

[54] **GAME RACKET**

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[52] U.S. Cl. **273/73 D**

[51] Int. Cl. **A63b 51/00**

[58] Field of Search **273/73 R, 73 C, 73 D,**
273/73 H

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Primary Examiner—Richard C. Pinkham

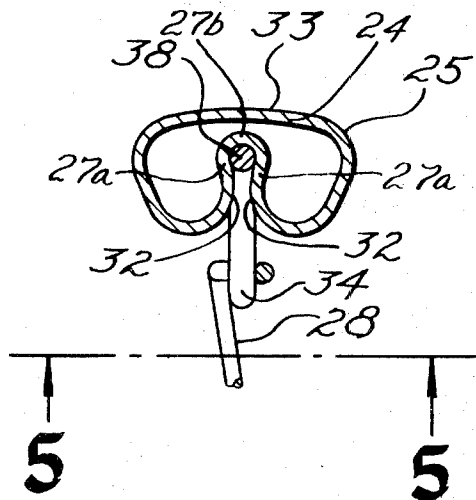
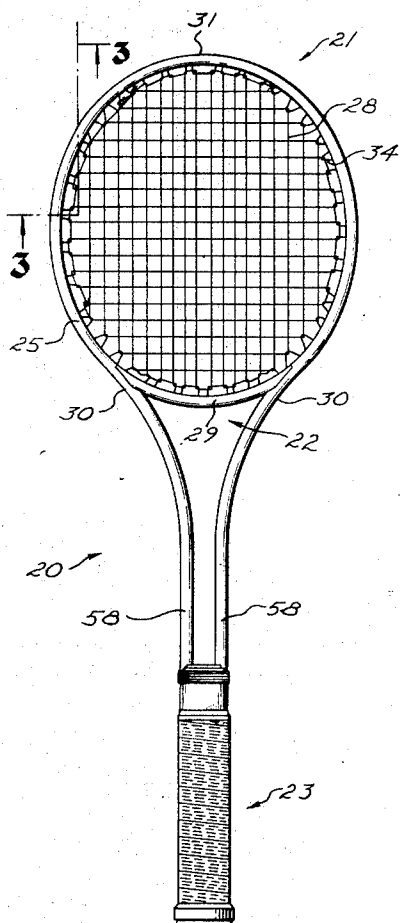
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[57] **ABSTRACT**

A tubular structure for a tennis or like game racket is formed from modified metal tubular members arranged in a spaced oval relationship forming a racket portion. The modified tubular members include an annular recess and gripping means for securing an annular formed ring or holding means to maintain the racket cross-strings permanently taut and in a spaced relationship.

13 Claims, 20 Drawing Figures



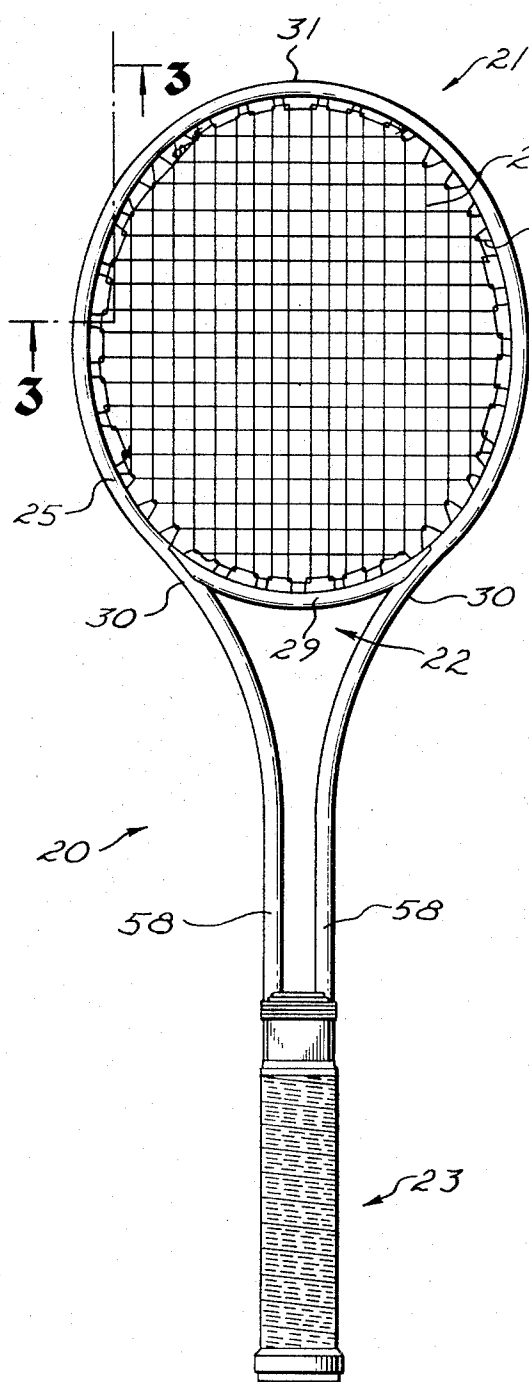


Fig. 1

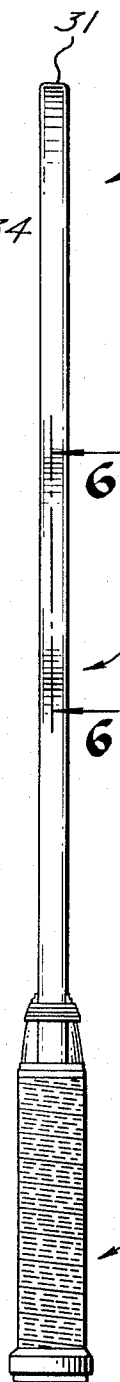


Fig. 2

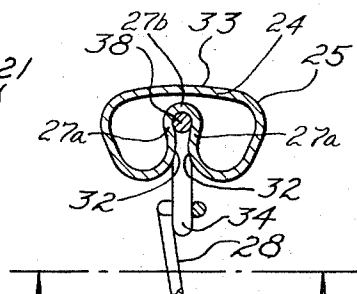


Fig. 3

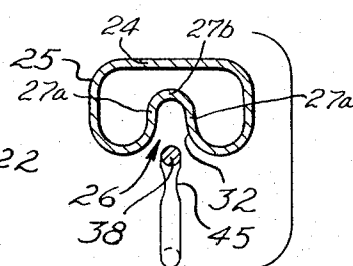


Fig. 4

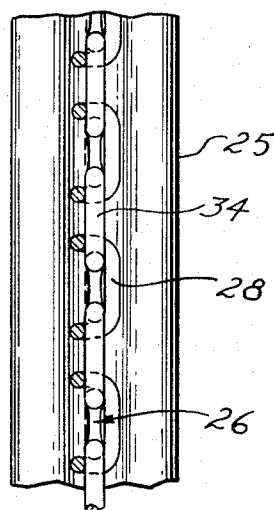


Fig. 5

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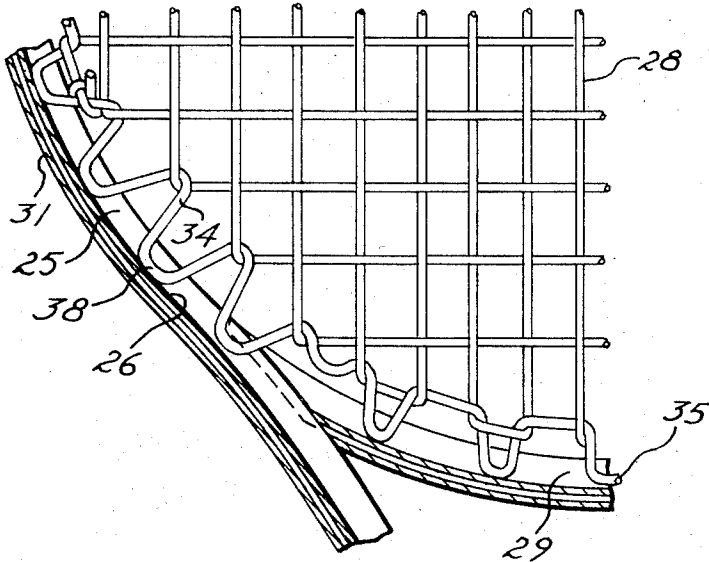


Fig. 6

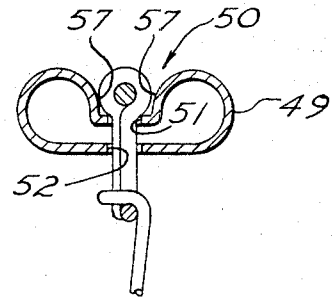


Fig. 9

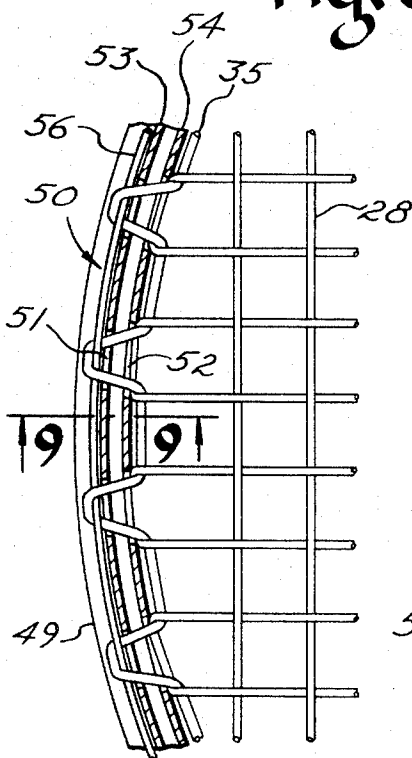


Fig. 7

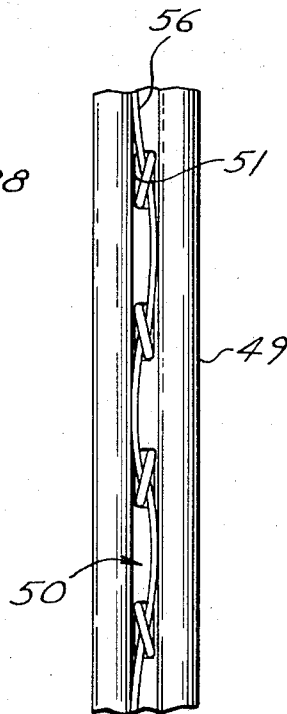


Fig. 8

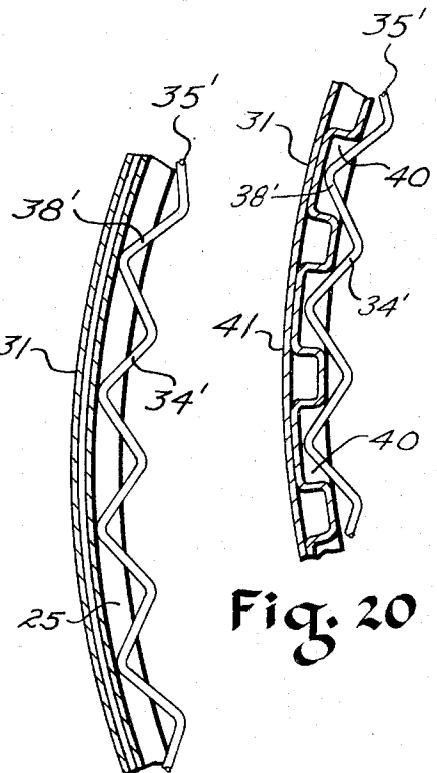


Fig. 10

Fig. 20

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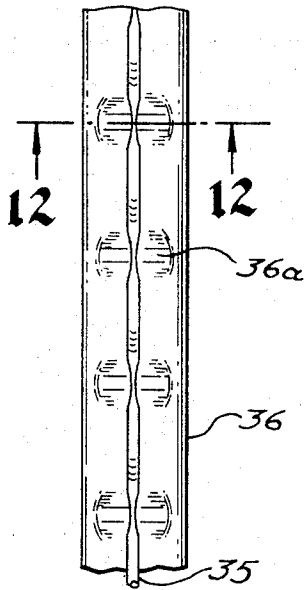


Fig. 11

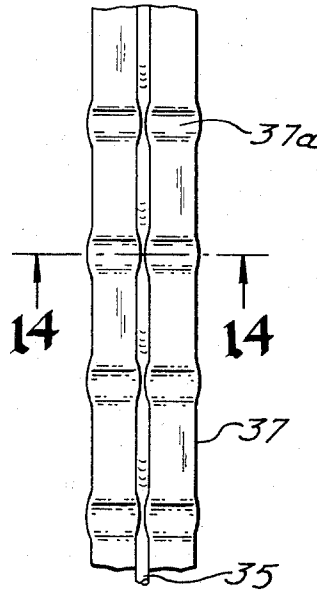


Fig. 13

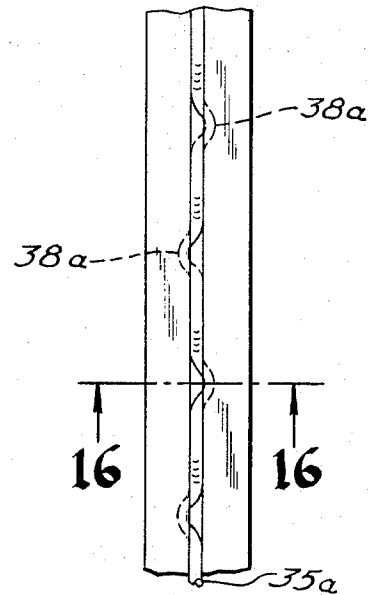


Fig. 15

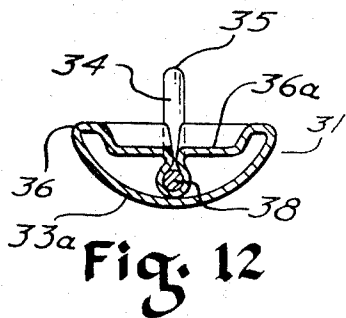


Fig. 12

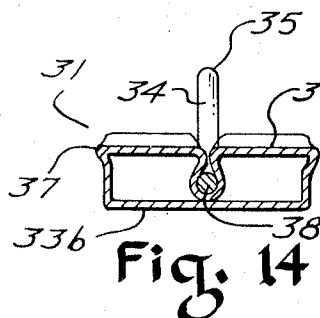


Fig. 14

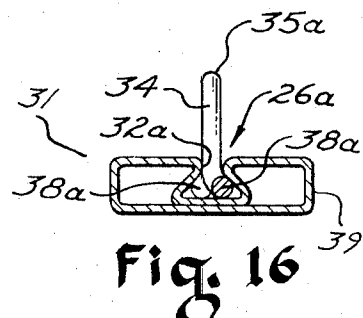


Fig. 16

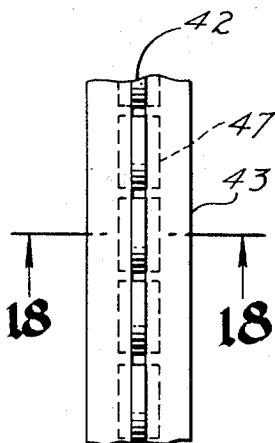


Fig. 17

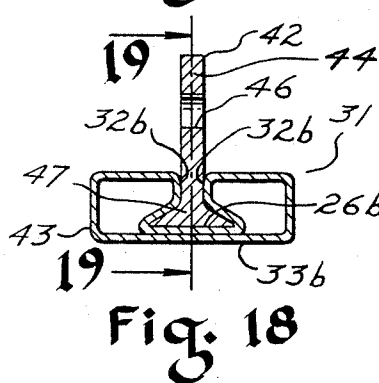


Fig. 18

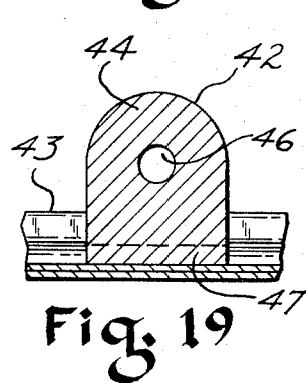


Fig. 19

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GAME RACKET

This invention relates to game rackets and particularly to a racket constructed of tubular material; for example, aluminum or steel tubing.

Metal tennis rackets and like game rackets constructed of tubular steel are well known. The tubular members are formed into an oval or loop having a combination of means for receiving and securing the cross-strings which, by necessity, are maintained taut and in a spaced relationship.

Various means suggested for securing the cross-strings to the oval or loop portion have achieved only limited success in providing durable and reliable game rackets. The loop portion of the racket tends to prematurely fail due to inferior means for securing the cross-strings to the tubular frame. For example, cross-strings are customarily interwoven on an annular ring secured to the tubular loop portion by still another winding wire sometimes referred to as a spiral wire or a coil wire. Due to ordinary wear and tear and constant flexing of the racket while in use, the coil or spiral holding wires loosen causing premature failure of the racket. These and other disadvantages are overcome by practicing this invention.

Briefly, this invention provides a tubular frame in combination with a holding means secured permanently therewith for securing and maintaining the cross-strings in a spaced relationship. The racket frames described and illustrated herein are preferably formed from metal tubing, but it will be readily appreciated that nonmetallic tubing may be substituted therefor. Coiling or spiral rings are no longer necessary and, accordingly, the major cause of weak cross-strings is thereby eliminated. The loop portion thus formed imparts rigidity to the game racket, evenly distributes impact stresses among the cross-strings, and further provides inherent resiliency between the cross-strings and the racket frame, all of which are important in providing excellent performance characteristics to a game racket. Manufacturing advantages are also realized wherein the racket construction is substantially simplified by forming a loop portion having string holding means rigidly secured to the tubular frame. Hence, the cross-strings are directly interwoven to the frame portion without the use of coiling or spiral wires.

The general object of this invention is to provide an improved game racket of tubular frame construction.

Another object of the invention is to provide improved holding means for securing the cross-strings to the oval portion of the racket frame.

Yet another object of the invention is to rigidly and firmly secure the string holding means to the oval portion of the racket frame while eliminating the need for coiling or spiral rings.

Still another object of the invention is to provide means for mounting the cross-strings to the oval portion of the racket frame whereby the strings will remain taut during extended use.

A still further object of the invention is to provide means for mounting the cross-strings to the oval portion which imparts rigidity to the frame, evenly distributes the impact among the cross-strings, and provides inherent resiliency between the cross-strings and the racket frame.

Other objects and advantages of the invention will be apparent from the following description of several em-

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bodiments thereof as disclosed in the accompanying drawings, in which said drawings:

FIG. 1 is a simplified front elevation view of a game racket;

FIG. 2 is a side elevation view of a game racket;

FIG. 3 is an enlarged section view taken along line 3—3 in FIG. 1;

FIG. 4 is a view of the enlarged exploded section of the racket shown in FIG. 3 prior to assembling;

FIG. 5 is a partial view of the game racket taken along line 5—5 in FIG. 3 and embodying annular holding means;

FIG. 6 is an enlarged section view as taken along line 6—6 in FIG. 2;

FIG. 7 is an enlarged section view of a game racket partially broken away showing a different embodied holding means for holding the cross-strings;

FIG. 8 is a partial side view showing the embodiment of FIG. 7 as viewed from the left;

FIG. 9 is a sectional view taken along line 9—9 in FIG. 7;

FIG. 10 is an enlarged sectional view similar to FIGS. 6 and 7 showing a slightly modified holding means;

FIG. 11 is a view similar to FIG. 5 showing a tubular frame crimped about the annular holding means of FIG. 10;

FIG. 12 is a sectional view taken along line 12—12 in FIG. 11;

FIG. 13 is similar to FIG. 11 showing another form of tubular frame crimped about the annular holding means of FIG. 10;

FIG. 14 is a sectional view taken along line 14—14 in FIG. 13;

FIG. 15 is similar to FIGS. 11 and 13 and shows still another form of tubular frame crimped about the annular holding means of FIG. 10;

FIG. 16 is a sectional view taken along line 16—16 in FIG. 15;

FIG. 17 is a view similar to FIGS. 11, 13 and 15 and shows still another embodiment of the invention;

FIG. 18 is a cross-sectional view taken along the line 18—18 of FIG. 17;

FIG. 19 is a sectional view taken along line 19—19 in FIG. 18; and

FIG. 20 is a sectional view similar to FIG. 10 of another form of tubular frame having spaced annular recesses.

Referring to the drawings in all of which like parts are designated by like reference numerals, a game racket 20 is shown having a loop portion 21 extending downwardly into a yoke portion 22 and further extending into a handle portion 23 (FIG. 1).

Referring to the loop portion 21, a tubular member 25, having a peripherally continuous wall 24 in transverse section and with said wall 24 having a wall thickness made up exclusively of said tubular member and having a formed recess 26, is fashioned into a loop wherein the opposed ends of the loop are spaced apart and extend into the yoke portion 22. A tubular web member or cross member 29 having the same cross-sectional shape as tubular member 25 is secured to opposed reaches 30 of the loop portion 21 in the yoke portion 22 thereby providing a continuous oval-shaped structure in said loop portion. Hence, a continuous oval-shaped tubular frame 31 is provided having a continuous recess or indentation 26 formed on the interior periphery thereof. The recess or indentation 26 re-

ceives and engages an annular holding means or annular ring 35, having inner holding bends 34 and outer locking bends 38, for securing and maintaining cross-strings 28 in a spaced relationship within the oval-shaped tubular frame 31. The tubular frame 31 further includes a pair of gripping shoulders 32, 32 formed adjacent to the recess or indentation 26 for permanently securing the annular ring or holding means 35 to said tubular frame by gripping the locking bends 38 (FIG. 3). The recess 26 comprises opposed sidewall portions 27a and an annular recess base surface 27b all of which are integral with the gripping shoulders 32. By the term "integral" or "integrally formed" is meant that all of the portions defining the recess and the gripping shoulder means are formed out of and are a part of the wall thickness of the peripherally continuous wall of the tubular member. The tubular frame 31 may be crimped whereby portions of the tube are pinched over the locking bends 38 as shown by indentations 36a and 37a in modified tubing 36 and 37 of FIGS. 11 and 13, respectively.

Alternative means formed in tubular frame 31 for engaging the holding means 35 are contemplated comprising a plurality of annularly spaced indentations 40 formed in a modified tubing 41 on the inner periphery of the frame (FIG. 20). The spaced indentations or recesses 40 engage a slightly modified annular holding ring or means 35' having V-shaped locking bends 38' and V-shaped holding bends 34'. The recesses 40 engage the locking bends 38' in the same manner as the recess 26, each recess 40 receiving one of said locking bends. Hence, spaced recesses 40 function in like manner to annular recess or indentation 26 providing means for engaging holding means 35'. Accordingly, spaced recesses 40 and annular recess 26 shall hereinafter be referred to as recess means.

The tubular frame 31 may have a cross-sectional form which varies widely, as indicated in the drawings. As shown at 33 in FIG. 3, the outside wall of the frame 31 may be rounded. Said outside wall may also be semi-circular as shown at 33a in FIG. 12, or flat as shown at 33b in FIGS. 14, 16, and 18. The formed recess means 26, 40 may likewise have a variety of geometric cross-sectional shapes such as circular as shown in FIGS. 3, 12, and 14, triangular as shown in FIGS. 16 and 18, or substantially rectangular as shown in FIG. 9. FIG. 10 illustrates the slightly modified holding means 35' in combination with tubing of the type shown at 25.

The tubular members 25 and 29 forming the tubular frame 31 are preferably fabricated from metal tubing. The recess means is formed into said tubular members by conventional forming methods such as progressive roller forming. The depth of the recess means is not critical and, accordingly, is ordinarily determined by the annular holding means 35 to be secured therein. Hence, the recess means may be spaced from the outside tubular wall (33, FIG. 3) or engage the outside tubular wall (33a, FIG. 12). The tubular metal is of such a gage thickness as to provide sufficient rigidity to the frame 31 to resist twisting stresses and torsional forces and yet maintain requisite resiliency. Although metallic tubular frames, such as tubular aluminum or steel frames, are presently preferred, certain reinforced plastic compositions, such as molded fiberglass or fiberglass reinforced extrusions, are contemplated within the scope of this invention.

The annular ring 35 preferably includes gripping indentations 45 in the locking bends 38 (FIG. 4) for engagement with the gripping shoulders 32, 32. The locking bends 38 are seated in the recess means and gripping shoulders 32, 32 project into said indentations to secure the annular ring 35 to the frame 31. Indents 45 may be used in the modified annular ring 35' as will be well understood. Spaced holding bends 34 are inwardly exposed thereby providing means for holding and maintaining the cross-strings 28 in a spaced relationship (FIG. 6). The formed annular ring 35, therefore, has a plurality of spaced holding bends 34 for holding the cross-strings and a plurality of spaced locking bends 38 formed in the annular length of the ring 35. Typical known annular rings are disclosed in Re 26,128 (U.S. Pat. No. 3,078,098) and U.S. Pat. No. 3,206,203, and ordinarily are formed from spring steel.

Referring now to FIG. 16, a modified annular ring 35a is secured to modified tubing 39 forming the oval frame 31 by providing said ring with off-set locking bend portions 38a which are laterally off-set within a triangular annular recess means 26a in the frame 31, said locking bend portions projecting beneath gripping shoulders 32a to secure the ring in place. Shoulders 32a on either side of the recess 26a preferably also grip the ring above the off-set portions 38a of the ring 35a in the manner of the previous embodiments of the invention.

Alternative annular holding means include a plurality of spaced tabs 42 (FIGS. 17-19), each tab having a triangular, laterally projecting base 47 secured by shoulders 32b, 32b within complementary triangular recess means 26b formed in a modified tubing 43. The spaced tabs 42 each have an exposed holding portion 44 having a hole 46 therethrough for receiving and holding the cross-strings 28 in a spaced relationship. The recess means 26b may comprise a continuous recess of the type shown at 26 or it may comprise spaced recesses of the type shown at 40.

In another embodiment of this invention (FIGS. 7, 8, and 9), the frame 31 comprises differently modified tubing 49 which is provided with an annular recess 50 formed in an outer peripheral wall 53 of said oval frame 31. Said modified tubing 49 is further provided with a plurality of annularly spaced through-openings, each comprising an exterior opening 51 located through the recessed wall 53 and an interior opening 52 disposed in the inner peripheral wall 54 of the said tubing. The locking bends 38 of annular holding means 35 pass through frame 31 via the through-openings 51-52 and engage an annular locking wire 56. The annular locking wire 56 interweaves the spaced locking bends 38 of formed ring 35 and prevents the inward displacement thereof for securing said formed ring to the frame and providing a secure relationship between frame and ring. Shoulders 57, 57 on either side of the recess 50 may be so spaced as to constitute additional gripping means for the locking bends 38. Although not essential, the frame 31 may be crimped so as to securely lock the formed ring 35 within the annular recess 50. Holding bends 34 of the formed ring 35 are disposed inwardly of the inner wall portion 54 where they engage the cross-strings 28 in the usual manner.

In the various embodiments of this invention, the cross-strings 28 are interwoven in a spaced relationship and secured in place by engaging the exposed holding portions 34 or 34' of the annular holding means 35 or 35' in such manner as to avoid sharp 180° bends in the

cross-strings which is a criterion well known in the art. Accordingly, the cross-strings 28 are strung from side to side and from top to bottom within the racket portion 21 wherein the horizontal strings interweave the vertical strings and the respectively disposed strings are essentially maintained in a properly spaced parallel relationship. The stringing operation is simply effected by conventional racket-stringing machines well known in the art.

The loop portion 21 is combined with a conventional handle 23 wherein distal end portions 58, 58 of the tubular member 25 extend downward into essentially a parallel relationship and thereupon engage said handle in any suitable manner.

The annular ring or holding means 35 is, in each form of the invention, provided with locking portions 38 defining an outer radius of the oval frame 31 and holding portions 34 defining an inner radius of said frame, the outer radius engaging the annular recess and the inner radius engaged by the cross-strings. The locking portions each have an outer surface disposed adjacent to a recess base surface and an inner surface above which an integral portion of the tubular wall is formed, bent, crimped, or the like.

Hence, an improved game racket is provided wherein an oval shape tubular frame firmly secures an annular holding means for permanently securing the racket cross-strings in a spaced relationship. The annular holding means permanently secured to the frame provides an improved game racket having increased durability and an extended useful life. Additionally, the manufacturing procedure for fabricating such game rackets is substantially simplified.

It will be understood that many changes in the details of the invention as herein described and illustrated may be made without, however, departing from the spirit thereof or the scope of the appended claims.

We claim:

1. A tubular structure for holding cross-strings in a spaced relationship within the frame portion of a game racket, comprising: a tubular member having a continuous peripheral wall in transverse section, said peripheral wall being made up exclusively of said tubular member, said tubular member shaped into a loop portion; said tubular member having opposed reaches extending into a yoke portion; a cross member secured to said opposed reaches and located therebetween in said yoke portion defining with said tubular member an oval frame; said oval frame having an annular recess means; said annular recess means defined by inwardly extending gripping shoulder means, opposed sidewall portions on each side of said annular recess means, and an annular recess base surface all integrally formed into the inner periphery of said oval frame from an inner peripheral portion of said peripheral wall; annular string-holding means having locking portions and holding portions; said holding portions extending inwardly of said loop portion and having cross-strings engaging said holding portions; said locking portions having an outer surface disposed adjacent to said annular recess base surface and having an inner surface; said annular recess means and said shoulder means being of a depth to completely receive and encase said locking portions when said locking portions are placed within said annular recess means, and with at least one of the opposed sidewall portions of said shoulder means being bent above said inner surface of said locking portions

thereby encasing said locking portions in said annular recess means whereby said string-holding means is rigidly and permanently secured to said tubular member.

2. The tubular structure as set forth in claim 1 wherein said annular string-holding means is a formed ring.

3. The tubular structure as set forth in claim 1 wherein said annular string-holding means is a formed holding ring; portions of said ring comprising said string-holding portions and other portions of said ring comprising said locking portions; and the opposed sidewall portions of said shoulder means being crimped above the portions of said ring comprising said locking portions.

4. The tubular structure as set forth in claim 1 wherein said locking portions have indents at opposite sides thereof, said opposed sidewall portions of said shoulder means being bent into tight engagement with said indents.

5. The tubular structure as set forth in claim 1 wherein said string-holding means is a wirelike member bent alternately outwardly to form said locking portions and inwardly to form said holding portions.

6. The tubular structure as set forth in claim 5 wherein said tubular member is crimped adjacent to each said locking portion whereby said opposed sidewall portions of said shoulder means are pinched over said locking portions.

7. The tubular structure as set forth in claim 1 wherein said locking portions include alternately laterally off-set bends spaced along said annular string-holding means within said recess means and providing said inner surface; said opposed sidewall portions of said shoulder means being bent above said off-set bends on both sides of said recess means.

8. The tubular structure as set forth in claim 7 wherein said string-holding means is a wirelike member bent alternately outwardly to form said locking portions and inwardly to form said holding portions, portions of said wirelike member which are bent outwardly to form said locking portions being also bent laterally to provide said spaced, laterally off-set bends.

9. The tubular structure as set forth in claim 1 wherein said annular string-holding means comprises a plurality of spaced tabs having holding portions extending inwardly of said loop portion and locking portions disposed within said recess means; each said locking portion including a base portion projecting laterally at least in the direction of said one opposed sidewall portion, said base portion providing said inner surface over which said one sidewall portion of said shoulder means is bent.

10. The tubular structure as set forth in claim 1 wherein said annular string-holding means comprises a plurality of spaced tabs having holding portions extending inwardly of said loop portion and locking portions disposed within said recess means; each said locking portion including a base portion projecting laterally in the direction of said opposed sidewall portions of said shoulder means and providing said inner surface, said opposed sidewall portions being bent above said laterally projecting base portion; said holding portions being apertured to receive said cross-strings.

11. The tubular structure as set forth in claim 1 wherein said recess means comprises a substantially continuous recess formed in the inner periphery of said loop portion.

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12. The tubular structure as set forth in claim 1 wherein said recess means comprise a plurality of spaced indentations formed into the inner periphery of said loop portion.

13. A game racket, comprising; a tubular member shaped into a loop portion; said tubular member having opposed reaches extending into a yoke portion; said tubular member having distal end portions extending in a substantially parallel relationship for receiving a handle; a cross member secured to said opposed reaches and located therebetween in said yoke portion defining with said tubular member an oval frame; said oval frame having an annular recess including gripping shoulders adjacent thereto formed in said frame on the inner periphery of said oval frame; holding means en-

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gaging the annular recess of said oval frame and secured thereto by said gripping shoulders; cross-strings secured to said holding means; a handle secured to said distal end portions; said holding means comprising a wirelike member bent alternately outwardly and inwardly with respect to the center of said oval frame to form locking and holding bends, respectively; said locking bends seated within said recess and said holding bends extending inwardly of said oval frame; portions of said wirelike member which forms said locking bends having indents at opposite sides thereof whereby said gripping shoulders tightly engage said locking bends at said indents.

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