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(54) **Improved games racket**

(57) A games racket having a head providing a frame for a bed of strings, the strings entering holes in the frame, and at least part of the frame having a cross-section which is concave in a region where the strings enter the holes, whereby the actual area (A) occupied by the bed of strings exceeds its visible area (P) when viewing the racket face on. By increasing the actual strung area in this way, the ball speed obtainable when striking the ball can be increased, compared with a conventional racket of equivalent overall size.

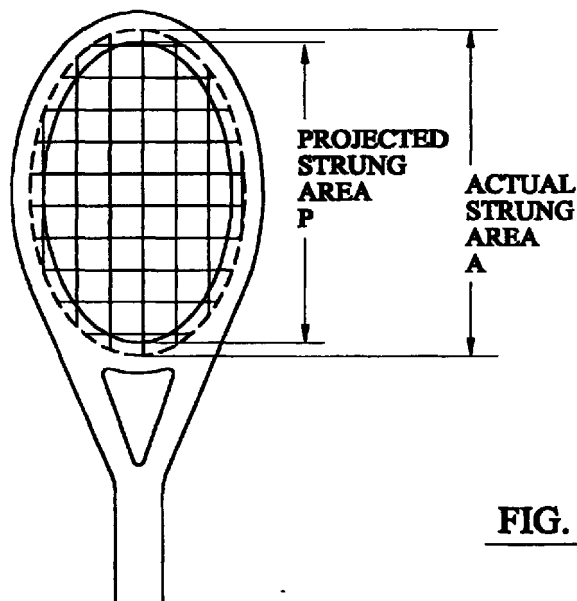


FIG. 6

Description

[0001] This invention relates to the head of a racket used for tennis, squash or badminton where the head is defined as the part of the racket that contains the strings.

[0002] The frame of the head must be strong and stiff so that it can resist the total force exerted by the tension of the strings which can in a tennis racket amount to around 500 kg force in each of the directions of the main and cross strings. Also, the frame of the head must resist bending in a sense perpendicular to the plane of the strings in a cantilever fashion. This means that the section through the head frame must be capable of providing high cantilever stiffness (i.e. along the axis of the frame section) but, due to the generally ovoid plan of racket heads, in general high torsional stiffness must also be provided by the racket head section. High cantilever and high torsional stiffness together in the head section thus provide a racket head which resists distortion to loads applied perpendicular to the string plane as occur when a ball or shuttlecock is struck in the course of play. To achieve these requirements, normally rackets have evolved with circular, ovoid, square, or rectangular head cross-sections. Additionally, rackets with such cross sections are easy to manufacture.

[0003] Another requirement of a racket is that the total area occupied by the strings should be as large as possible consistent with limitations imposed by the laws imposed by Controlling Authorities (e.g. International Tennis Federation) and also within limitations imposed by considerations of the required strength and stiffness being generated by the frame construction at an acceptable resulting weight of the frame. Increased string area leads to increased racket power as explained later.

[0004] The purpose of the invention described here is to define a cross section for the head of a racket which optimises the above requirements and which alternatively may be varied around the head of the racket to impart other desirable characteristics.

[0005] According to the present invention there is provided a games racket having a head providing a frame for a bed of strings, the strings entering holes in the frame, and at least part of the frame having a cross-section which is concave in a region where the strings enter the holes, whereby the actual area occupied by the bed of strings exceeds its visible area when viewing the racket face on.

[0006] Thus, the present invention can increase the strung area of the head in relation to the overall dimensions of the head.

[0007] Various cross-sections of the head frame are possible as described below. In a preferred embodiment, the concave region is combined with a curved outer cross-section of the frame to produce a crescent-shaped overall cross-section.

[0008] The concave region may be provided all around the inner perimeter of the head. Alternatively, it

may be provided only in one or more distinct parts of the frame. In a preferred embodiment, just the upper part of the racket opposite the handle (for example, the top half) is provided with the concave section.

[0009] The concave region need not be of constant shape or depth, but can vary with position around the frame, or may vary in relation to the string holes (e.g. deeper around the holes than away from the holes). In the preferred embodiment, wherein the upper part of the head is provided with the concave section, the concavity preferably increases gradually with a smooth transition from the non-concave to the concave part.

[0010] By using the present invention, an increase in the area of the string bed of 5-10% is possible, compared with a conventional racket of the same size.

[0011] Reference is made, by way of example only, to the accompanying drawings in which:

Figures 1 to 5 illustrate various possible cross-sectional shapes of part of a games racket head in accordance with the present invention;

Figure 6 illustrates the difference between the actual strung area A and a projected strung area P in a racket embodying the present invention; and
Figure 7 illustrates a modified embodiment of the invention in which only part of the racket head is provided with a concave cross-section.

[0012] The basis of the invention is to specify a section through the head frame which is essentially concave in a sense that the concavity exists along its inner perimeter, i.e. on the side of the frame where the strings enter the section as shown in Figure 1. The concavity may be incorporated into what is otherwise a square, rectangular or ovoid section as shown in Figures 2, 3 and 4 and may be an essentially crescent section as shown in Figure 5.

[0013] It has been found that using the latest manufacturing techniques with carbon fibres/epoxy composites (which are well known to those skilled in the art) that the geometrical considerations of racket head sections referred to in the first paragraph above are now less important because of the high stiffness and strength that can be generated by carbon fibre/epoxy composites and so other considerations, in this case maximising stringing area, can be a prime design limitation. The effect of maximising string area is to increase the "power" that can be generated by the racket - that is the ball speed produced on striking, for instance a tennis ball.

[0014] To define the degree by which the string area may be increased it is necessary to make certain definitions which are shown in Figure 6. The "ACTUAL" string area A and "PROJECTED" string area P will be understood from the Figure. In practice it is found that racket head sections can be specified where

A-P
P

is between 5 & 10% but this should not be regarded as a limitation. In other words, the strung area can be increased by 5-10% compared with a conventional games racket having the same overall size.

[0015] In a preferred embodiment in which the concave section can be utilised to advantage, the section is used around part of the racket head only, for instance from positions defined on a clock face say from 9 o'clock to 3 o'clock as shown in Figure 7.

[0016] This has the effect of moving the effective centre of the string bed towards the crown of the head and because the maximum power of the string head is associated with its centre, then the point where maximum power can be generated is moved further away from the handle of the racket. The head speed generated by the racket depends partly on rotation of the racket about the handle area and so the point of maximum power is moved to a point of increased linear velocity, thus increasing the power generated even further which is a very desirable outcome.

[0017] In Figures 6 and 7, the concave section forms a single continuous concave region around all or part of the racket head. However, this is not essential and a similar effect may be obtained by providing a plurality of distinct concave regions (i.e. portions around the head frame in which the concave section is formed). As well as, or instead of, providing one or more extended concave regions, it is possible to provide local regions of concavity such that areas on the inner perimeter of the frame immediately around the strings are concave (recessed), whereas areas away from the strings are less concave or not at all concave. The effect is still provided of allowing the strings to vibrate over a larger area than would otherwise be possible.

[0018] Figures 1 to 5 illustrate possible cross-sections at a pair of points through the head frame; however, it is not essential for the cross-sectional shape to stay the same all around the frame. The concave section may be made more or less pronounced as one proceeds around the frame, for example more pronounced towards the apex of the racket (12 o'clock position), and less so towards the sides (9 o'clock and 3 o'clock positions).

[0019] This is particularly applicable in the preferred embodiment shown in Figure 7, wherein the concavity may begin as a smooth transition from a normal (flat or convex) inner cross-section at a position corresponding to 7 o'clock, increase as one proceeds clockwise around the head frame to a predetermined depth which is maintained around the apex of the frame, and decrease from the predetermined depth to finally reach zero (back to a non-concave section) at the 5 o'clock position.

[0020] The present invention is particularly applica-

ble to tennis rackets but may also be usefully applied to rackets for other sports including squash and badminton.

Claims

1. A games racket having a head providing a frame for a bed of strings, the strings entering holes in the frame, and at least part of the frame having a cross-section which is concave in a region where the strings enter the holes, whereby the actual area occupied by the bed of strings exceeds its visible area when viewing the racket face on.
2. A games racket according to claim 1, wherein the frame has a generally square cross-section except in said concave region.
3. A games racket according to claim 1, wherein the frame has a generally rectangular cross-section except in said concave region.
4. A games racket according to claim 1, wherein the frame has a generally ovoid cross-section except in said concave region.
5. A games racket according to claim 1, wherein the cross-section of the frame including said concave region has a crescent shape.
6. A games racket according to any preceding claim, wherein the concave region is provided around the whole of the frame.
7. A games racket according to any of claims 1 to 5, wherein the games racket has a handle, and the concave region is provided around a portion of the head opposite the handle.
8. A games racket according to any preceding claim, wherein the concave region is formed as a single continuous region.
9. A games racket according to any of claims 1 to 5, wherein the concave region is formed at a plurality of distinct parts of the frame.
10. A games racket according to any preceding claim, wherein the or each concave region has a constant depth.
11. A games racket according to any of claims 1 to 9, wherein the or each concave region has a depth which varies with position around the frame.
12. A games racket according to claim 11, wherein a transitional region of gradually decreasing concavity is provided between the or each part of the frame

including the concave region, and the remaining part of the frame.

13. A games racket according to any of claims 1 to 9, 11 or 12, wherein the or each concave region has a depth which is greater around the holes than away from the holes. 5
14. A games racket according to any preceding claim, wherein the actual area of the bed of strings exceeds its visible area by between 5 and 10%. 10

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FIG. 1

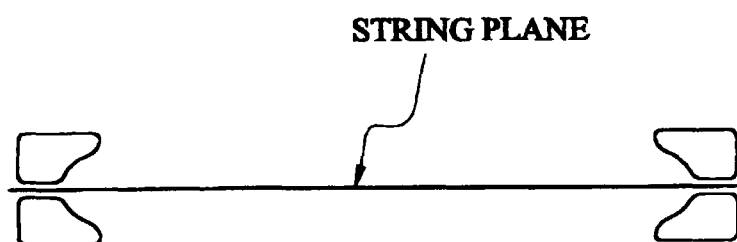


FIG. 2

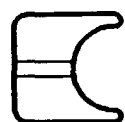


FIG. 3

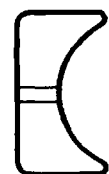


FIG. 4



FIG. 5



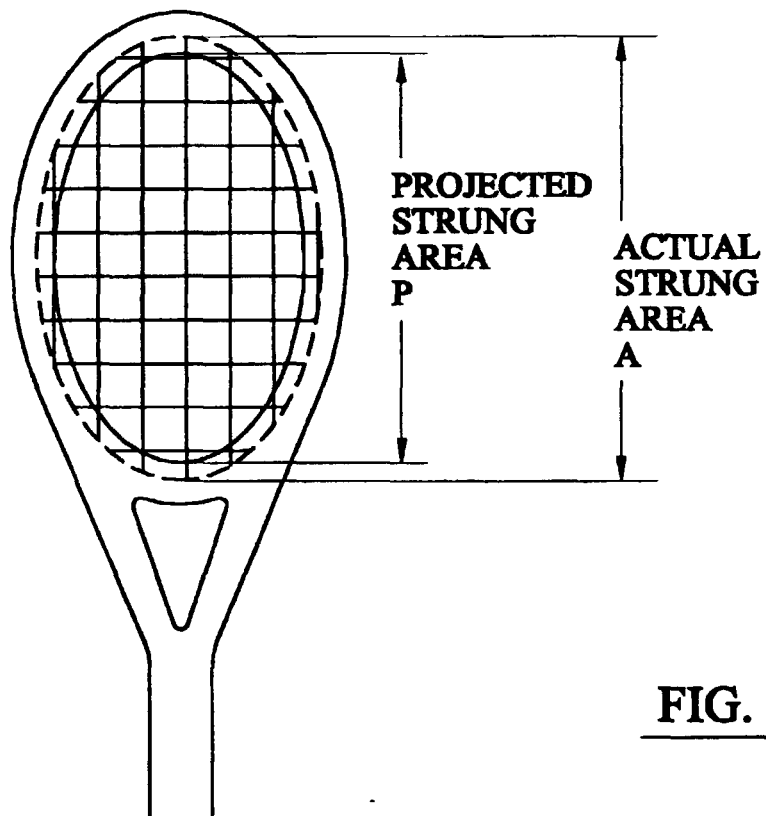


FIG. 6

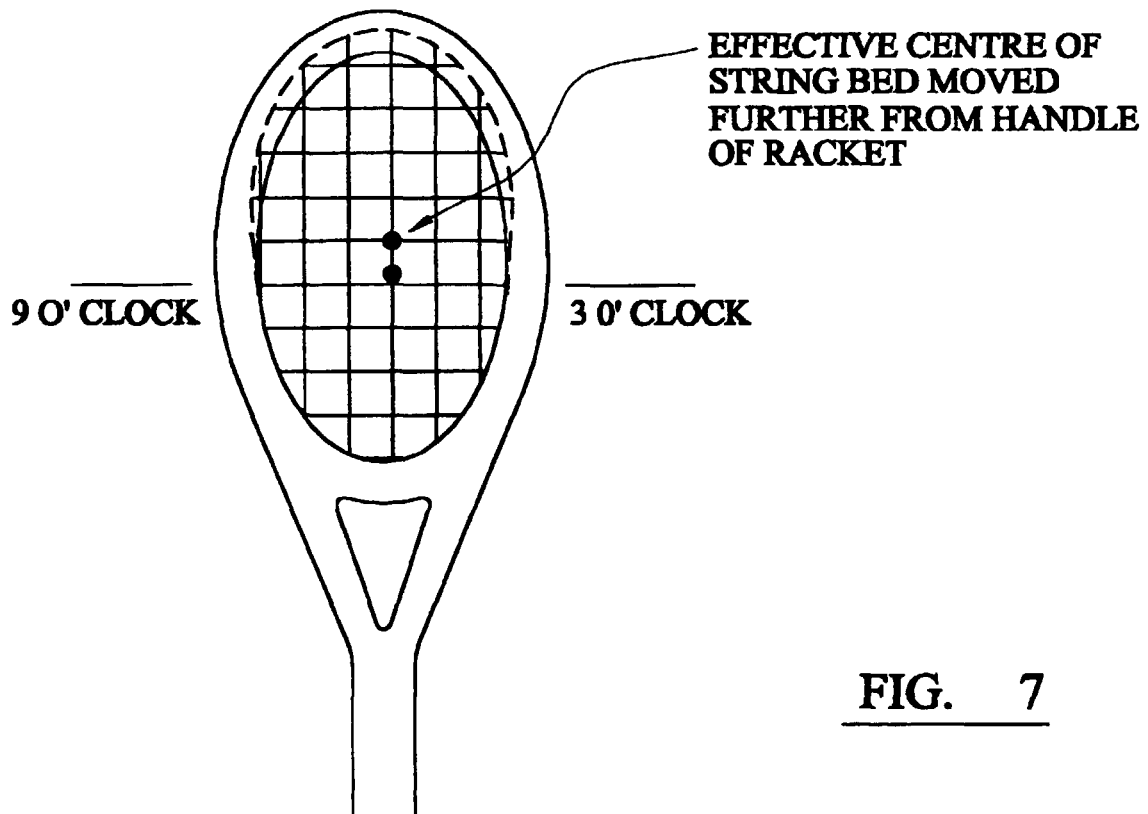


FIG. 7