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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

TENNIS RACKET

This invention relates to tennis rackets.

5 Tennis rackets have evolved rapidly over the last few years. In the last twenty five years players have moved from using small headed wooden framed rackets to large headed rackets made of modern stiff materials such as graphite and titanium. The use of these modern materials has resulted in modern tennis rackets having significantly larger heads and lighter weight than those used
10 previously. The lighter weight allows rackets to be swung more quickly; resulting in more powerful shots. The increase in head size produces a larger sweet spot region in the racket and so allows a player more margin for error in hitting the ball.

15 The larger head also allows more topspin to be applied to the ball which causes the ball to dip below the trajectory of an unspun ball giving very powerful shots significantly more margin for error than otherwise possible. They will now dip much sooner and drop into court whereas previously they would have sailed out over the baseline. Topspin is applied to the ball by brushing the racket up
20 the back and over the top of the ball during which virtually the full width of the string bed contacts the ball.

It has been argued that the increased dominance of powerful topspin shots is damaging the competitive game, particularly at the elite level. For example, ten
25 years ago many players served and volleyed, i.e. they followed their serves to the net and played their second shot from close to the net before the ball bounced. Serving and volleying in elite singles tennis is now very unusual. This is because the increased power, controlled by topspin, allows the receiving player (i.e. the non-server) to hit passing shots from behind the baseline with
30 more power, control and dip than previously possible. These powerful dipping

shots are harder to volley and so the large majority of players are staying back on the baseline after they have served.

5 The game, particularly men's singles, is therefore less varied than in the past with players exchanging groundshots (shots hit after the ball bounces) from the baseline and only occasionally volleying following weak shots from their opponent. Many argue that the game is now one-dimensional and correspondingly less exciting.

10 One solution which has been proposed is to reduce the size of the racket head back to that which was commonplace when wooden framed rackets were used. A reduction of the width of the frame from 31.8cm (12.5 inches) to 22.9cm (9 inches) has been proposed. This would reduce the width of the string bed and would therefore reduce the amount of topspin which could be applied to the
15 ball. It would not, however, reduce the power of the racket and in fact may increase the power, as the racket would be even lighter with a smaller frame.

Reducing the racket head size would have other disadvantages as well. It is much harder to return serve with a smaller racket head and this could well
20 result in players with a powerful serve having an undue advantage thereby distorting the game in another undesirable direction. Non-elite players find tennis more enjoyable with the larger sweet spot region of larger headed modern rackets, producing fewer errors, and therefore having better rallies. A proposal for elite players to use smaller rackets, but for other players to be
25 allowed to use larger ones, may be problematic for those aspiring to be elite: a style developed by a junior using a larger headed racket would not easily adapt to a smaller racket. Furthermore, club players like to use the same rackets as the elite players. Indeed this is the basis of marketing most tennis rackets. This

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would no longer be possible unless the club player was prepared to accept the disadvantage of playing with a smaller racket.

5 It is therefore an object of the present invention to provide a tennis racket with which a reduced amount of spin can be applied without the disadvantages mentioned above.

10 According to the present invention there is provided a tennis racket including a frame which has a head portion comprising a top end, a bottom end and two side portions framing a string bed, and a handle end extending from the bottom end of the head portion, in which the racket in the area of one or both side portions in the sweet spot region is dimensioned to reduce the ability to impart spin on a ball when a racket is in use. The changes in the dimensions of the racket in the side portions in the sweet spot region may be by any suitable means, for example by varying the depth of the frame or by extending the bedding or gromits in such a way that they act as fins to reduce the ability to impart spin. Alternatively, the fins may be provided as additional components which can be attached to a racket of standard dimensions.

20 Optionally the frame in one or both of the side portions in the sweet spot region is at least 35mm deep in the direction largely perpendicular to the string bed. The frame of the head portion may be of a uniform depth around the racket head, or the frame in one or both side portions may be deeper than the frame at the top and/or bottom end of the head portion. If the frame is of a uniformly greater depth than current rackets, the racket may be heavier and more unwieldy than one with deepening of the frame in one or both of the side portions, subject to the materials chosen for the frame.

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The deepening of one or both sides of the frame in the sweet spot region of the racket (the provision of one or more fins) reduces the effective width of the racket for applying spin. If a player were to try to use the full width of the string bed to spin the ball, the ball would hit the frame and a miss-hit would result. The racket head can retain the current dimensions and the racket is therefore not made lighter as would be the case with the reduced sized racket. If anything, the additional depth to the frame may still add weight to the racket, although with current materials it may be possible to reduce weight elsewhere to compensate for the deepening in the side portions without adversely affecting the strength of the racket and so the overall weight of current rackets could be maintained. The fact that the racket head retains the current size also means that the larger sweet spot region is maintained.

Optionally, the deepened portion (fin) is formed as a fixed part of the frame. The fin can be made with the same material as the rest of racket frame, in which case there will be an increase in the stiffness of the racket or it can be made with a more flexible material, for example rubber or neoprene.

The fin may be adjustable so that it may be pushed back into, or adjacent to, the rest of the frame. This allows for a tennis racket which could be used by different players of different standards who may not all wish to have the reduced spin or the increased occurrence of miss-hits.

A further option is a racket in which the depth of the fins can be adjusted. Again this will allow the racket to be used by different players of different standards, and also allows a player to increase the depth of the frame in the sweet spot region and therefore reduce the effective area for spin as they become more competent.

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Optionally, the increased depth of frame is obtained by means of an accessory which may be attached to the tennis racket in the sweet spot region. This would allow existing players who already own rackets to adapt their rackets without the expense of having to purchase a new racket.

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In one embodiment the frame may be uniformly deeper in the side portions around the sweet spot of the racket. Naturally, if the same materials are used throughout, this racket will be heavier than a racket of a similar uniform frame depth. Therefore, an alternative is to have the fin of the frame toothed in the area around the sweet spot region of the racket. This would have the effect of reducing the effective width of string bed for imparting spin on the ball, but the weight increase would be less. Another alternative for reducing the weight increase is to have the frame perforated with one or more holes in the fins.

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Optionally, the frame may be tapered from the head end to the fins in the sweet spot region of the racket. The frame could also taper from the fins to the bottom end and the handle. This may provide a more aesthetically pleasing racket although the racket will be stiffened when compared to a racket with the deepened section only in the sweet spot region.

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The invention may be put into practice in a number of ways and an embodiment will now be shown by way of example, with reference to the accompanying figures, in which:

Figure 1 shows a racket in which both side portions are deeper in the direction perpendicular to the string bed than the rest of the frame; and

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Figures 1(a)-(d) show different examples of the deepened portions (fins).

Referring to figure 1, there is shown a tennis racket 1 comprising a top end 3, side portions 5 and a bottom end 7 which frame a string bed 9. The racket also

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includes a handle portion 11 extending from the bottom end 7. The string bed has a portion near the centre which is known as the sweet spot region 8. As will be appreciated by those skilled in the art, the exact shape and size of the sweet spot region will vary from racket to racket and is also affected by variables such as the type of and tension of strings employed. The sweet spot region shown in figure 1 is for example only. Generally, if a ball is hit in the sweet spot region it will travel in the direction intended and with more power and less vibration than if hit outside this region.

As shown in figure 1, the racket frame is generally uniform when viewed from above. However, when viewed in the plane of the string bed the side portion in the area around the sweet spot is deeper than the frame at the top end of the racket head. This deepening preferably extends on both faces of the racket frame so as to influence both forehand and backhand shots. As indicated above, the effect of the deepened portion (fin) is to reduce the effective striking area for spin shots. If a player tries to use the full width of the racket to spin the ball, the ball would hit the frame and a miss hit would be the result. Naturally, the deeper the side portions are, the smaller the effective striking area for spin shots becomes.

The fins can be solid (as shown in Figure 1(a)) or of some other form to reduce weight, to reduce additional stiffening, to reduce air resistance or for aesthetic purposes. For example Figure 1(b) shows a square toothed fin and Figure 1(c) shows a perforated fin. Each of these arrangements will reduce the weight of the racket when compared to the solid portion shown in figure 1(a).

The fin should preferably extend over most of the length of the sweet spot region 8 of the string bed 9. However, there may be situations where the object of the present invention can be met using a racket with a shorter length or

lengths of fin if appropriately arranged in the sweet spot region. Of course, the fin may extend further round the frame if so desired and in one embodiment of the present invention the frame is of uniform depth around the whole of the head portion. The depth of frame is selected such that the racket has reduced
5 ability to impart spin on a ball when the racket is in use. The depth of the frame to achieve this result will also vary depending on the width of the string bed as it is the effective width of string bed (when the depth of the frame is taken into consideration) which controls the ability to apply spin to the ball.

10 As another alternative, the fin can extend over the full length of the side portions 5 of the racket head or can be tapered from the region in which it is required to the top and/or bottom ends of the racket head, as shown in Figure 1(d). This may provide a more aesthetically pleasing shape to the racket than those shown in the previous figures.

15 Instead of being a fixed part of the frame, the fin can also be adjustable to different depths or entirely removable (not shown). It can be adjustable in the sense that the fin can be pushed back into or adjacent to the frame or so that the depth of the fin can be varied. It can also take the form of an accessory (not
20 shown) that is attached (for example, by clipping or screwing) onto an existing tennis racket with a substantially uniform frame in the region of the sweet spot to have the same effect. The fin may also be constituted by the gromits or bedding of the strings.

25 As explained above, the deeper the frame in the side portions 2 the less the spin that can be applied to a tennis ball. Trials have shown that increasing the depth of the frame of a racket with a string bed width "x" of 250mm and head depth "y" of 25mm by a further 15mm on each face greatly reduces the amount of spin that may be applied. Naturally, different depths of side portions in the

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region of the sweet spot may be employed to reduce the amount of spin which may be applied to a greater or lesser extent. It may be that for practice purposes a player may wish to use a racket with a greater restriction on spin to improve their technique. A racket which is up to 450% deeper in side portions in the regions of the sweet spot on each face may be considered. For example, a
5 frame depth of 10mm could be extended to a total depth of 100mm in the side portions.

Preferred ranges of the deepened portion of the racket are set out in the
10 accompanying claims either as percentage increases when compared to other portions of the frame, or as absolute values.

CLAIMS

1. A tennis racket including a frame which has a head portion comprising a top end, a bottom end and two side portions framing a string bed, and a
5 handle end extending from the bottom end of the head portion, in which the racket in the area of one or both side portions in the sweet spot region is dimensioned to reduce the ability to impart spin on a ball when a racket is in use.
- 10 2. A tennis racket as claimed in claim 1, in which the frame in one or both of the side portions in the sweet spot region is at least 35mm deep in the direction largely perpendicular to the string bed.
- 15 3. A tennis racket as claimed in claim 1 or claim 2, in which the frame of the head portion is of a uniform depth.
4. A tennis racket as claimed in claim 1 or claim 2, in which the frame in one or both side portions is deeper than the frame at the top and/or bottom end of the head portion.
- 20 5. A tennis racket as claimed in Claim 4, in which the deepened portion (fin) of the frame is formed as a fixed part of the frame.
6. A tennis racket as claimed in Claim 4, in which the fin of the frame is
25 moveable and can be pushed back into, or adjacent to, the rest of the frame.
7. A tennis racket as claimed in Claim 4, in which the depth of the fin of the frame can be adjusted.

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8. A tennis racket as claimed in Claim 4, in which the increased depth of portions of the frame in one or both of the side portions is obtained by means of an accessory which may be attached to the frame of a tennis racket in the region of the sweet spot.

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9. A tennis racket as claimed in any one of claims 4 to 8, in which the frame is uniformly deeper in the side portion(s) in the sweet spot region of the racket.

10. A tennis racket as claimed in any one of Claims 4 to 8, in which the fins of the frame are toothed in the area around the sweet spot region of the racket.

11. A tennis racket as claimed in any one of Claims 4 to 9, in which the fins around the sweet spot region of the racket are perforated with one or more holes.

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12. A tennis racket as claimed in any of claims 4 to 11, in which the depth of the frame is tapered from the head end to the fins in the sweet spot of the racket and/or tapered back to the bottom end.

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13. A tennis racket as claimed in any one of claims 4 to 12, in which the frame is deepened on each face of the frame by equal amounts.

14. A tennis racket as claimed in any one of claims 4 to 13, in which the fins on each face of the frame are up to 450% deeper than the top end and/or the bottom end of the frame.

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15. A tennis racket as claimed in claim 14, in which the fins on each face of the frame are between 30% and 300% deeper than the top end and/or the bottom end of the frame.
- 5 16. A tennis racket as claimed in Claim 15, in which the fins on each face of the frame are between 50% and 200% deeper than the top end and/or the bottom end of the frame.
- 10 17. A tennis racket as claimed in Claim 16, in which the fins on each face of the frame are between 75% and 150% deeper than the top end and/or the bottom end of the frame.
- 15 18. A tennis racket as claimed in Claim 17, in which the fins on each face of the frame are between 90% and 120% deeper than the top end and/or the bottom end of the frame.
19. A tennis racket as claimed in claim 1 or claim 2, in which the frame in at least one or both of the side portions is in the range of 35-100mm deep.
- 20 20. A tennis racket as claimed in claim 19, in which the frame in at least one or both of the side portions is in the range of 40-95mm deep.
21. A tennis racket as claimed in claim 20, in which the frame in at least one or both of the side portions is in the range of 45-90mm deep.
- 25 22. A tennis racket as claimed in claim 21, in which the frame in at least one or both of the side portions is in the range of 50-85mm deep.

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23. A tennis racket as claimed in claim 22, in which the frame in at least one or both of the side portions is in the range of 55-80mm deep.
24. A tennis racket as claimed in claim 23, in which the frame in at least one or both of the side portions is in the range of 60-75mm deep.
25. A tennis racket as claimed in claim 24, in which the frame in at least one or both of the side portions is in the range of 65-70mm deep.
26. A tennis racket constructed and arranged substantially as herein specifically described with respect to and as shown in figures 1 and 1(a) to 1(d) of the accompanying drawings.

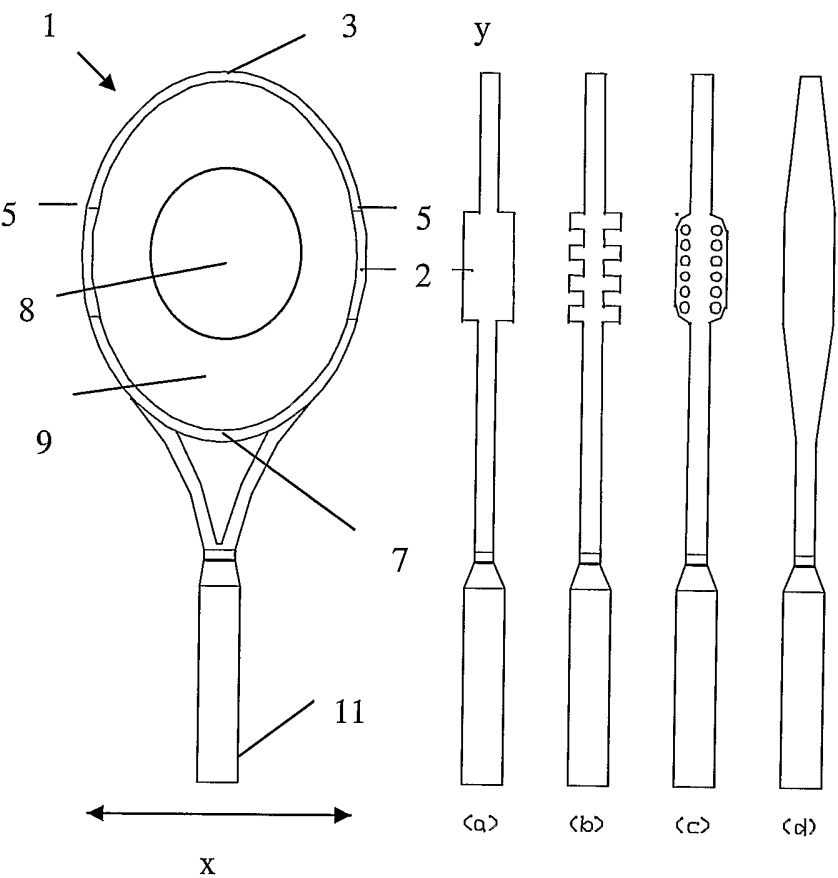


FIGURE 1

INTERNATIONAL SEARCH REPORT

International Application No
/GB2004/003441

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A63B49/02 A63B69/38

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 A63B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, PAJ, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 664 380 A (KUEBLER SIEGFRIED) 12 May 1987 (1987-05-12) the whole document	1-5,9, 11-25
X	US 3 820 785 A (OCCHIPINTI P ET AL) 28 June 1974 (1974-06-28) column 2, line 12 - line 37 figures 1,2	1,3
X	US 4 911 444 A (YONEYAMA MINORU) 27 March 1990 (1990-03-27) the whole document	1,4,5, 11-16
X	FR 2 691 073 A (ROSSIGNOL SA) 19 November 1993 (1993-11-19) the whole document	1,4,5, 12-14
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☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

A document defining the general state of the art which is not considered to be of particular relevance

E earlier document but published on or after the international filing date

L document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

O document referring to an oral disclosure, use, exhibition or other means

P document published prior to the international filing date but later than the priority date claimed

T later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

X document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

Y document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

8 document member of the same patent family

Date of the actual completion of the international search

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INTERNATIONAL SEARCH REPORT

International Application No
PCT/GB2004/003441

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 009 422 A (SOONG TSAI C) 23 April 1991 (1991-04-23) the whole document	1-3,5,9, 11,13
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INTERNATIONAL SEARCH REPORT

International application No.
PCT/GB2004/003441

Box II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☒ Claims Nos.: 26
because they relate to subject matter not required to be searched by this Authority, namely:
Rule 6.2(a) PCT - References to other parts of the international application
2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International Application No

/GB2004/003441

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