

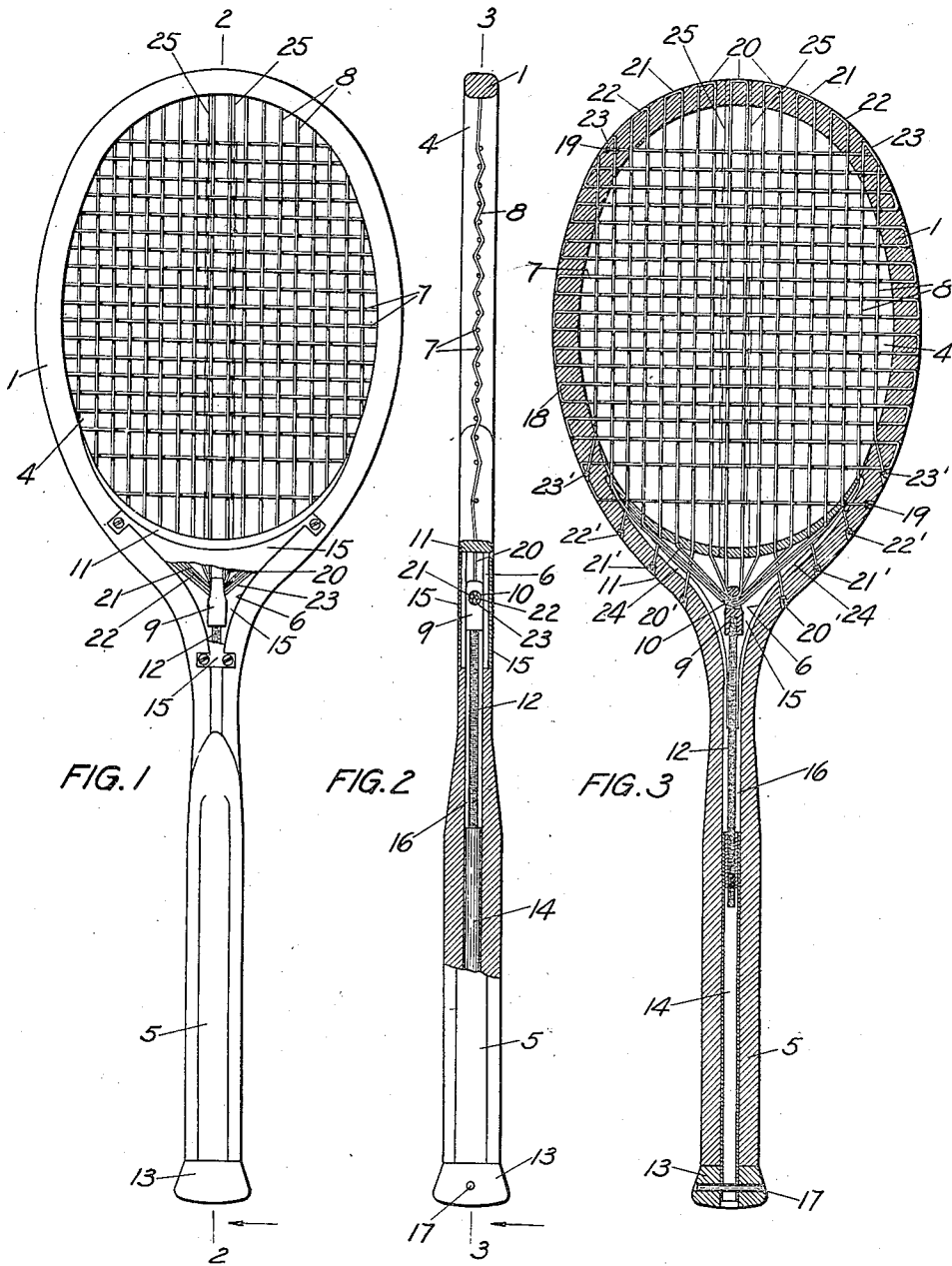
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E. J. CRAVEN

TENNIS RACKET

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INVENTOR.

Edward J. Craven,  
BY  
Frank A. Cutler,  
ATTORNEY.

ATTORNEY.

## UNITED STATES PATENT OFFICE.

EDWARD J. CRAVEN, OF SPRINGFIELD, MASSACHUSETTS.

## TENNIS RACKET.

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My invention relates to improvements in rackets, such as those used in playing tennis, and consists essentially of a frame and handle of approved shape, size and construction, a net comprising longitudinal and transverse reaches of strings of peculiar arrangement, a tightener for the strings that makes up the longitudinal reaches of said net, said tightener being provided with a screw-threaded member, and a cap for the outer end of said handle, said cap being provided with a screw-threaded member to engage said first-named screw-threaded member, together with such other parts and members as may be necessary or desirable in order to render the racket complete and serviceable in every respect, all as hereinafter set forth.

The primary object of my invention is to provide means, in a racket, for tightening and loosening the strings thereof, whereby breaking said strings can be avoided, and they can have imparted thereto as will just the right amount of tension, more or less as required, which means is comparatively simple, both in construction and operation, yet strong and durable, not liable to get out of order, convenient, and withal highly efficient and entirely practical.

The strings of rackets of ordinary construction are very liable to break, or to twist or distort the frame of the racket, on the one hand, and to become loose, on the other hand, when subjected to weather changes, with the result that much expense and time are involved in replacing broken strings, or the frame is permanently impaired, or the efficiency of the racket is reduced to a point where said racket is almost or quite useless, any and all of which troubles are avoided in or by my construction.

Another object is to afford means for applying or imparting directly to the longitudinal-reach strings, and indirectly to the transverse-reach string or strings, the even and uniform pull so necessary if the racket is to function to the best advantage and give the most pleasing and satisfactory results.

A further object is to produce a racket having means for tightening and loosening the strings without thereby interfering with the proper balance of the racket, as would be the case if the additional parts and members greatly increased the weight of the

racket, or were so placed as to throw it out of balance.

Other objects and advantages will appear in the course of the following description.

I attain the objects and secure the advantages of my invention by the means illustrated in the accompanying drawings, in which—

Figure 1 is a side elevation of a racket which embodies a practical form of my invention, a portion of one of the throat plates being broken out; Fig. 2, a longitudinal section through said racket, taken on lines 2—2 in Fig. 1, and, Fig. 3, a longitudinal section through the racket, taken on lines 3—3 in Fig. 2.

Similar reference characters designate similar parts throughout the several views.

The racket comprises a resilient frame 1 having a net space 4 therein, a handle 5, there being an opening or throat 6 formed at or adjacent to the junction between said frame and said handle, a net comprising transverse reaches 7 and longitudinal reaches 8, a tightener 9 in said throat, said tightener having an eye 10 therein adjacent to the end thereof that is next to a bridge-piece 11 which assists in forming the throat and is between the same and said space, said second-named strings all passing through said eye, an externally screw-threaded stem or spindle 12 to the inner terminal of which said tightener is securely attached, a cap 13 at the outer end of said handle, and a hollow, internally screw-threaded spindle 14 securely attached at the outer terminal to said cap, and adapted to receive and engage the screw-threaded portion of said first-named spindle. The throat 6 opens through opposite sides of the frame 1, and cover plates 15—15 are provided to close these open sides of said throat.

There is a central bore through or passage in the handle 5, as represented at 16, to receive the spindles 12 and 14, said passage opening at one end into the throat 6 and at the other end through the outer end of said handle. The hollow spindle 14 may be secured to the cap 13 by means of a transverse pin 17. The spindle 14 has a fairly tight fit in the passage 16, and the abutting faces of the handle 5 and the cap 13 are flat and of some area, whereby in addition to the engagement between the screw-

threaded parts of said spindle and the spindle 12, provision is made for sufficient frictional resistance to hold said cap and its spindle against rotation, without the application of some little force to said cap. It is by the rotation of the cap 13 that the strings of the net are tightened and loosened.

When the cap 13 is rotated in one direction, the spindle 14 is carried with it and actuates the spindle 12 with the tightener 9 outwardly, through the medium of the screw-threaded connection between said spindles, and, when said cap is rotated in the opposite direction, it carries with it the attached spindle and thereby causes the other spindle with said tightener to be actuated inwardly.

The transverse reaches 7 are parts of a single (preferably) string 18, of gut or other suitable material, passed back and forth through transverse openings in the sides of the frame 1, the ends of said string being knotted, as represented at 19—19, to secure them to said frame. The knots 19 are at the outer ends of two of the transverse passages in the sides of the frame through which the outermost reaches 7 pass. Obviously, if the frame 1 be expanded laterally the string 18 is tightened, and the reaches 7 rendered taut.

The longitudinal reaches 8 are parts of four (more or less) strings 20, 21, 22, and 23, also of gut or other suitable material, interlaced with the string 18, and passed through and connected with the frame 1 and the tightener 9 in the manner described hereinafter. Passages parallel with the longitudinal center of the frame 1 are provided in the upper part of said frame for the strings 20, 21, 22, and 23, and passages that may be slightly divergent on opposite sides of said center are provided in the lower part of said frame for said strings, and it is in these lower passages that the terminals of the strings are received and knotted to secure them in place. Passages are also provided in the bridge-piece 11 for the aforesaid strings, each of which passages is in line with one of the passages in the upper part of the frame 1. The inner ends of the passages in the lower part of the frame 1 for the outermost reaches 8 of the string 23 are also in line with the outermost passages in the upper part of said frame for said string.

The peripheral portion of the frame may have grooves therein, between the passages therethrough for the strings, to receive therein the parts of said strings that are woven in and out of said frame, and the outer edges of said passages, wherever necessary, are enlarged to accommodate the knots 19 and other knots yet to be specified.

The reaches 7 are approximately parallel with each other and at right angles to the reaches 8, and the latter are parallel with each other and with the longitudinal center of the frame 1.

The string 20 makes up the six inner reaches 8, and the ends of said string are knotted at 20'—20' to secure them to the frame 1. The string 21 makes up the four reaches 8 outside of the inner group just mentioned, two on each side of said group, and the ends of said string are knotted at 21'—21' to secure them to the frame. The string 22 makes up the next four outer reaches 8, two on a side, and the ends of said string are knotted at 22'—22' to secure them to the frame. The string 23 makes up the two outermost reaches 8 on each side of the racket, and has the ends knotted at 23'—23' to secure them in place in the frame.

The string 20, starting at the knots 20', passes through the lower part of the frame 1, on opposite sides of the longitudinal center thereof, into and through the throat 6, through the bridge-piece 11 into and through the space 4, and through the upper part of said frame; then inwardly on top of and through said frame again, through said space and said bridge-piece into said throat once more, and convergently to and through the eye 10 in the tightener 9; and lastly, from opposite ends of said tightener, through said throat, bridge-piece, space, and top of the frame, when the string again extends outside of the frame, between the outer ends of the two innermost vertical passages therein. A central group of six reaches 8 is thus produced, the string 20 being looped three times through the top of the frame, in the center and at two off-center points, and looped four times through the tightener 9. A pull exerted on the looped portions of the string 20 in the eye 10, draws said string, which is secured to the frame 1 by the knots 20', tight throughout its entire length, and tends to compress said frame longitudinally and expand the same transversely. This is possible because the string can run freely through the eye 10 and the passages in the frame and bridge-piece therefor. The same applies generally to the other strings.

The two innermost reaches 8 pass on through the eye 10, wherein the string 20 crosses to produce the next two reaches 8. Outside of these four reaches are two others formed by the string 20.

The string 21, starting at the knots 21' passes through the lower part of the frame 1, on opposite sides of the longitudinal center thereof, into and through the throat 6, through the bridge-piece 11 into and through the space 4, and through the upper part of said frame; then upwardly and inwardly on top of and through said frame again, through said space and said bridge-piece, into said throat once more, and convergently into and through the eye 10 in the tightener 9. Thus two reaches 8 are formed each side of the aforesaid central group.

The string 22, starting at the knots 22',

passes through the lower part of the frame 1, on opposite sides of the longitudinal center thereof, into and through the throat 6, through the bridge-piece 11 into and through the space 4, and through the upper part of said frame; then upwardly and inwardly on top of and through said frame again, through said space and said bridge-piece into said throat once more, and convergently to and through the tightener eye 10. Two reaches 8 are thus formed on each side of those formed by the strings 20 and 21.

The string 23, starting at the knots 23' passes through the lower part of the frame 1, on opposite sides of the longitudinal center thereof, into and through the throat 6, through the bridge-piece 11 into and through the space 4, and through the upper part of said frame; then upwardly and inwardly on the outside of and through said frame again, through said space and said bridge-piece into said throat once more, and convergently into and through the tightener eye 10. The two outermost reaches 8 and two reaches 8 inside of the former are thus formed.

A pull exerted by the tightener 9 on the loop of any of the strings 21, 22, or 23, tightens said string throughout its entire length, and tends to compress the frame 1 in the direction of its length, thereby producing an action or result generally similar to that or those produced when the tightener is moved to exert a pull on the loops of the string 20 which pass through said tightener.

The lengths of the strings which make up the reaches 8 should, of course, be so proportioned as to impart substantially the same amount of tension to one string as is imparted to the other, when the strings are subjected to the drawing action of the tightener 9.

The outer portions of the string 23 pass through the frame 1 without passing through the bridge-piece 11, but the inner portions of said string pass through the outermost openings in said bridge-piece.

It is now seen that all of the strings 20, 21, 22, and 23, are looped through the eye 10 in the tightener 9, with an equal number of reaches 8 on opposite sides of the longitudinal center of the frame 1, and that these looped portions are in the throat 6. Other portions of these strings are looped through the upper part of the frame 1. It follows, therefore, that movement of the tightener 9 in the direction to draw on the portions of the strings that pass through the eye 10 put said strings under a tension which is equally distributed and uniform throughout their entire lengths.

When the strings 20, 21, 22, and 23 are tightened, the frame 1, being of more or less yielding or resilient material, is shortened longitudinally and expanded laterally, and this lateral expansion of said frame exerts

a pull on the string 18 and tightens the same uniformly throughout its entire length, the amount of tension being substantially the same as that of said first-named strings.

The tightening of the strings is effected by turning the cap 13 to the right and thus drawing the tightener 9 outwardly. The strings are loosened, to take the tension off of them and off of the frame 1, by rotating the cap 13 in the opposite direction.

The sides of the throat 6 may be grooved, as represented at 24—24', to afford ample space for the oblique portions of the strings 22 and 23 which are in said throat, and to prevent the tightener from cutting or injuring any of the strings, in the event said tightener be drawn outwardly far enough otherwise to catch them between the upper part of the tightener and the inner end of the passage 16.

When this racket is to be laid away, the strings are loosened to a sufficient length to prevent them from breaking in the event they are acted on by weather conditions that would tend to break them. Then, when about to use this racket, the strings are tightened to whatever extent may be deemed necessary, and during the use of the racket the tension of the strings is changed if and as occasion requires. Thus it is possible to maintain the net in the best possible condition for batting purposes.

Inasmuch as the strings 20, 21, 22, and 23, during the tightening operation, have a tendency to draw the reaches 7 out of straight-line courses, small, longitudinal, tie cords 25—25' are interwoven with said reaches and attached at opposite ends to the top of the frame 1 and the bridge-piece 11, said cords being on opposite sides of the two innermost reaches 8. These tie cords thus connect the intermediate portions of the reaches 8, and prevent them from following any of the strings 20, 21, 22, and 23 when acted on by the tightener 9 during the tightening operation. Usually two cords 25 are sufficient, although more might be employed.

Since the tightening elements are located in the throat and handle of the racket, the proper balance of the racket is maintained. Furthermore, these tightening elements are so light in weight as not materially to increase the weight of the racket.

The cover plates 15 may be removable in order to afford ready access to the interior of the throat 6.

The strings which pass through the eye 10 prevent the tightener 9 and the spindle 12 from rotating, when the spindle 14 is rotated to tighten or loosen said strings.

In order to keep down the weight, the tightener 9 may be made of aluminum, and screwed or otherwise attached to the spindle 12, which latter is usually made of steel.

As hereinbefore intimated, more or less

change in the shape, size, construction, and arrangement of some or all of the parts of this racket may be made without departing from the spirit of my invention or exceeding the scope of what is claimed.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The combination, in a racket, with a frame and a handle, and a string having its ends fastened to said frame, and forming transverse reaches in the space in said frame, of a plurality of strings interwoven with said reaches and forming longitudinal reaches all approximately at right-angles to said first-named reaches, a tightener having an eye therein, said last-named strings being looped through said frame and through said eye, and having their ends fastened to said frame, and all of said strings being individual relatively, and actuating means for said tightener.

2. The combination, in a racket, with a frame having a handle, and a string forming transverse reaches in the space in said frame, of a plurality of strings interwoven with said reaches and forming longitudinal reaches, a tightener having an eye therein, said last-named strings being looped through said frame and through said eye, and having their ends fastened to said frame, a cap for the outer end of said handle, and screw-threaded engaging spindles rigidly connected respectively with said tightener and said cap.

3. The combination, in a racket, with a frame and a handle, said frame having a throat therein and being provided with a bridge-piece, means covering the open sides of said throat and adapted to afford access to the interior of the throat, and a string having its ends attached to said frame, and forming reaches in the space in said frame, of a perforated tightener in said throat, a plurality of longitudinal-reach-forming strings having their ends attached to said frame, and being looped through said frame, and through the perforation in said tightener after passing through said bridge-piece and being interwoven with said transverse reaches, and actuating means for said tightener.

4. The combination, in a racket, with a frame and a handle, said frame having a throat therein and being provided with a bridge-piece, and a string forming transverse reaches in the space in said frame, of a perforated tightener in said throat, a plurality of longitudinal-reach-forming strings having their ends attached to said frame, and being looped through said frame, and through the perforation in said tightener after passing through said bridge-piece, and interwoven with said transverse reaches, a cap for the outer end of said handle, and screw-threaded engaging spindles rigidly

connected respectively with said tightener and said cap.

5. In a racket, a frame and a handle, a perforated tightener, a string having its ends fastened to said frame, and being looped three times through the frame and twice through the perforation in said tightener, and means to move said tightener endwise.

6. In a racket, a frame provided with a bridge-piece, a handle, a perforated tightener, a string having its ends attached to the bottom part of said frame, and being looped three times through the upper part of said frame, passed through said bridge-piece, and looped twice through the perforation in said tightener, and means to move said tightener lengthwise.

7. In a racket, a frame and a handle, a perforated tightener, a string having its ends attached to said frame and being looped three times through said frame and twice through the perforation in said tightener, whereby an intermediate group of six longitudinal reaches is formed in the space in said frame, and additional strings each having its ends attached to said frame and being looped twice through said frame and once through said perforation, whereby two longitudinal reaches are formed by each string in said space on each side of said group, and means to move said tightener lengthwise.

8. The combination, in a racket, with a frame and a handle, a throat being formed in said frame, a bridge-piece separating said throat from the large space within said frame, and a string having its ends attached to said frame and being looped through the same to form transverse reaches in said space, of a perforated tightener in said throat, a string having its ends attached to said frame and being looped three times through the frame, and after passing through said bridge-piece being looped twice through the perforation in said tightener, whereby an intermediate group of six longitudinal reaches is formed, additional strings each having its ends attached to said frame and being looped twice through said frame, and once through said perforation after passing through said bridge-piece, whereby two longitudinal reaches are formed by each of said last-named strings on each side of said group, the longitudinal reaches being interwoven with the transverse reaches, and means to actuate said tightener longitudinally.

9. The combination, in a racket, with a frame and a handle, a throat being formed in said frame, a bridge-piece separating said throat from the large space within said frame, and a string having its ends attached to said frame and being looped through the

same to form transverse reaches in said space, of a perforated tightener in said throat, a string having its ends attached to said frame and being looped three times  
5 through the frame, and twice through the perforation in said tightener after passing through said bridge-piece, whereby an intermediate group of six longitudinal reaches is formed, additional strings each having its  
10 ends attached to said frame and being looped twice through said frame, and once through said perforation after passing through said bridge-piece, whereby two longitudinal reaches are formed by each of said last-  
15 named strings on each side of said group, the longitudinal reaches being interwoven with the transverse reaches, a cap for said handle, and screw-threaded engaging spin-

dles rigidly attached respectively to said tightener and said cap.

20 10. The combination, in a racket, with a frame provided with a bridge-piece and a handle, a string forming transverse reaches in the space in said frame, and a tie cord interlaced with said reaches intermediate  
25 of their ends, and having its ends attached respectively to the upper part of said frame and to said bridge-piece, of a perforated tightener, a plurality of longitudinal-reach-forming strings having their ends attached  
30 to said frame, and being looped through said frame and the perforation in said tightener, and interwoven with said transverse reaches and actuating means for said tightener.

EDWARD J. CRAVEN.