



12 **EUROPEAN PATENT APPLICATION**

21 Application number : **92305054.6**

51 Int. Cl.<sup>5</sup> : **A63B 53/04**

22 Date of filing : **02.06.92**

30 Priority : **06.06.91 US 711323**

72 Inventor : **Hoeflich, John B.**  
**318 Elm Street**  
**South Dartmouth, Massachusetts 02748 (US)**

43 Date of publication of application :  
**09.12.92 Bulletin 92/50**

84 Designated Contracting States :  
**DE FR GB SE**

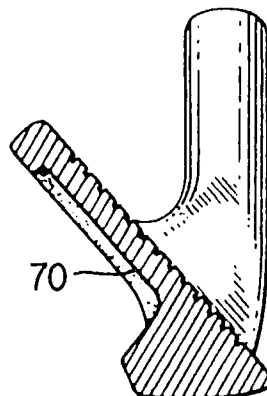
74 Representative : **Carmichael, David Andrew**  
**Halliday et al**  
**G.F. REDFERN & CO. Marlborough Lodge, 14**  
**Farncombe Road**  
**Worthing, West Sussex BN11 2BT (GB)**

71 Applicant : **ACUSHNET COMPANY**  
**Belleville Avenue**  
**New Bedford, Massachusetts 02745 (US)**

54 **Golf club irons.**

57 The set of irons have a cavity back (70) where the cavity volume is adjusted such that the geometric centre of the club face and the centre of mass of the club head coincide.

**FIG. 8**



This invention relates to golf clubs and, more particularly, to irons having a back cavity where the perimeter outside the back cavity is varied such that the geometric centre of the face of the club head coincides with the centre of mass of the club head.

Golf clubs comprise a shaft and a club head and are generally classified into three categories: woods, irons and putters. Irons are classified by loft angle. Irons with low loft angles, e.g. 20° to 30°, are classified as long irons while irons with large loft angles, e.g. 40° to 50°, are classified as short irons. Typically, irons are numbered from long to short, i.e. 1, 2, 3, 4, 5, 6, 7, 8, 9, PW (pitching wedge), SW (sand wedge) and LW (lob wedge).

The club head of an iron has a face, for hitting the golf ball, and a back. The back may have either a cavity or a smooth surface. Each face has an area referred to as a sweet spot. The sweet spot is that area on the face of a club head which, when it impacts a golf ball, provides the most favourable results. Cavity back irons have larger sweet spots than solid back irons. There have been suggestions to vary the size and position of the back cavity; see U.S. Patent numbers 4,715,601 issued 29th December 1987 and 4,848,747 issued 18th July 1989. However, none of these references teaches the achieving of aligning the geometric centre of the face of an iron with the centre of gravity of the club head by varying the perimeter weight of the back of the club head.

It has now been discovered that an exceptionally playable cavity back iron can be made by adjusting the perimeter weighting outside the cavity in the back of the iron so that the centre of gravity of the club head and the geometric centre of the face of the club head coincide.

According to the present invention it is important that the weight adjustment be in the perimeter of the club head and not in the cavity itself. This achieves better heel-toe balance than can be achieved by adjusting the weight in the cavity itself. It is especially desirable to maintain a flat cavity bottom. This can be achieved by maintaining a constant distance between the face and the cavity bottom throughout a substantial portion of the cavity.

In addition to adjusting the perimeter weight in the back of the club head, the hosel length of the irons is maintained at substantially the same length, preferably within  $\pm 0.01$  inch (0.254 mm) and most preferably  $\pm 0.005$  inch (0.127 mm), while the ratio of the overall percentage of the club weight in the toe and sole is greater in the short irons than in the long irons.

The geometric centre of the face is located by finding the mid-point of the blade length along the sole and moving upward a distance about equal to the radius of a golf ball, from about 1/2 inch to about 1 inch (about 1.3 to about 2.5 cm). More preferably, the geometric centre of the face is located about 0.8 to 0.9 inch (about 2.0 to 2.3 cm) up from the mid-point of the blade as measured along the sole.

In order to produce an iron in accordance with the present invention, it is preferred that the offset of the club heads be greater in the long irons than in the short irons, preferably decreasing progressively from long irons to short irons. As is well known to those in the art, offset is the distance from a plane tangent to the front of the hosel parallel to the leading edge of the club to the leading edge. The progression of offset from the long to the short irons contributes to the performance of the iron. In the long irons the larger offset helps keep the players' hands ahead of the ball at impact and promotes a steep angle of attack to get the ball airborne more quickly.

The bounce angle is also preferably varied. As is well known to those in the art, bounce angle is the distance between the ground and the line which connects the leading edge of the sole with the trailing, or effective trailing, edge of the sole. Preferably, the longer irons have a negative bounce angle while the middle irons have a neutral bounce angle and the shorter irons have a positive bounce angle. The bounce angle helps improve playability, launch angle and spin rate.

These and other aspects of the present invention may be more fully understood by reference to the following drawings:

Figure 1 is a preferred iron in accordance with the present invention;

Figure 2 is a side view of a preferred club head in accordance with the present invention;

Figure 3 is a front view of a preferred club head in accordance with the present invention;

Figure 4 is a bottom view of a preferred club head in accordance with the present invention;

Figure 5 is a back view of a club head as embodied in a 2 iron;

Figure 6 is a section view of Figure 5 of a club head as embodied in a 2 iron;

Figure 7 is a back view of a club head as embodied in an 8 iron;

Figure 8 is a section view of Figure 7 of a club head as embodied in an 8 iron;

Figure 9 is a back view of a club head as embodied in a pitching wedge; and

Figure 10 is a section view of Figure 9 of a club head as embodied in a pitching wedge.

Figure 1 illustrates iron 10. The iron 10 comprises a shaft 12 with a grip 14 and a head 16. The head 16 is connected by a hosel 18 to the shaft 12 in a conventional manner. Similarly, grip 14 is attached to the shaft 12 in a conventional manner. Head 16 comprises a toe 20, a heel 22, a sole 24 and a top 26. The finished

club height 28 is also illustrated. The finished club height 28 progressively decreases from long irons to short irons as is conventional. A front face 32 of the club head 16 is suitably scored with grooves in a conventional manner.

5 Figure 2 illustrates a side view of a club head. Loft angle 30 is the angle between the centre line of the hosel 18 and the club head face 32. Top line thickness 34 is the thickness of the top of the club head from the face 32 to the back of the club head. Preferably, top line thickness is uniform across the top of the club head for each of the clubs. Offset 36 is the parallel distance from the plane 37 tangent to the front of hosel 18 to the leading edge 39 of face 32. Preferably, the offset progressively decreases from the long irons to the short irons. Bounce angle 38 is also depicted. It is also preferred that the bounce angle increases from long irons to short  
10 irons.

Figure 3 illustrates the front of a club head which has not been scored. Lie angle 40 is shown, along with hosel length 42, par height 44, toe height 46, and blade length 48. Mid-point 50 of blade length 48 is also shown. Although not necessarily to scale, the location of the geometric centre of the club head face is shown as 52. The geometric centre is about a golf ball's radius up from the sole 24. Preferably, the geometric centre 52 is  
15 about 1.0 to about 0.5 inches (2.5 to 1.3 cm) measured vertically from sole 24. More preferably, it is about 0.9 inches (2.3 cm) from sole 24.

Figure 4 illustrates sole 24 of a club head with heel sole width 60 and toe sole width 62. Cavity 70 is shown in the back of the club head.

Figure 5 illustrates the cavity back of a number 5 iron, while Figure 7 illustrates the cavity back of a number  
20 8 iron, and Figure 9 illustrates the cavity back of a pitching wedge (PW). Figures 6, 8 and 10 are sectional views of the respective irons illustrated in Figures 5, 7 and 9 along the centre lines as shown. In each of Figures 5 to 10, cavity 70 is illustrated. The longest dimension 72 of the cavity is also shown.

For a preferred set of irons made in accordance with the present invention, the following dimensions are provided:

25

**TABLE A-1**

Iron	Loft	Lie	Offset		Bounce	Hosel		Blade	
	Angle (30)	Angle (40)	(in)	(cm)	Angle (38)	(in)	(cm)	(in)	(cm)
1	16	56	.386	0.980	-3	2.65	6.73	3.0	7.62
2	18	57	.363	0.922	-3	2.67	6.78	3.0	7.62
3	21	58	.330	0.838	-2	2.66	6.75	3.0	7.62
4	24.5	59	.293	0.744	-2	2.67	6.78	3.0	7.62
5	28	60	.257	0.652	-1	2.67	6.78	3.0	7.62
6	32	61	.218	0.553	-1	2.72	6.90	3.0	7.62
7	36	61.5	.181	0.459	0	2.72	6.90	3.0	7.62
8	40	62	.144	0.365	+1	2.70	6.85	3.0	7.62
9	44	62.5	.109	0.276	+2	2.70	6.85	3.0	7.62
PW	48	63	.095	0.241	+4	2.75	6.98	3.0	7.62
W	52	63	.095	0.241	+4	2.75	6.98	3.0	7.62
SW	56	63	+.010	0.025	+10	2.72	6.90	3.0	7.62
LW	60	63	+.010	0.025	+8	2.70	6.85	3.0	7.62

55

TABLE A-2

Iron	Top Line Thickness (34)		Toe Sole Width (62)		Heel Sole Width (60)		Head Weight (gram)	Finished Club Length (28)	
	(in)	(cm)	(in)	(cm)	(in)	(cm)		(in)	(cm)
1	0.27	0.685	.885	2.247	.590	1.49	235	39.5	100.33
2	0.27	0.685	.910	2.311	.605	1.53	242	39	99.06
3	0.27	0.685	.910	2.311	.605	1.53	247	38.5	97.79
4	0.27	0.685	.920	2.336	.640	1.62	253	38	96.52
5	0.27	0.685	.925	2.349	.640	1.62	260	37.5	95.25
6	0.27	0.685	.925	2.349	.650	1.65	267	37	93.98
7	0.27	0.685	.940	2.387	.680	1.72	274	36.5	92.71
8	0.27	0.685	.940	2.387	.680	1.72	282	36	91.44
9	0.27	0.685	.990	2.514	.695	1.76	286	35.625	90.48
PW	0.27	0.685	1.040	2.641	.725	1.84	289	35.5	90.17
W	0.27	0.685	1.040	2.641	.730	1.85	293	35.5	90.17
SW	0.27	0.685	1.060	2.692	.810	2.05	292	35.5	90.17
LW	0.27	0.685	1.060	2.692	.800	2.03	291	35.5	90.17

TABLE A-3

Iron	Cavity Volume (72)		% Club Weight in Combined Toe and Sole
	(in <sup>3</sup> )	(cm <sup>3</sup> )	
1	0.6	9.83	50
2	0.65	10.65	52
3	0.55	9.01	50
4	0.58	9.50	52
5	0.28	4.58	53
6	0.44	7.21	56
7	0.4	6.55	56
8	0.47	7.70	57
9	0.35	5.73	57
PW	0.35	5.73	57
W	--	--	57
SW	0.32	5.24	57
LW	--	--	57

The toe and sole weight were measured by physically cutting each club along the line marked 71 in Figure 5. The line 71 is a continuation of the toe line and the sole line of each cavity 70. The cavity volume was measured by placing each club with the back horizontal, filling the cavity with sand, levelling the sand to be even with the back of the club head, measuring the weight of the sand and calculating the volume from the measured weight.

The irons can be made of any desired metal. Best results have been obtained using stainless steel that

has been heat treated to obtain a Rockwell hardness of C18 to C22.

Any conventional shaft and grip can be used with the club heads of the present invention. Best results have been obtained with True Temper shaft MS-209 and Golf Pride Victory half cord grip.

It will be understood that the claims are intended to cover all changes and modifications of the preferred embodiment of the invention herein chosen for the purpose of illustration which do not constitute a departure from the scope of the invention.

**Claims**

1. A set of irons each of which has a club head, and a shaft, each said club head having a front playing face and a back, said back having a cavity therein, said front playing face having a geometric centre and the perimeter weighting of the club head outside of the cavity being adjusted such that each said club head has a centre of mass which coincides with said geometric centre of said club head.
2. The set of irons of Claim 1, wherein each club head has an offset and said offset progressively decreases from long irons to short irons.
3. The set of irons of Claim 1, wherein there are included long irons, medium irons and short irons and wherein the long irons have a negative bounce angle, the medium irons have a neutral bounce angle, and the short irons have a positive bounce angle.
4. The set of irons of Claim 1, wherein said cavity has a volume and said volume is greater in the long irons than in the short irons.
5. The set of irons of Claim 1, wherein said club head has a hosel length and said hosel length remains substantially constant.
6. The set of irons of Claim 1, wherein said club head has an overall weight, a sole weight and a toe weight and the ratio of combined toe weight and sole weight to said overall weight is greater in the short irons than in the long irons.
7. A set of irons having a plurality of irons within said set, each iron within said set comprising a club head and a shaft; each iron within said set having a club head comprising a hosel for attachment of said club head to said shaft, the hosel length being substantially the same for each club head in the said set, a face for striking a golf ball, and a back having a cavity therein; each iron within said set having a geometric centre of said face of said club head and a centre of mass of said club head; the long irons of the set having a greater cavity volume than the short irons and the perimeter weighting of each club head outside the cavity being such that said geometric centre and said centre of mass of each of said irons in said set coincide.
8. The set of irons of Claim 7, wherein irons within said set have substantially identical hosel lengths.

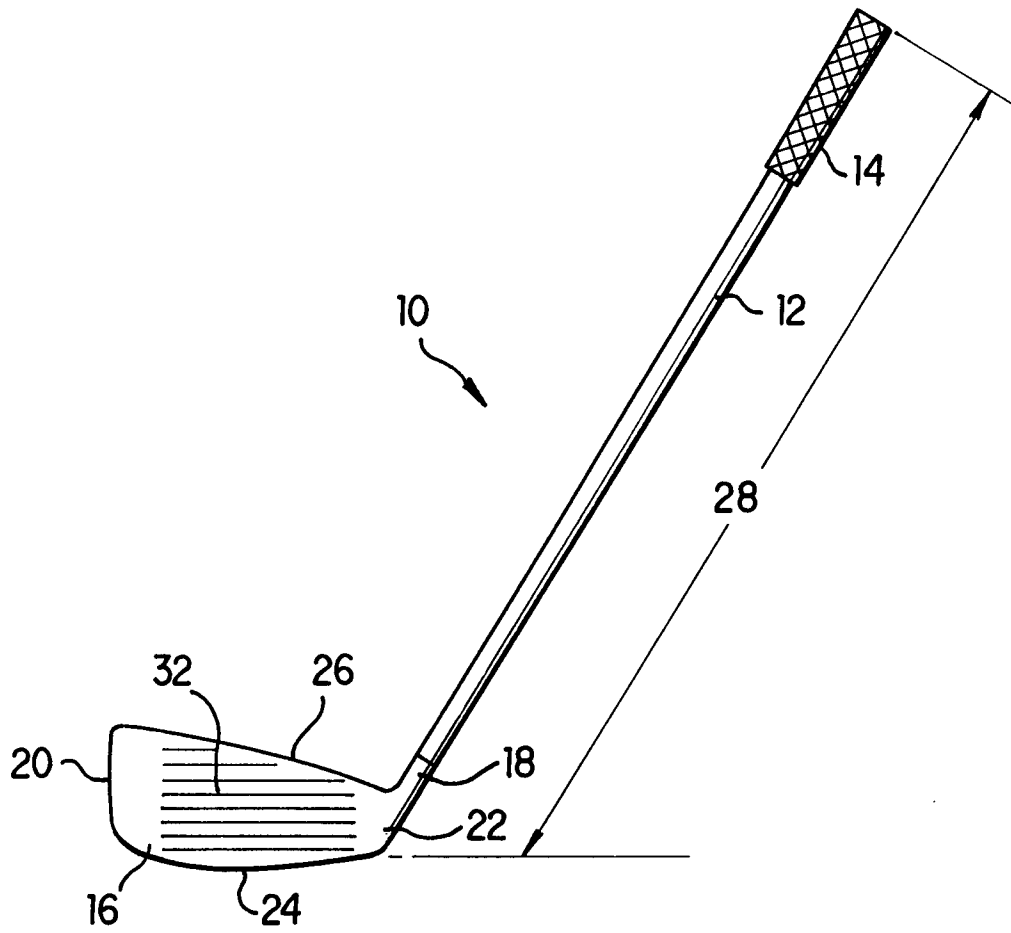


FIG. 1

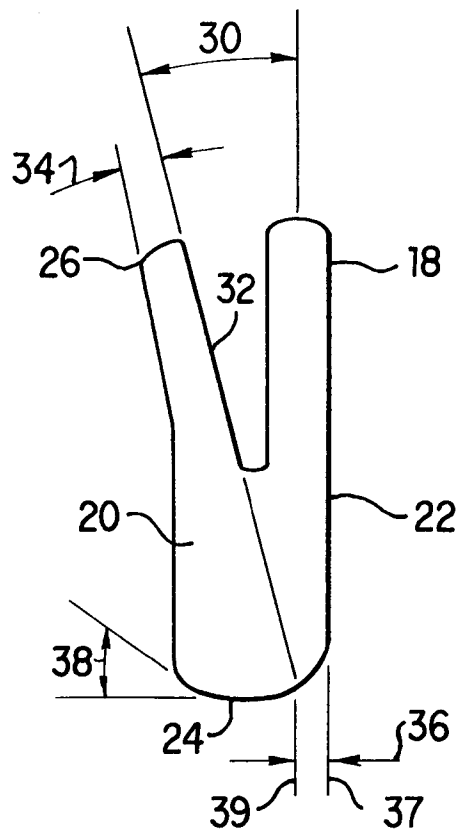


FIG. 2

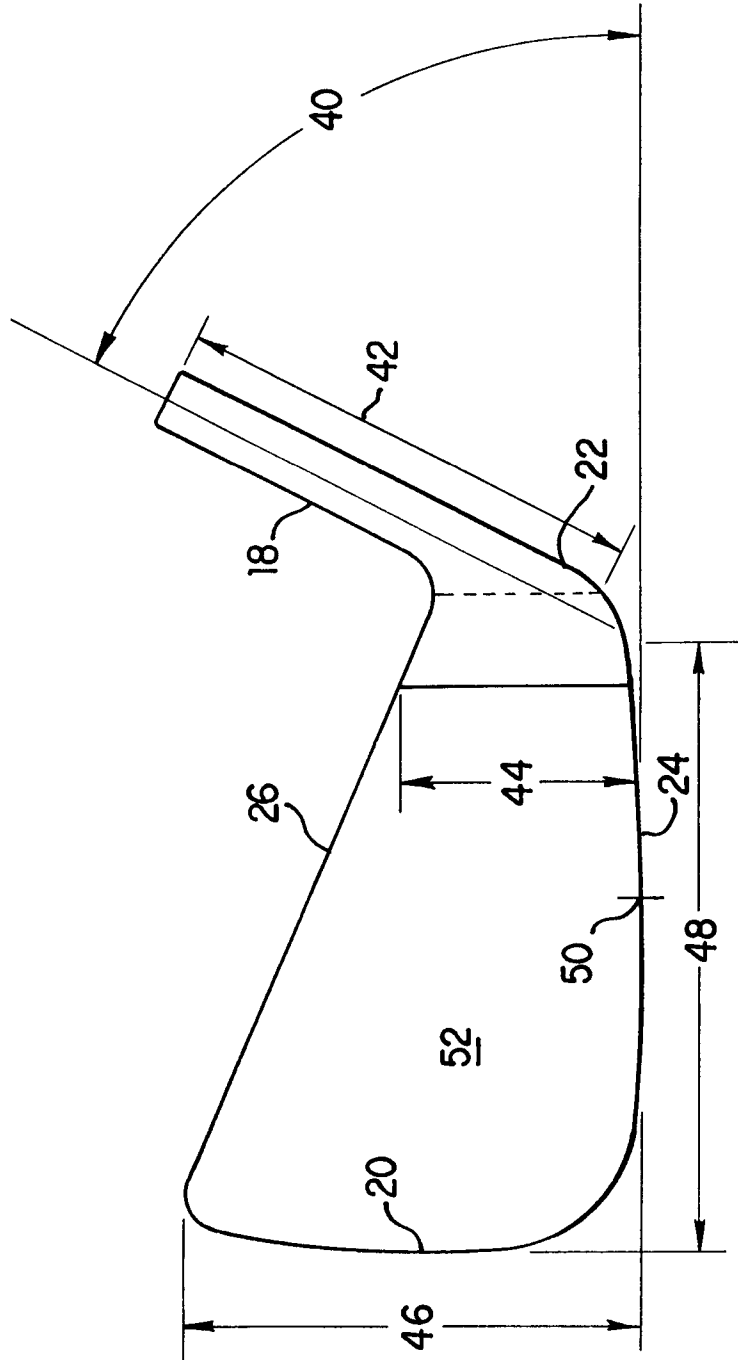


FIG. 3



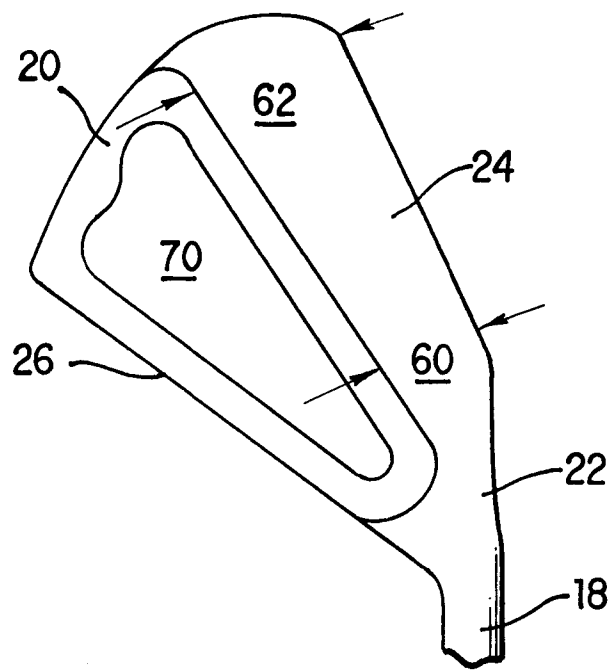


FIG. 4

FIG. 5

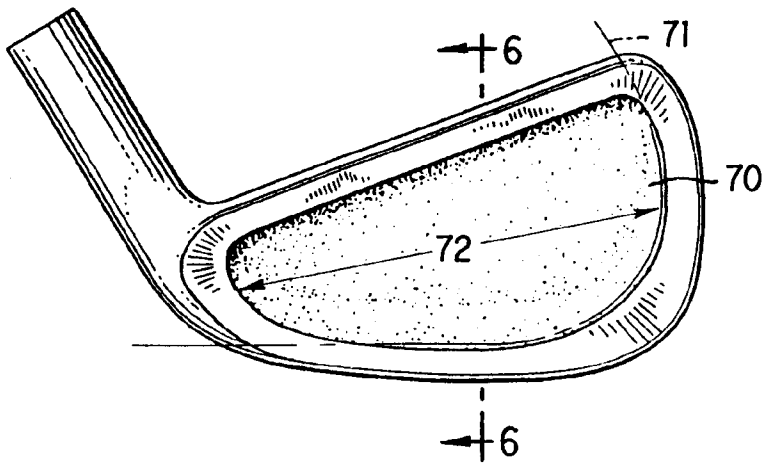


FIG. 6

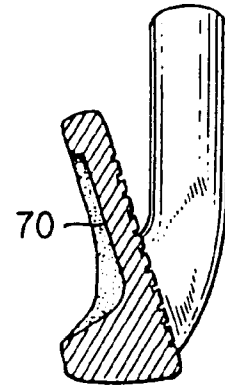


FIG. 7

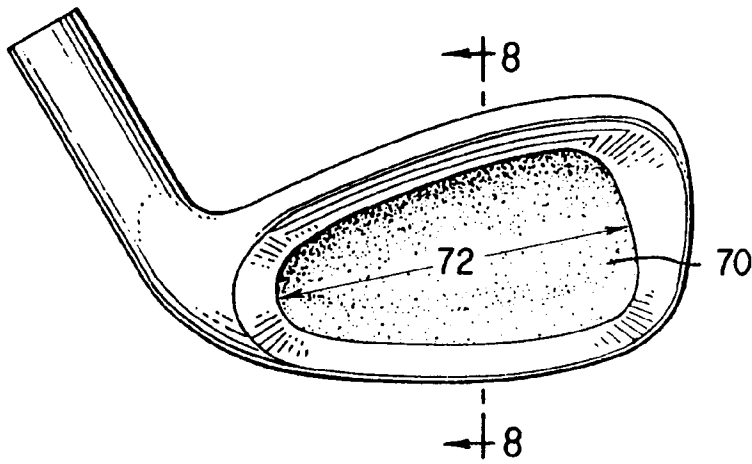


FIG. 8

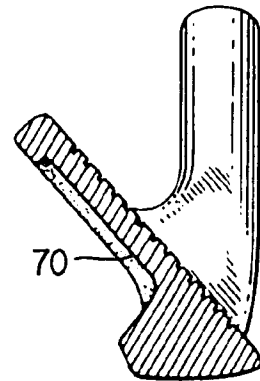


FIG. 9

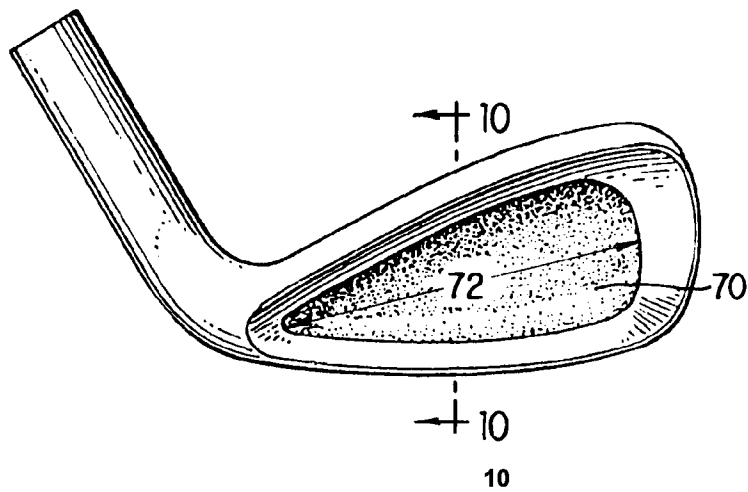
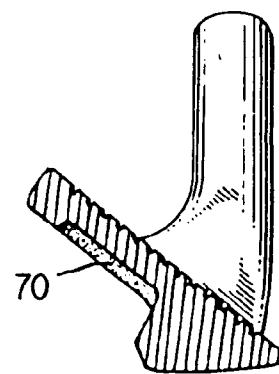


FIG. 10





European Patent  
Office

EUROPEAN SEARCH REPORT

Application Number

EP 92 30 5054

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
Y	US-A-3 693 978 (EAST) * column 1, line 37 - line 49; figure 7 * ---	1,7	A63B53/04
Y,D	US-A-4 715 601 (LAMANNA) * column 4, line 45 - column 5, line 27 * * column 5, line 61 - column 6, line 39; figures 1-3 * ---	1,7	
A,D	US-A-4 848 747 (FUJIMURA ET AL.) * column 1, line 28 - line 49; claim 1; figures 3,4 * -----	1,7	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			A63B
Place of search	Date of completion of the search	Examiner	
BERLIN	11 SEPTEMBER 1992	MONNE E.	
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention	
X : particularly relevant if taken alone		E : earlier patent document, but published on, or after the filing date	
Y : particularly relevant if combined with another document of the same category		D : document cited in the application	
A : technological background		L : document cited for other reasons	
O : non-written disclosure		.....	
P : intermediate document		& : member of the same patent family, corresponding document	

EPO FORM 1503 01.92 (P0401)