Description

This invention relates to squash rackets, and, more particularly, to a squash racket which is lighter than prior squash rackets and which has a balance point or center of gravity which is closer to the head end of the racket than to the handle end.

Squash rackets conventionally have a length of about 68.5 cm (27 inches) and a weight of about 187 to 218 grams. Squash rackets are also usually "head light," i.e., the balance point or center of gravity of the racket is closer to the handle end of the racket than the head end. It is common to add lead or other weight to the handle of a squash racket in order to increase the weight of the racket, and the lead increases the "head light" characteristic of the racket.

Representative competitive squash rackets have been measured, and the physical properties of the rackets fall within the following ranges:

Weight (Grams)	Length	Balance	lend
187-218	68.3-68.8 cm	30.6-34.9 cm	297375-349347 gcm^2
	(26.9-27.08 in)	(12.04-13.73 in)	(1625-1909 ozin^2)

"Balance" is the distance of the balance point or center of gravity from the handle end of the racket. "lend" is the moment of inertia about an axis at the end of the handle which extends perpendicularly to the handle and is a measure of the ability of the racket to resist rotation about the axis.

Frolow Reissue Patent No. 31,419 describes a tennis racket which is lighter than conventional tennis rackets and in which weight is removed from the handle end and added to the head end to make the racket "head heavy," i.e., the balance point or center of gravity is closer to the head end of the racket than the handle end. Frolow also describes making the racket stiffer so that the frequency of vibration of the racket described in column 13 of Figure 40 of the patent is greater than 140 cycles per second. The Frolow patent does not describe a squash racket, which is distinctly different than a tennis racket in shape, weight, and other physical characteristics.

Summary of the Invention

The invention provides a squash racket which is significantly lighter than prior squash rackets and which is "head heavy." The weight of the racket is within the range of about 150 to about 175 grams. The length of the racket is about 68.5 cm (about 27 inches), and the balance point or center of gravity is about 38 to about 42 cm (about 15 to about 16.5 inches) from the handle end. The moment of inertia about an axis at the end of the handle is about 333975 to about 356850 gcm^2 (about 1825 to 1925 Oz. In.^{2}), and the center of percussion is about 49.5 to 57 cm (about 19-1/2 to 22-1/2 inches) from the end of the handle. The racket preferably does not include lead or other weighting material in the handle, although a small amount of lead might be used to fine tune the weight of the racket.

Description of the Drawing

The invention will be explained in conjunction with illustrative embodiments shown in the accompanying drawing, in which --

Figure 1 is a plan view of a squash racket frame formed in accordance with the invention;
Figure 2 is a side elevational view of the racket frame;
Figure 3 is a sectional view taken along the line A-A of Figure 1;
Figure 4 is a sectional view taken along the line B-B of Figure 1;
Figure 5 is a sectional view taken along the line C-C of Figure 1;
Figure 6 is a sectional view taken along the line D-D of Figure 1;
Figure 7 is a sectional view taken along the line E-E of Figure 1;
Figure 8 is a sectional view taken along the line F-F of Figure 1;
Figure 9 is a plan view of a modified embodiment of a squash racket frame formed in accordance with the invention;
Figure 10 is a side elevational view of the racket frame of Figure 9;
Figure 11 is a sectional view taken along the line A-A of Figure 9;
Figure 12 is a sectional view taken along the line B-B of Figure 9;

TABLE I

Cross Section	Height		Width	
	cm	(inch)	cm	(inch)
AA	1.69	0.669	0.90	0.355
BB	1.69	0.669	0.93	0.367
CC	1.99	0.787	0.93	0.367
DD	1.72	0.717	1.39	0.551
EE	2.29	0.902	2.87	1.13
FF	1.88	0.740		

A modified embodiment of a squash racket frame 40 is illustrated in Figures 9 and 10. The frame 40 is also molded from graphite fibers and resin and has an overall length L of 68.28 cm (26.882 inches). The longitudinal and transverse dimensions A and B of the strung surface are 21.47 cm (8.453 inches) and 18.12 cm (7.1349 inches), respectively. The weight of the frame is 5.5 to 6.0 ounces (156 to 171 grams), and the balance point is 38.8 to 40.9 cm (15.3 to 16.1 inches) from the butt end 41. The end moment of inertia about the axis G-G is 333975 to 352275 gcm^2 (1825 to 1925 oz. $in.^2$.), The center of percussion measured with respect to an axis G-G at the butt end 41 is 51 cm (20.1 inches) from the butt end, and the center of percussion measured with respect to an axis at a point 7.6 cm (3 inches) from the butt end is 45.9 cm (18.1 inches) toward the head.

The racket frame 40 has a dual taper side profile (Figures 9 and 10) and tapers outwardly from the head end 42 to a maximum height at Section F-F and tapers downwardly from Section F-F to the handle portion 43. The height H and width W of the cross sections illustrated in Figures 11-16 are set forth in Table II:

TABLE II

Cross Section	Height		Width	
	cm	(inch)	cm	(inch)
AA	1.67	0.660	0.77	0.320
BB	1.52	0.600	0.89	0.350
CC	1.52	0.600		
DD	1.98	0.780	1.39	0.550
EE	2.29	0.902	2.88	1.134
FF	2.35	0.980	0.89	0.350

The dimensions for the racket frame may vary within a range of about ± 1.3 cm (± 0.5 inch), and the frequency is preferably at least 140 Hz and more preferably at least 150 Hz. The center of percussion about the axis G-G may be within the range of 49.5 to 57 cm (19-1/2 to 22-1/2 inches) from the axis, and preferably within the range of 51 to 57 cm (20 to 22-1/2 inches).

The handle portions of the racket frames 20 and 40 are formed only from graphite fibers and resin and preferably do not include any lead or other weighted material. However, a few grams of lead tape might be used to provide the racket with a desired total weight. Conventional squash rackets commonly include as much as 20 to 30 grams of lead in the handle to increase the weight of the racket.

The graphite frame can be made in the conventional manner by laying the graphite fibers and resin around an elongated inflatable bladder which is then arranged in the shape of the frame. The resin is cured under heat and pressure, and the bladder is then deflated and removed to provide a hollow frame.

Claims

1. A squash racket (20) comprising a frame (21) having a head portion (22) adapted to support a strung surface, a handle portion (25) adapted to be held by a player, a shaft portion (24) connected to the handle portion, and a throat portion (26) connecting the handle portion and the head portion, the improvement characterized by the racket having:

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Cross Section	Height		Width	
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BB	1.69	0.669	0.93	0.367
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EE	2.29	0.902	2.87	1.13
FF	1.88	0.740		

A modified embodiment of a squash racket frame 40 is illustrated in Figures 9 and 10. The frame 40 is also molded from graphite fibers and resin and has an overall length L of 68.28 cm (26.882 inches). The longitudinal and transverse dimensions A and B of the strung surface are 21.47 cm (8.453 inches) and 18.12 cm (7.1349 inches), respectively. The weight of the frame is 5.5 to 6.0 ounces (156 to 171 grams), and the balance point is 38.8 to 40.9 cm (15.3 to 16.1 inches) from the butt end 41. The end moment of inertia about the axis G-G is 333975 to 352275 gcm^2 (1825 to 1925 oz. $in.^2$.), The center of percussion measured with respect to an axis G-G at the butt end 41 is 51 cm (20.1 inches) from the butt end, and the center of percussion measured with respect to an axis at a point 7.6 cm (3 inches) from the butt end is 45.9 cm (18.1 inches) toward the head.

The racket frame 40 has a dual taper side profile (Figures 9 and 10) and tapers outwardly from the head end 42 to a maximum height at Section F-F and tapers downwardly from Section F-F to the handle portion 43. The height H and width W of the cross sections illustrated in Figures 11-16 are set forth in Table II:

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FF	2.35	0.980	0.89	0.350

The dimensions for the racket frame may vary within a range of about ± 1.3 cm (± 0.5 inch), and the frequency is preferably at least 140 Hz and more preferably at least 150 Hz. The center of percussion about the axis G-G may be within the range of 49.5 to 57 cm (19-1/2 to 22-1/2 inches) from the axis, and preferably within the range of 51 to 57 cm (20 to 22-1/2 inches).

The handle portions of the racket frames 20 and 40 are formed only from graphite fibers and resin and preferably do not include any lead or other weighted material. However, a few grams of lead tape might be used to provide the racket with a desired total weight. Conventional squash rackets commonly include as much as 20 to 30 grams of lead in the handle to increase the weight of the racket.

The graphite frame can be made in the conventional manner by laying the graphite fibers and resin around an elongated inflatable bladder which is then arranged in the shape of the frame. The resin is cured under heat and pressure, and the bladder is then deflated and removed to provide a hollow frame.

Claims

1. A squash racket (20) comprising a frame (21) having a head portion (22) adapted to support a strung surface, a handle portion (25) adapted to be held by a player, a shaft portion (24) connected to the handle portion, and a throat portion (26) connecting the handle portion and the head portion, the improvement characterized by the racket having:

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a) a weight within the range of about 150 to about 175 grams, and
b) a center of gravity located closer to the head end (29) of the racket than the handle end (28) of the racket.

2. The squash racket of claim 1 in which the length of the frame (21) is about 68,5 cm (27 inches) and the center of gravity of the racket is about 38 to about 42 cm (about 15 to about 16,5 inches) from the handle end (28) of the racket.

3. The squash racket of claim 1 in which the vibrational frequency of the racket in the first mode of free-free constraint is at least about 140 Hz.

4. The squash racket of claim 1 in which the vibrational frequency of the racket in the first mode of free-free constraint is at least about 150 Hz.

5. The squash racket of claim 1 in which the moment of inertia of the racket about an axis (G-G) at the handle end which extends perpendicularly to the handle is about 333975 gcm^2 to about 356850 gcm^2 (about 1825 to about 1950 $ozin^2$).

6. The squash racket of claim 1 in which the center of percussion measured from the handle end (28) is about 49,5 to 57 cm (19½ to 22½ inches) from the handle end.

7. The squash racket of claim 1 in which the center of percussion measured from the handle end is about 51 to 57 cm (20 to 22½ inches) from the handle end.

8. The squash racked of claim 1 in which the racket is formed from graphite fibers and resin and the handle portion (25) does not include added weight.

9. A squash racket (20) comprising a frame (21) having a head portion (22) adapted to support a strung surface, a handle portion (25) adapted to be held by a player, a shaft portion (24) connected to the handle portion, and a throat portion (26) connecting the handle portion and the head portion, the overall length of the frame being about 68.5 cm (27 inches), the improvement characterized by the racket having:
a) a weight within the range of about 150 to 175 grams,
b) a center of gravity located about 38 to about 42 cm (about 15 to about 16.5 inches) from the handle end (28) of the racket,
c) a center of percussion measured from the handle end (28) of about 49.5 to 57 cm (about 19½ to 22½ inches) from the handle end,
d) a moment of inertia about an axis at the handle end which extends perpendicularly to the handle of about 333975 to about 356850 gcm^2 (about 1825 to about 1950 $ozin^2$), and
e) a vibrational frequency in the first mode of free-free constraint of at least about 140 Hz.

10. The squash racket of claim 9 in which the vibrational frequency of the racket is at least about 150 Hz.

11. The squash racket of claim 9 in which the center of percussion measured from the handle end is about 51 to 57 cm (about 20 to 22½ inches) from the handle end (28).

Patentansprüche

1. Squashschläger (20), mit einem Rahmen (21), der einen Kopfabschnitt (22) besitzt und angepaßt ist, eine bespannte Oberfläche zu haltern; einem Griffabschnitt (25), der angepaßt ist, um von einem Spieler gehalten zu werden; einem Schaftabschnitt (24), der mit dem Griffabschnitt verbunden ist; und einem Halsabschnitt (26), der den Griffabschnitt und den Kopfabschnitt verbindet, wobei die Verbesserung dadurch gekennzeichnet ist, daß der Schläger aufweist:
a) ein Gewicht im Bereich von etwa 150 bis etwa 175 g, und
b) einen Schwerpunkt, das sich näher zum Kopfende (29) des Schlägers als zum Griffende (28) des Schlägers befindet.

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2. Squashschläger nach Anspruch 1, bei dem die Länge des Rahmens (21) etwa 68,5 cm (27 inches) beträgt, und das Schwerpunkt des Schlägers etwa 38 bis etwa 42 cm (etwa 15 bis etwa 16,5 inches) vom Griffende (28) des Schlägers entfernt ist.

3. Squashschläger nach Anspruch 1, bei dem die Schwingungsfrequenz des Schlägers im ersten Modus des Frei-Frei-Zwangs mindestens etwa 140 Hz beträgt.

4. Squashschläger nach Anspruch 1, bei dem die Schwingungsfrequenz des Schlägers im ersten Modus des Frei-Frei-Zwangs mindestens etwa 150 Hz beträgt.

5. Squashschläger nach Anspruch 1, bei dem das Trägheitsmoment des Schlägers um eine Achse (G-G) am Griffende, die sich senkrecht zum Griff erstreckt, etwa 333975 gcm^2 bis etwa 356850 gcm^2 (etwa 1825 bis etwa 1950 $ozin^2$) beträgt.

6. Squashschläger nach Anspruch 1, bei dem der Schlagmittelpunkt, gemessen vom Griffende (28) her, etwa 49,5 bis 57 cm (19½ bis 22½ inches) vom Griffende entfernt ist.

7. Squashschläger nach Anspruch 1, bei dem der Schlagmittelpunkt, gemessen vom Griffende her, etwa 51 bis 57 cm (20 bis 22½ inches) vom Griffende entfernt ist.

8. Squashschläger nach Anspruch 1, bei dem der Schläger aus Graphitfasern und Harz gebildet ist, und der Griffabschnitt (25) kein Zusatzgewicht enthält.

9. Squashschläger (20) mit einem Rahmen (21), der einen Kopfabschnitt (22) besitzt und angepaßt ist, eine bespannte Oberfläche zu halten; einem Griffabschnitt (25), der angepaßt ist, um von einem Spieler gehalten zu werden; einem Schaftabschnitt (24), der mit dem Griffabschnitt verbunden ist; und einem Halsabschnitt (26), der den Griffabschnitt und den Kopfabschnitt verbindet, wobei die Gesamtlänge des Rahmens etwa 68,5 cm (27 inches) beträgt und die Verbesserung dadurch gekennzeichnet ist, daß der Schläger aufweist:
   a) ein Gewicht im Bereich von etwa 150 bis etwa 175 g,
   b) einen Schwerpunkt, der sich etwa 38 bis etwa 42 cm (etwa 15 bis etwa 16,5 inches) vom Griffende (28) des Schlägers befindet,
   c) einen Schlagmittelpunkt, der, vom Griffende (28) her gemessen, etwa 49,5 bis 57 cm (etwa 19½ bis 22½ inches) vom Griffende entfernt ist,
   d) ein Trägheitsmoment um eine Achse am Griffende, die sich senkrecht zum Griff erstreckt, von etwa 333975 bis etwa 356850 gcm^2 (etwa 1825 bis etwa 1950 $ozin^2$), und
   e) eine Schwingungsfrequenz im ersten Modus des Frei-Frei-Zwangs von mindestens 140 Hz.

10. Squashschläger nach Anspruch 9, bei dem die Schlagfrequenz des Schlägers mindestens etwa 150 Hz beträgt.

11. Squashschläger nach Anspruch 9, bei dem der Schlagmittelpunkt, gemessen vom Griffende aus, etwa 51 bis 57 cm (etwa 20 bis 22½ inches) vom Griffende (28) entfernt ist.

Revendications

1. Une raquette de squash (20), comprenant un cadre (21) avec une partie de tête (22) conçue pour supporter une surface de frappe, une partie de poignée (25) conçue pour être tenue par un joueur, une partie de manche (24) reliée à la partie de poignée et une partie de col (26) reliant la partie de poignée et la partie de tête, le perfectionnement étant caractérisé en ce que la raquette présente :
   a) un poids compris dans la plage allant d'environ 150 à environ 175 g, et
   b) un centre de gravité situé plus près de l'extrémité de tête (29) de la raquette que de l'extrémité de poignée (28) de la raquette.

2. La raquette de squash de la revendication 1, dans laquelle la longueur du cadre (21) est d'environ 68,5 cm (27 pouces) et le centre de gravité de la raquette se trouve à environ 38 à environ 42 cm (environ 15 environ 16,5 pouces) de l'extrémité de poignée (28) de la raquette.

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3. La raquette de squash de la revendication 1, dans laquelle la fréquence de vibration de la raquette dans le premier mode de contrainte libre-libre est d'au moins environ 140 Hz.

4. La raquette de squash de la revendication 1, dans laquelle la fréquence de vibration de la raquette dans le premier mode de contrainte libre-libre est d'au moins environ 150 Hz.

5. La raquette de squash de la revendication 1, dans laquelle le moment d'inertie de la raquette autour d'un axe (G-G) situé à l'extrémité de poignée et s'étendant perpendiculairement à la poignée est d'environ 333 975 g.cm^2 à environ 356 850 g.cm^2 (environ 1825 à environ 1950 onces × pouce carré).

6. La raquette de squash de la revendication 1, dans laquelle le centre de percussion mesuré à partir de l'extrémité de poignée (28) est situé à environ 49,5 à 57 cm (19½ à 22½ pouces) de l'extrémité de poignée.

7. La raquette de squash de la revendication 1, dans laquelle le centre de percussion, mesuré depuis l'extrémité de poignée, se trouve à environ 51 à 57 cm (20 à 22½ pouces) de l'extrémité de poignée.

8. La raquette de squash de la revendication 1, dans laquelle la raquette est formée de fibres de graphite et de résine et la partie de poignée (25) ne comporte pas de lest additionnel.

9. Une raquette de squash (20), comprenant un cadre (21) avec une partie de tête (22) conçue pour supporter une surface de frappe, une partie de poignée (25) conçue pour être tenue par un joueur, une partie de manche (24) reliée à la partie de poignée et une partie de col (26) reliant la partie de poignée et la partie de tête, la longueur du cadre (21) étant d'environ 68,5 cm (27 pouces), le perfectionnement étant caractérisé en ce que la raquette présente :

a) un poids compris dans la plage allant d'environ 150 à environ 175 g,

b) un centre de gravité situé à environ 38 à environ 42 cm (environ 15 environ 16,5 pouces) de l'extrémité de poignée (28) de la raquette,

c) un centre de percussion mesuré à partir de l'extrémité de poignée (28) situé à environ 49,5 à 57 cm (19½ à 22½ pouces) de l'extrémité de poignée,

d) un moment d'inertie autour d'un axe situé à l'extrémité de poignée et s'étendant perpendiculairement à la poignée d'environ 333 975 à environ 356 850 g.cm^2 (environ 1825 à environ 1950 onces × pouce carré).

e) une fréquence de vibration dans le premier mode de contrainte libre-libre est d'au moins environ 140 Hz.

10. La raquette de squash de la revendication 9, dans laquelle la fréquence de vibration de la raquette est d'au moins environ 150 Hz.

11. La raquette de squash de la revendication 9, dans laquelle le centre de percussion, mesuré depuis l'extrémité de poignée, se trouve à environ 51 à 57 cm (20 à 22½ pouces) de l'extrémité de poignée (28).