hosel components of the head.

2. Head according to Claim 1 comprising a face, a sole and a hosel, wherein the hosel is located substantially at the heel side of the head and wherein the face is in the form of a face plate which is attached in the head in a manner such that the stress wave transmission characteristics of the face plate are substantially independent of the hosel and/or sole.

3. Head according to Claim 2 wherein the face plate is attached to the sole of the head.

4. Head according to Claim 3 wherein the face plate is attached directly to the sole at the lower part of the face plate.

5. Head according to Claim 3 or 4 wherein the face plate is attached directly to the sole at the bottom edge and/or at the lower part of at least one of the side edges of the face plate, and/or at the rear surface of the face plate near to the bottom edge and/or the lower part of at least one of the side edges of the face plate.

6. Head according to Claim 4 or 5 wherein the direct attachment is at one or more discrete attachment points.

7. Head according to any of Claims 3 to 6 wherein the sole of the head is shaped to provide one or more lugs for direct attachment to the face plate.

8. Head according to any of Claims 2 to 7 wherein the face plate is attached to the sole of the head by one or more struts.

9. Head according to Claim 8 wherein such a strut is attached to the rear surface and/or the edge of the face plate.

10. Head according to Claim 8 or 9 comprising a single strut extending between the sole and the rear surface or

edge of the face plate.

11. Head according to Claim 10 wherein the strut is furcate.

12. Head according to Claim 8 or 9 comprising two or more struts extending between the sole and the rear surface and/or edge of the face plate.

13. Head according to any of Claims 2 to 12 wherein the face plate is not attached directly to the hosel of the head.

14. Head according to any of Claims 2 to 13 wherein there is a gap between the face plate and the sole.

15. Head according to Claim 14 wherein said gap is closed by means of a solid element.

16. Head according to any of the preceding Claims which is the head for an 'iron' club.

17. Head for a golf club, substantially as described with reference to and/or as shown in any of the accompanying drawings.

18. Head according to any of the preceding Claims substantially as described herein.

Patents Act 1977
Examiner's report to the Comptroller under Section 17
(The Search report)

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Application number
GB 9415103.2

Relevant Technical Fields

(i) UK Cl (Ed.M) A6D (D23A, D23B)

(ii) Int Cl (Ed.5) A63B 53/00, 53/02, 53/04, 53/06

Search Examiner
R Howe

Date of completion of Search
20 September 1994

Databases (see below)
(i) UK Patent Office collections of GB, EP, WO and US patent specifications.

(ii) ONLINE DATABASE : WPI

Documents considered relevant following a search in respect of Claims :-
1-18

Categories of documents

X: Document indicating lack of novelty or of inventive step.

Y: Document indicating lack of inventive step if combined with one or more other documents of the same category.

A: Document indicating technological background and/or state of the art.

P: Document published on or after the declared priority date but before the filing date of the present application.

E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

&: Member of the same patent family; corresponding document.

Category	Identity of document and relevant passages		Relevant to claim(s)
X	GB 2218340 A	(STEGGAL) see especially Figure 2c and page 4 line 15 - page 5 line 9	1 at least
X	US 4919428	(PERKINS) see Figure 1	1 at least
X	US 1250296	(FITZJOHN) see figures	1 at least

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