April 23, 1963 J. R. LACOSTE 3,086,777

RACKET FOR LAWN-TENNIS AND SIMILAR GAMES

Filed March 20, 1961 3 Sheets-Sheet 1

Fig. 1

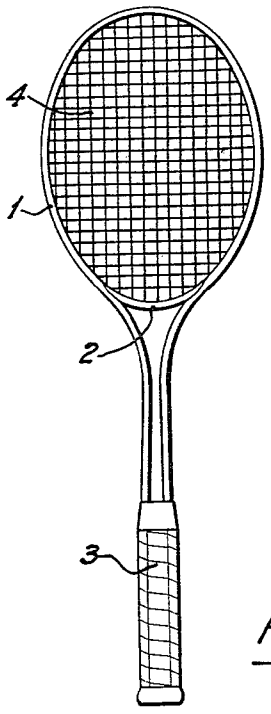



Fig. 4

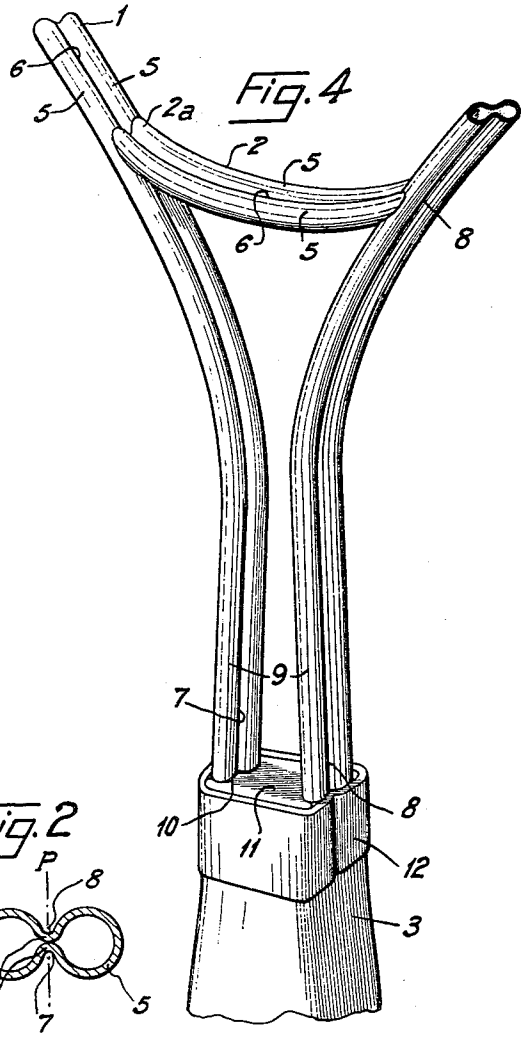
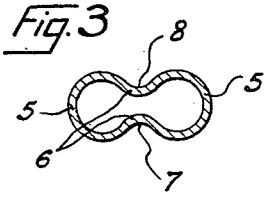



Fig. 2




Fig. 3




INVENTOR
Jean R. Lacoste

Watson, Cole, Grindle & Watson
ATTORNEYS

April 23, 1963 J. R. LACOSTE 3,086,777

RACKET FOR LAWN-TENNIS AND SIMILAR GAMES

Filed March 20, 1961 3 Sheets-Sheet 2

Fig. 5

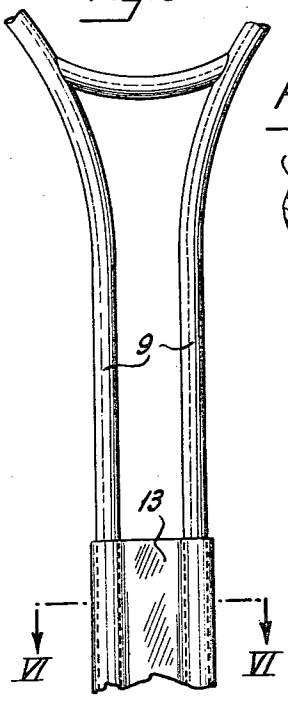



Fig. 7

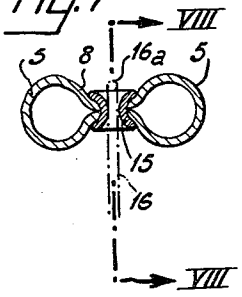



Fig. 8

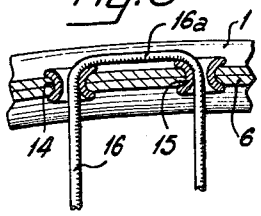



Fig. 9

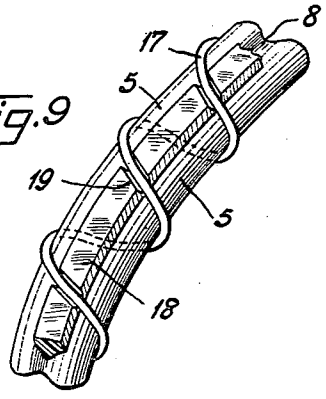



Fig. 6

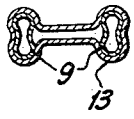
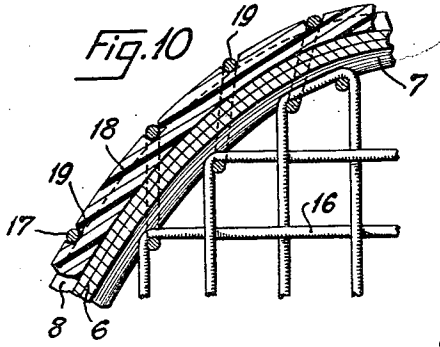



Fig. 10




INVENTOR

Jean R. Lacoste

Watson, Cole, Grindle & Watson

ATTORNEYS

April 23, 1963 J. R. LACOSTE 3,086,777

RACKET FOR LAWN-TENNIS AND SIMILAR GAMES

Filed March 20, 1961 3 Sheets-Sheet 3

Fig. 11

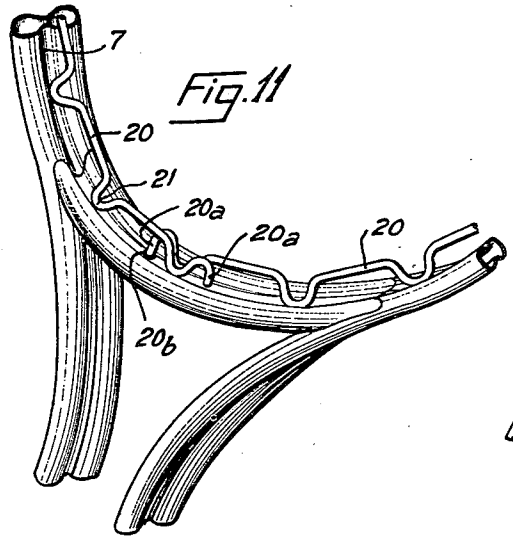



Fig. 12

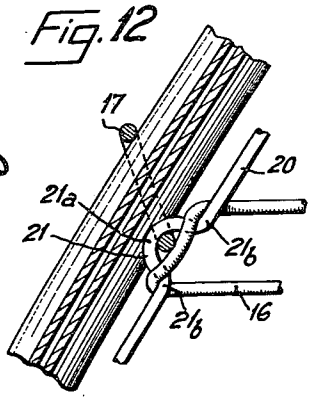



Fig. 13

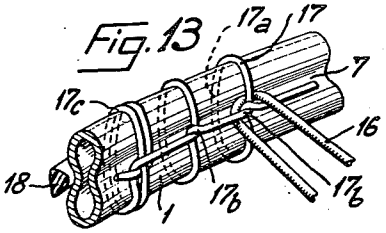



Fig. 14

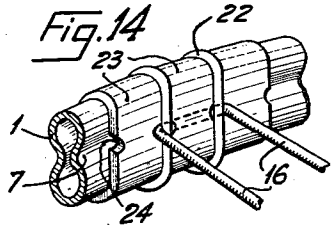



Fig. 15

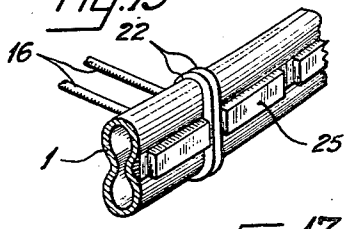



Fig. 16

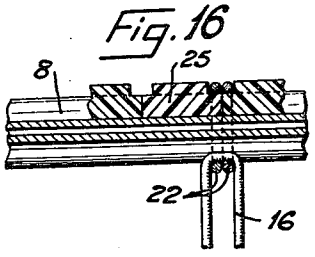
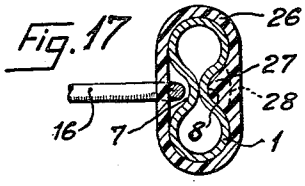



Fig. 17




INVENTOR
Jean R. Lacoste

Walton, Cole, Klindle & Watson
ATTORNEYS

United States Patent Office 3,086,777 Patented Apr. 23, 1963



3,086,777

# RACKET FOR LAWN-TENNIS AND SIMILAR GAMES

Jean René Lacoste, 1 Ave. du Marechal Maunoury, Paris, France

Filed Mar. 20, 1961, Ser. No. 96,950
Claims priority, application France Mar. 30, 1960
8 Claims. (Cl. 273—73)

In the construction of rackets for lawn-tennis and similar games, it has previously been suggested to construct the racket frames from metal channel elements or metal tubing of round or oval cross section in place of the conventional wooden frames. However, known rackets of this kind have not been successful.

A satisfactory tennis racket should be lightweight and well balanced. Its frame, while being as far as possible stream-lined in contour parallel to the direction of racket movement when striking a ball, should at the same time possess high resistance to twisting and warping stresses as may arise when a ball strikes the racket off center. Further, it is necessary that the strings be attached to the frame through simple and effective means, preferably with a conventional stringing machine; nor should the strings engage any sharp angles on the frame surface or be subjected to sharp bends since their service life would otherwise be reduced. Moreover the racket should not vibrate or be noisy in use.

It is an object of this invention to provide a racket which will fulfill the above requirements to a high degree.

According to this invention, the racket frame is constructed from a sectional metal element which comprises two spaced beads interconnected by a web of smaller transverse dimension so as to define a pair of longitudinal grooves between the beads along the opposite sides of the element.

Preferably the metallic frame element is tubular; and one convenient method of producing such a tubular frame element is to deform a tube of circular or oval cross section by exerting pressure along two diametrically opposite generatrices thereof; such deforming pressure may be applied far enough to cause the opposite wall surfaces of the tube to engage each other, or alternatively a predetermined spacing may be allowed to remain between said opposite wall surfaces.

In making a racket frame from such a sectional metal element, the element is bent in such a place that the aforementioned beads project from opposite sides of the general plane of the frame.

A racket frame thus constructed combines light weight and strength. Its rigidity in the striking direction is very high even when provided with a low thickness dimension in said direction, so that the drag characteristic of the racket is low.

Such a racket frame can be assembled with a handle made of metal, wood or other material, and such assembly can readily be effected in such a way as to impart excellent resistance against torsional deformations to the racket as a whole.

The stringing of such a racket can be carried out in various ways. Thus the conventional method of threading the strings through spaced holes formed in the frame member may be used, such holes in this case being formed through the web portion of the frame member. Alternatively auxiliary means of attachment may be used for connecting the strings with the frame and in this respect the provision of the outer and inner longitudinal grooves in the frame considerably facilitates the positioning of strings and exerts both a guiding and a protecting function therefor.

The ensuing disclosure made with reference to the



accompanying drawings, given by way of example but not of limitation, will provide a clear understanding of the manner in which the invention may be embodied in practice.

FIG. 1 is a simplified view of an improved tennis racket in front elevation;

FIGS. 2 and 3 show two alternative forms for the sectional contour of the improved racket frame member;

FIG. 4 is a partial perspective view, on an enlarged scale, illustrating the core of the racket and showing one example of the means for connecting the frame with the handle;

FIG. 5 is a partial front view illustrating a modified form of handle assembly;

FIG. 6 is a section on line VI—VI of FIG. 5;

FIG. 7 shows in cross section a perforated racket frame member provided with eyelets for string attachment;

FIG. 8 is a section on line VIII—VIII of FIG. 7;

FIG. 9 is a fragmentary perspective view of a portion of the frame provided with a stringing jig or template for defining the pitch of a helix or coil used in the stringing process;

FIG. 10 is a sectional view on a plane parallel to the plane of projection of FIG. 9 showing the manner in which the strings are engaged around the coil;

FIG. 11 illustrates a serrated wire annulus positioned within the frame for string attachment;

FIG. 12 is a partial longitudinal section showing means for retaining the annulus with the strings attached thereto within the frame;

FIG. 13 is a perspective view illustrating some modified methods of winding the string attaching wire; and

FIGS. 14 to 17 illustrate various ways of mounting the strings on rings threaded around the frame member.

Shown in FIG. 1 is a tennis racket wherein the frame is constructed from a sectional member **1** of special configuration to be described, bent to the requisite shape of a loop, and further provided in this example with an arcuate bracing segment **2** for completing the oval frame. The frame thus constructed is connected to a handle **3** and is provided with strings **4** stretched across it.

The sectional member from which the frame is formed includes two longitudinal beads **5** of preferably rounded form and interconnected by a web portion **6** of lesser thickness so as to define a pair of grooves **7** and **8** on either side of the member. Preferably the member is tubular. It can readily be formed to the desired cross sectional contour by using a tube of any suitable e.g. circular or oval cross section and deforming it by applying pressure along two opposed generatrices of it, e.g. by passing the tubular member through the nip between two rollers of corresponding contour, in one or more passes.

The width and depth dimensions of the grooves **7** and **8** may be varied according to requirements. When using a tubular member as indicated above, the sectional shaping operation may be so effected as to bring the opposite wall portions of the member into engagement in the web portion, as shown in FIG. 2; alternatively a space may be left between said wall portions as shown in FIG. 3.

In forming the frame, the contoured member is bent in such a plane that the beads **5** will be positioned, on opposite sides from the general mid-plane of the frame, the trace of which mid-plane on the plane of FIG. 2 is shown by the dotted line P.

The brace member **2** consists of a length of the same (or a similar) contoured member as that from which the main part of the frame is made. This brace is firmly secured to the main frame part preferably by welding or brazing. Its positioning and assembly are greatly simplified since, as shown in FIG. 4, with the ends **2***a* cut so as to conform with the shape of the contoured member **1**,

the respective bead portions in the main frame member and the brace will provide dual guiding means to permit highly accurate relative centering.

A racket frame constructed as thus described has excellent rigidity in the direction of movement when hitting a ball, while being contoured in said direction for minimum air resistance or drag, and at the same time showing satisfactory resiliency in the direction of the plane defined by the strings. These features are due to the fact that the cross sectional contour of the frame member according to the invention possesses a high moment of inertia referred to the trace of plan P while having a relatively small thickness dimension parallel to that plane.

Tests carried out with racket frames of this type made from hardened alloy steel provided with a hard chromium plating have yielded especially satisfactory results.

The frame may be connected with the handle in any of various ways. Excellent assemblies have been obtained by providing the racket frame with adjacent spaced extensions **9** of the contoured frame member **1** as shown e.g. in FIGS. 1, 4 and 5, and inserting the end portions of such extensions into slots **10** formed in a core member **11** made of wood or the like, then radially reinforcing the assembly by inserting it into an annular ferrule member **12**; the ring or ferrule member **12** may, if desired, form an integral part of a tubular handle **3** (FIG. 4). The recesses **10** and the appropriate faces of the ring member may be shaped to conform with the contour of the frame member including the grooves **7** and **8** thereof; however a very strong assembly is found to be obtained even when the recesses **10** and ring member **12** are so formed as to engage only the bead surfaces of the frame member.

In view of the highly rigid character of extensions **9**, it may in many cases be found sufficient merely to insert the core member **11** in between said extensions, and bond it thereto if desired. In this modified form the ferrule member **12** would be dispensed with; furthermore, the core **11** may then form an integral extension of the racket handle.

In another modification, shown in FIGS. 5 and 6, the extensions **9** may be inserted into the suitably shaped end portion **13** of a tubular racket handle **3**, and the assembly then being preferably welded or brazed.

Regardless of the particular form of frame-to-handle assembly used, an extremely strong connection therebetween is obtainable. The resulting racket assembly is found in particular to show remarkably high resistance against twisting stresses, an important feature for a tennis racket. Further, a good balancing of the racket assembly can be achieved, since the high rigidity and strength of the sectional element from which is formed the upper portion of the handle adjacent the frame, makes it possible so to construct the assembly that most of the weight of it is located at the frame and at the grip, a feature that is found to improve the effectiveness of the racket.

All the above favourable features are obtainable without any increase in weight. Moreover, this construction provides a convenient method of adjusting the weight of the racket by simply modifying the wall gauge thickness of the metal from which the sectional frame member is formed.

Various methods of stringing the racket are applicable in conjunction with the approved construction described above. Thus the strings may either be connected directly to the frame or through auxiliary attachment means, in various simple and effective ways.

According to FIGS. 7 and 8, the web portion **6** of the member **1** and spacer or brace member **2** are perforated at spaced locations and eyelets **15** having rounded edges are inserted through the perforations **14**. In this case both walls of the web portion **6** are preferably contiguous. The strings **16** are passed through the eyelets and it will readily be understood that with this arrangement the strings sustain no sharp bends; moreover the string portions **16***a* lying alongside the frame are positioned within the grooves **8** and are thus protected from damage e.g. when the outer periphery of the frame strikes or rubs against the surface of a tennis court. If desired, the eyelets may be dispensed with and the holes **14** formed with suitably rounded edges.

Embodiments using intermediate string attaching means will now be described. In FIGS. 9 and 10, the strings **16** are attached to the frame by way of a coil or helix **17** of piano wire or the like, wound about the frame member. This method of stringing the racket also derives considerable benefit from the puarticular type of frame member used according to the invention.

Firstly, the winding of the coil is facilitated in regard to the fact that the pitch of the coil should, as will be understood, be varied along the length of the frame member in order to achieve the requisite spacing between the strings in the different parts of the frame. This problem of correct pitch variation is solved according to the invention by using during the stringing process, a template **18** contoured so as to be insertable into the outer groove **8** of the frame member, the template being formed along its outer surface with spaced notches **19** adapted to receive the turns of the coil **17**. The template may remain in place in the finished racket or may be removed after the stringing operation.

In any case tests have shown that after the coil has been properly wound and tightened about the frame member, provided the coil is made from sufficiently stiff wire, the turns of the coil will not be liable to slip or turn. The coil can be stretched tight without impeding subsequent stringing operations since the inner groove **7** in the frame member provides the necessary clearance for threading the strings **16**. Moreover, the strings may be passed around two adjacent turns where required without any tendency to shifting the turns. Furthermore, provided the groove **7** has been suitably dimensioned, the strings will be retained laterally by the beads **5** thereby preventing any warping or shifting of the plane of the strings.

The same general advantages as above are present in cases where the strings are not directly attached to the coil. Thus in the embodiments shown in FIGS. 11 and 12, the strings are attached by way of an annulus **20** made of spring steel or the like, and formed with castellations or serrations **21** suitably spaced in regard to the prescribed spacing of the strings **16**.

In this case the coil **17** can be very conveniently wound about the frame member and the annulus **20**. For this purpose the annulus **20** is snapped into the inner groove **7** of the frame where it is retained by its inherent elasticity without there being any need to provide separate guiding or retaining means therefor. A template such as **18** (FIGS. 9 and 10) may or not be used in this instance as desired. Desirably the ends **20***a* of the annulus are bent outwards towards the frame member, one of the outbent ends being preferably inserted into a small anchoring recess **20***b* formed in the inner side of the frame member.

The coil is threaded through the notches **21***a* defined in the apices of the serrations. The strings **16** are passed across the bases **21***b* of the serrations and under the coil as shown in FIG. 12. In this case also the groove **7** provides the necessary clearance for the passing of the strings while the beads act to guide and retain the annulus thereby preventing the strings from shifting and vibrating in use. Such a string assembly is found to possess an especially desirable elasticity owing to the elasticity of the annulus **20**.

FIG. 13 illustrates some modified means of attaching the coil **17** to the frame member **1**. In this case the coil wire is so wound as to present crossed loops **17***a* to provide half-hitches as at **17***b*. The strings **16** are passed over the half-hitches and are thereby retained at the requisite spacings while preventing sharp bends in the string. The strings are retained in position by the

beads 5 of the frame. The spacing between the spans of string 16 may if desired be increased by providing the half-hitch with a round turn as shown at 17c. A template 18 is desirably provided in the outer groove 8 of the frame member.

In accordance with a further form shown in FIG. 14 spaced rings 22 may be provided around the frame member for attaching the strings to the frame. As shown in FIG. 14 the rings 22, e.g. metallic and of round cross section, are retained in the requisite spaced relation by means of tubular spacers 23 of appropriately selected lengths and formed with notches 24 to provide clearance for the strings 16. The strings are guided in the groove 7 which moreover enables the strings to be threaded through the rings without having to impart an intricate shape to the rings. Where desired the strings may be passed round one or more spaced rings.

In FIGS. 15 and 16 the tubular spacer 23 are omitted and castellated spacer strips 25 received in the outer groove 8 of the frame member are used instead.

According to FIG. 17 the ring 26 is formed with an inward projection or boss 27 in its side positioned outwardly of the racket which boss engages into the outer groove 8 of the frame member. The string 16 is retained in and guided by groove 7.

The rings 26 may be spaced by means of spacers in the form of spots 28 of solder or plastic resin (e.g. Araldite) deposited within the groove 8 between the bosses of the rings to maintain the prescribed spacings between them.

Various other modifications and alternative will occur to those familiar with the art within the scope of the present invention. In the claims the term tennis racket should be construed in a broad sense so as to include rackets for games other than lawn-tennis, e.g. squash and badminton.

What I claim is:

1. A tennis racket comprising a frame shaped from a frame member of uniform cross sectional contour including a pair of spaced bead portions projecting from opposite sides of the racket frame and an interconnecting web portion defining a pair of longitudinal grooves respectively extending along the inner and outer peripheries of the frame; spacer means located within the outer one of said grooves and providing gaps at predetermined spacings along the outer periphery of the frame; string attachment means providing a plurality of loops passing around said frame member and within said gaps; strings engaging said loops and strung across the frame, portions of said strings extending into the inner said groove and a handle connected to said frame.



2. A racket as claimed in claim 1, wherein said string attachment means comprise a wire coiled around said frame members and having turns engaging said gaps.

3. A racket as claimed in claim 1 wherein said string attachment means comprise a wire wound around said frame member into loops providing half-hitches and respectively engaging said gaps, said strings being passed over said half-hitches.

4. A racket as claimed in claim 1 wherein said spacer means comprise an arcuate template strip member having one edge inserted in said outer one of said grooves and provided in its outwardly directed surface with notches defining said gaps.

5. A racket as claimed in claim 1 wherein said string attachment means comprise rings surrounding the frame member and engaging said gaps.

6. A racket as claimed in claim 5 wherein said spacer means comprise spacer members positioned in said outer one of said grooves intermediate said rings and provided at their ends with notches wherein said rings engage.

7. A racket as claimed in claim 5 wherein said rings are provided with a projection engaging said outer one of said grooves.

8. A racket as claimed in claim 7 wherein said spacer means comprise spots deposited within said groove intermediate said projections of said rings.


**References Cited** in the file of this patent

UNITED STATES PATENTS

| | | |
|---|---|---|
| 1,452,803 | Harris | Apr. 24, 1923 |
| 1,502,845 | Blache | July 29, 1924 |
| 1,750,727 | Norton | Mar. 18, 1930 |
| 2,171,223 | Robinson | Aug. 29, 1939 |
| 2,456,023 | Rosenbalm | Dec. 14, 1948 |

FOREIGN PATENTS

| | | |
|---|---|---|
| 14,397 | Great Britain | 1909 |
| 855,902 | France | Feb. 26, 1940 |