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[54] **RACKET WITH METAL FRAME WELDED TO
HANDLE SLEEVE**
10 Claims, 9 Drawing Figs.

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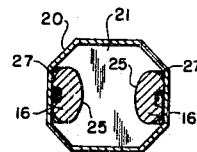
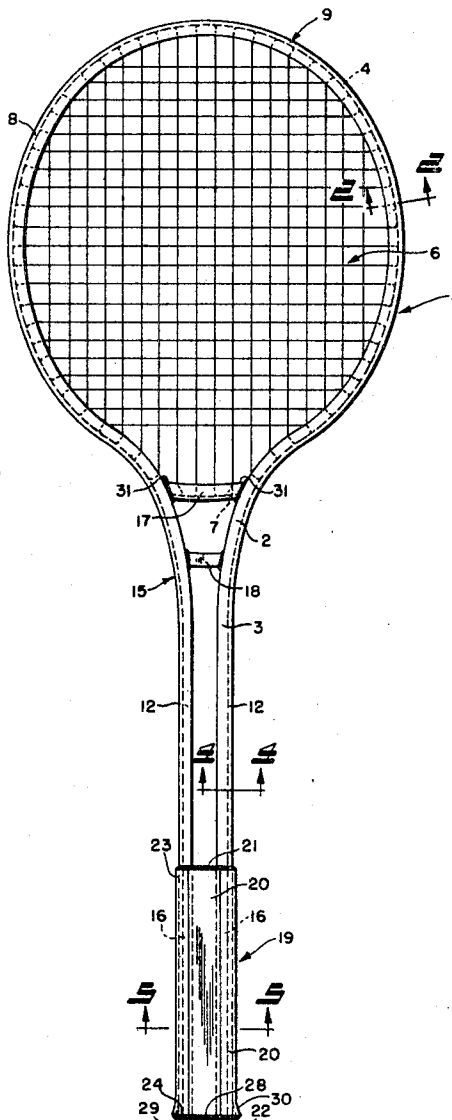
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ABSTRACT: A racket having an extruded metal frame with string holes in the bow whose ends are coined or forged to provide smooth rounded shoulders which preclude string damage and wear. A continuous groove in the outer periphery of the frame contains the portions of the strings passing between the holes to prevent damage thereto by contact with external surfaces. The frame has two parallel spaced handle extensions which extend into a handle sleeve. At each end of the handle sleeve is a metal plate which has two opposite edge notches to receive the handle extensions. The end plates are welded to the handle extensions and to the handle sleeve.



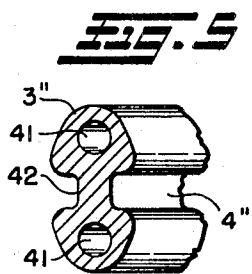
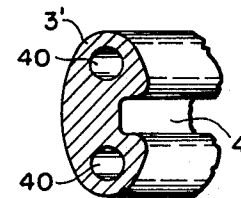
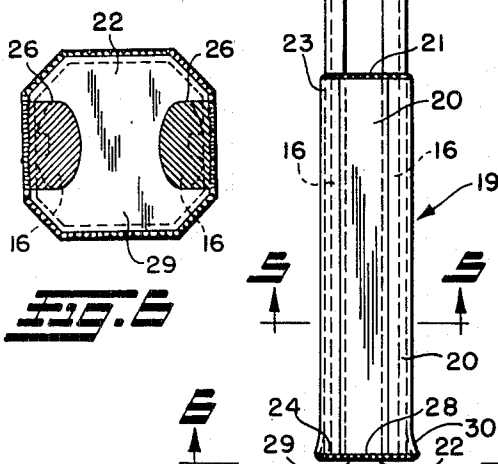
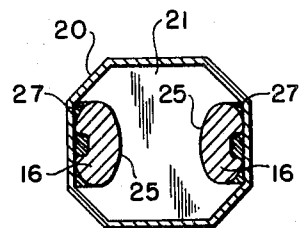
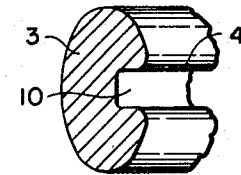
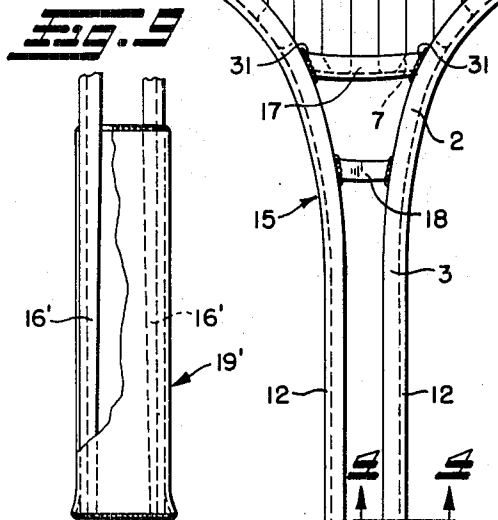
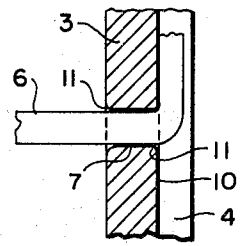
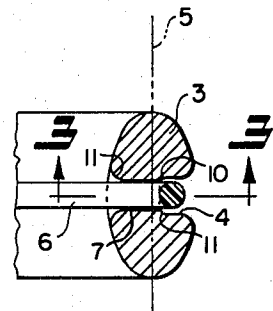
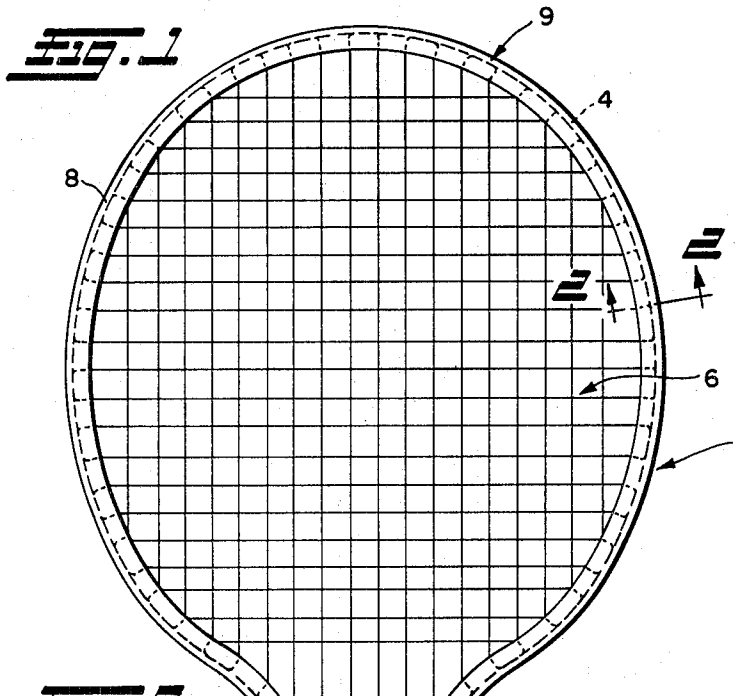


FIG. 10



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RACKET WITH METAL FRAME WELDED TO HANDLE SLEEVE

BACKGROUND OF THE INVENTION

This invention relates generally as indicated to a racket and more particularly to certain improvements in rackets for use in playing tennis, badminton, squash, paddle ball, and other such games.

Those who have some familiarity with the modern day wooden tennis racket know that the bow is very susceptible to warping which if severe enough makes the racket totally useless, and in any event substantially affects the tension of the strings. The wooden racket is also easily marred and may even break especially if abused as it oftentimes is by the frustrated amateur. Accordingly, there is a definite need for a racket made of a much more durable material that does not warp such as metal, but the problems inherent in the use of metal for rackets have not very satisfactorily been overcome, as evidenced by the general acceptance of the wooden racket.

Metals are as a rule much heavier than wood, so much so in fact that the weight of the racket often becomes a problem when metal is used, and there is always the danger of a sharp corner cutting or damaging the strings. Another problem which has plagued racket manufacturers is how to attach the handle of the racket to a metal frame in such a manner that it will be sufficiently strong to withstand the high shock loads during play and yet not add too much to the weight of the racket. Variations in the weight of the racket must also be possible without substantially affecting its strength to permit use by men, women, or children.

In recent years, there have been considerable strides in making metal rackets which are light enough to be within the prescribed weight ranges, and ways have been found to prevent damage to the strings, but only by stringing the racket in an unorthodox manner not at all like conventional stringing. Ways have also been devised for attaching the handle to the metal frame, but for one reason or another none have proven to be entirely satisfactory.

SUMMARY OF THE INVENTION

With the foregoing in mind, it is a principal object of this invention to provide a racket generally of the type described which may be made out of metal to substantially eliminate warping and breakage, and may be strung in conventional manner without fear of string damage.

Yet another object is to provide a metal racket which may be formed in a simple and economical manner and be of any prescribed weight.

Still another object is to provide such a racket with a groove around the entire outer periphery of the bow to protect the strings against damage.

A further object is to provide a racket of the type described with a very strong, lightweight handle.

These and other objects are achieved by making the frame of the racket out of a continuous piece of metal, preferably extruded, with a groove in one side which provides a weight reducing channel around the entire outer periphery of the frame when bent to shape and receives the strings passing from one string hole to another for protecting the same against damage by external forces. The string holes are coined or forged at both ends prior to bending the metal strip into shape to provide smooth rounded shoulders which prevent string damage and wear, and the handle is welded at both ends to the frame to provide a strong, lightweight construction.

To the accomplishment of the foregoing and related ends, the invention, then, comprises the features hereinafter fully described and particularly pointed out in the claims, the following description and the annexed drawings setting forth in detail certain illustrative embodiments of the invention, these being indicative, however, of but a few of the various ways in which the principles of the invention may be employed.

BRIEF DESCRIPTION OF THE DRAWING

In the annexed drawing:

FIG. 1 is a plan view of a preferred form of racket constructed in accordance with this invention;

FIG. 2 is an enlarged transverse section through one of the string holes in the bow of the racket of FIG. 1, taken on the plane of the line 2-2 thereof;

FIG. 3 is an enlarged fragmentary longitudinal section along the groove in the outer periphery of the bow, taken along the plane of the line 3-3, FIG. 2;

FIG. 4 is an enlarged transverse section through a portion of the frame of FIG. 1 in the region of the throat;

FIG. 5 is an enlarged transverse section through the handle of FIG. 1 taken on the plane of the line 5-5 thereof;

FIG. 6 is an enlarged end elevation view of the outer end of the handle as seen from the plane of the line 6-6, FIG. 1;

FIGS. 7 and 8 are enlarged transverse sections similar to FIG. 4, but showing other configurations for the metal frame to reduce the weight of the racket; and

FIG. 9 is a plan view another form of handle for use with the racket of FIG. 1, partially broken away to show the tapering of the throat extensions to reduce the weight of the racket.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now in detail to the drawings and first especially to FIG. 1, there is shown by way of example a tennis or similar type racket 1 the frame 2 of which has been formed by bending to shape a continuous strip 3 desirably having a generally uniform solid section throughout its length. Although various metals and nonmetals such as magnesium, steel, fiberglass, plastic, or wood may be used to make the frame 2 depending upon the weight and strength requirements and other factors to be later discussed, it has been found that aluminum provides a very high strength, lightweight frame which may be easily extruded into the desired elliptical cross-sectional shape shown in FIG. 2 with a longitudinal groove 4 in one side. A plane 5 passing through the foci of the elliptical section is perpendicular to the plane of the strings 6, thus providing a truly aerodynamic-shaped frame in the direction of ball strike for maximum efficiency and minimum air resistance.

To facilitate stringing of the frame 2, holes 7 are drilled or otherwise machined in the extruded metal strip 3 in the central region 8 thereof which will constitute the bow 9 prior to shaping the frame and while the strip 3 is in a substantially perfectly flat condition. The holes 7 are formed perpendicular to the bottom 10 of the longitudinal groove 5, after which the burrs are removed in conventional manner and the ends of the holes 7 are coined or forged to provide smooth, rounded shoulders 11 at each end, whereby strings 6 of gut, nylon, or other suitable material may be used without fear of being damaged by sharp corners.

After the holes 7 have been properly coined or forged, the elongated strip 3 is bent into the final desired shape using a press brake or suitable dies. When thus formed, the central region 8 of the metal strip 3 constitutes the bow 9 as aforesaid, whereas the ends 12 of the strip 3 extend from the bow 9 in parallel closely spaced relation to provide the throat 15 and handle extensions 16 for the frame. A bridging element 17 preferably of the same material as the metal strip 3 and having string holes 7 formed therein with the ends of the holes coined to provide rounded shoulders is welded in conventional manner between the ends of the central region 8 to complete the bow 9, and a similar bridging element 18 without holes may be welded between the strip ends 12 somewhat spaced from the first bridging element 17 to provide a more rigid structure and more firmly transfer side loads on the racket to the handle. The strength of the frame 2 adjacent the welds will be reduced somewhat due to the elevated temperatures of the welding process, but it may be restored if necessary by conventional heat treating such as employed by the aircraft industry.

Attached to the handle extensions 16 is a handle 19 which preferably consists of a hollow one-piece thin metal sleeve 20 of hexagonal or other suitable shape telescoped over the handle extensions 16 which are in spaced apart relation within the

sleeve and secured thereto by welding end plates 21, 22 to the ends of the sleeve 20 around the entire periphery and welding the end plates 21, 22 to the handle extensions 16. As clearly shown in FIGS. 5 and 6, the end plates 21 and 22 are in the form of metal stampings having a configuration substantially identical to the ends 23, 24 of the tubular sleeve 20 which they abut, and are provided with a pair of notches 25 and 26 in opposite sides thereof which are of a shape generally corresponding to the shape of the handle extensions 16 to provide close mating engagement therewith. The tubular sleeve 20 and end plates 21, 22 are desirably of the same metal as the frame 2 to facilitate welding.

When welding the handle extensions 16 to the inner end plate 21, it is preferred that the clearance 27 between the handle extensions 16 and tubular sleeve 24 in the region of the notches 25 be completely filled with weld metal as shown in FIG. 5. The notches 26 in the outer end plate 22, on the other hand, are completely filled with weld metal, since the handle extensions 16 desirably extend only to the inner face 28 of the outer end plate 22 so that the weld metal may be made flush with the outer face 29 of the end plate 22 without having to remove any weld metal. This type of handle construction is very light in weight and extremely strong since it provides a torque box over the entire length of the handle. The outer end 24 of the tubular sleeve 20 may be flared outwardly as shown to provide a knob 30 at that end which when wrapped with a suitable leather, plastic, or rubber wrapping in conventional manner prevents the hand from sliding off of the handle during play. The size of the handle grip may be varied as by varying the size of the sleeve 20 or by varying the thickness of the grip material.

The frame 2 may now be strung in conventional manner by passing the strings 6 through the holes 7 in the bow 9 and bridging element 17 and tightening them either by hand or with the use of a conventional stringing machine without fear of damaging the strings, whether they be gut, nylon, or other suitable material, since there are no sharp corners at the ends of the holes which could damage the strings. The holes 7 through the outer ends of the bridging element 17 are at an angle to clear the weld connections 31. The portions of the strings 6 between the holes 7 are contained in the longitudinal groove 4 which extends around the entire outer periphery of the frame, whereby all of the strings 6 are protected against damage by external forces, and the weight of the frame 2 is reduced by the groove 4 without appreciably affecting the strength. For making the frame 2 lighter, the handle extensions 16' may be tapered 30 percent more or less toward their outer ends as shown in FIG. 9 without unduly weakening the handle 19', and an even greater reduction in the weight can be achieved by providing longitudinal holes 40 and 41 in the extruded strip 3' or 3'' with or without a second groove 42 running along the entire inner periphery of the frame, as shown in FIGS. 7 and 8. Otherwise the construction of the rackets of FIGS. 7-9 is substantially identical to that shown in FIG. 1.

A championship tennis racket can readily be obtained by making the frame 2 of extruded aluminum having the same cross-sectional configuration shown in FIG. 4, whereas a medium weight racket and a lady's racket may be obtained by using the extruded shapes of FIGS. 7 or 8 with holes therein and perhaps the additional groove 42 which also impart greater flexibility to the frame.

From the above discussion, it can be seen that the various features disclosed herein permit manufacturing a tennis racket out of extruded metals, preferably aluminum, which may be of any desired weight and strung in conventional manner without fear of damaging the strings. Such a metal racket is of a welded, unitized construction which is substantially warp proof, extremely strong, and can withstand considerable abuse

without marring or in any other way damaging its appearance. When aluminum is used, the surface can be made even harder for greater resistance to scratching and marring by hard anodizing the metal, and the aluminum may also be color anodized to enhance its beauty.

Although the various principles of the present invention have been described primarily with reference to a tennis racket, it will be apparent that they have similar applications to other types of rackets as well, including badminton, squash, and paddle ball rackets, to name a few.

I claim:

1. A racket comprising a metal frame including a bow and a throat extending from said bow, said throat having a pair of handle extensions extending therefrom in closely spaced substantially parallel relation to each other, and a handle secure to said handle extensions, said handle comprising a one-piece hollow metal sleeve telescoped over said handle extensions which are in spaced apart relation within said sleeve, and metal end plates at the ends of said sleeve, said end plates having notches in opposite sides for said handle extensions, said notches having a shape generally corresponding to the shape of said handle extensions for close mating engagement therewith, said end plates being welded to the ends of said sleeve and handle extensions to provide a torque box over the entire length of said handle.

2. The racket of claim 1 wherein there is a slight clearance between said handle extensions and metal sleeve at the inner end of said handle in the region of said notches which is completely filled with weld metal.

3. The racket of claim 1 wherein said handle extensions terminate adjacent the inner face of said end plate at the outer end of said handle, said notches in said last-mentioned end plate being in alignment with the ends of said handle extensions and completely filled with weld metal for attaching said last-mentioned end plate to said extensions.

4. The racket of claim 1 wherein said handle extensions are tapered toward their outer ends within said handle to reduce the weight of said frame.

5. The racket of claim 1 wherein said bow is provided with a plurality of circumferentially spaced holes therethrough for the strings, the ends of said holes being coined to provide smooth, rounded shoulders to protect the strings against damage by sharp corners.

6. The racket of claim 5 further comprising a first bridging element welded between the ends of said central region, said first bridging element having string holes therein with coined ends providing rounded shoulders for protecting the strings against damage, the holes through the outer ends of said first bridging element being disposed at an angle to clear the weld connections between said first bridging element and bow.

7. The racket of claim 1 wherein said frame and handle are made of aluminum, welded together and heat treated to comprise a completely unitized all metal racket.

8. The racket of claim 7 wherein said metal frame is an extrusion having a groove extending completely around the outer periphery of said bow, said groove being intersected by said holes for receipt of the portions of the strings between said holes to protect the same against damage by external forces.

9. The racket of claim 1 wherein said frame is in the form of an extruded strip of metal having a generally elliptical cross section to provide a true aerodynamic shape in the direction of ball strike for maximum efficiency and minimum air resistance.

10. The racket of claim 9 wherein said frame has a groove which extends around the entire inner periphery of said frame and longitudinal holes therein for reducing the weight of the racket.