April 2, 1963 YOSHIAKI TAKAHASHI 3,083,968

GAME RACKET CONSTRUCTION

Filed Dec. 17, 1958 3 Sheets-Sheet 1

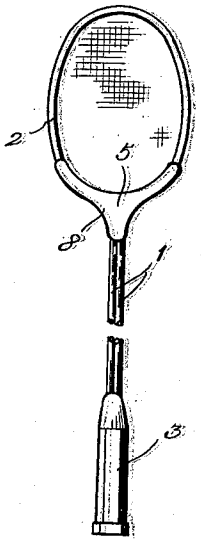


FIG. 1.

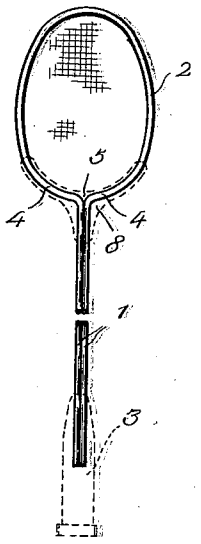


FIG. 2.

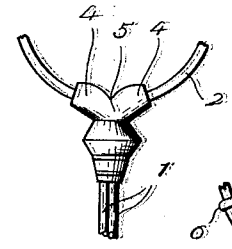


FIG. 3.

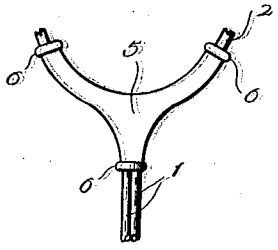


FIG. 4.

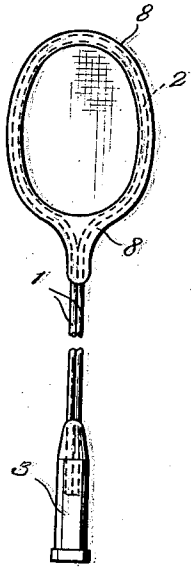


FIG. 5.

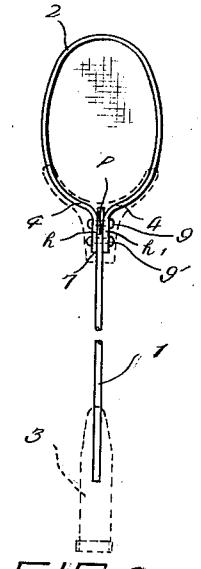


FIG. 6.

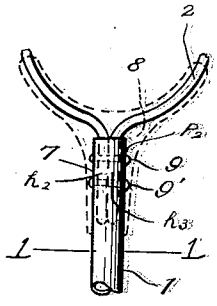


FIG. 7.



FIG. 8.

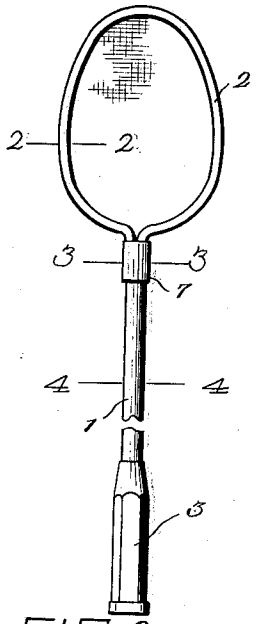


FIG. 9.

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GAME RACKET CONSTRUCTION

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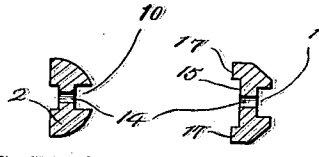


FIG. 10

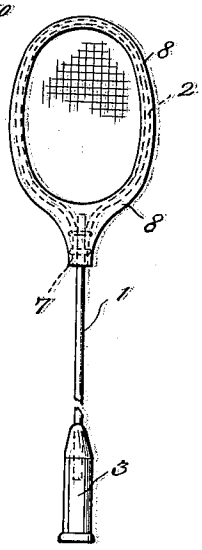


FIG. 13

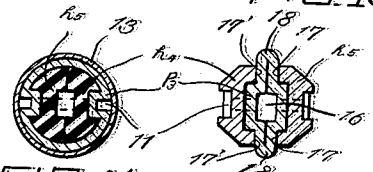


FIG. 11

FIG. 14

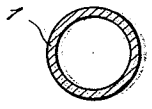


FIG. 12

FIG. 15

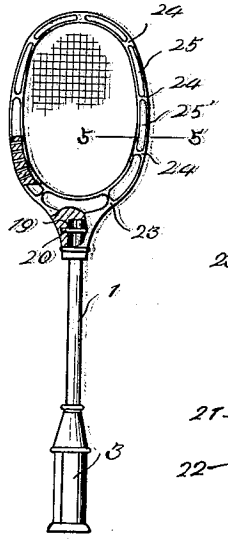


FIG. 16

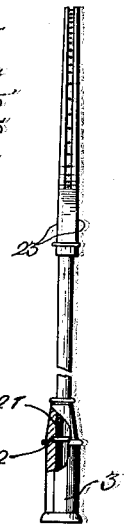


FIG. 17

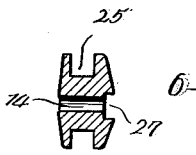


FIG. 18

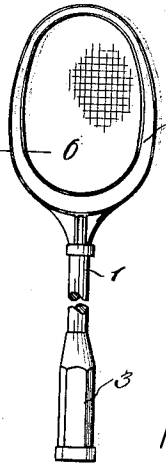


FIG. 19



FIG. 20



FIG. 23

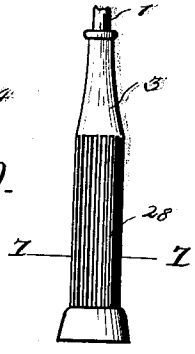


FIG. 21

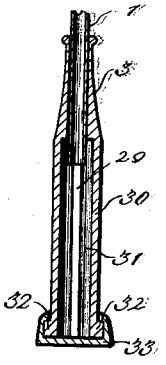


FIG. 22

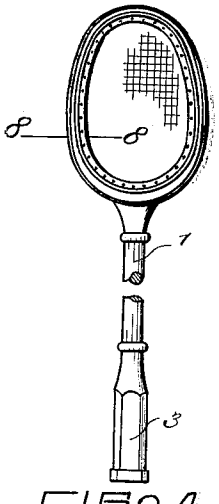


FIG. 24

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GAME RACKET CONSTRUCTION

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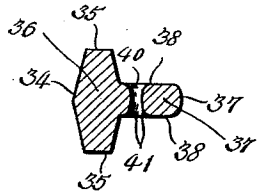


FIG. 25.

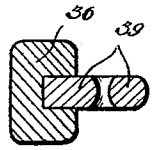


FIG. 26

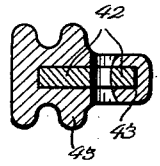


FIG. 27.

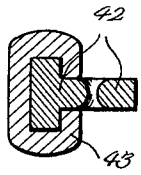


FIG. 28

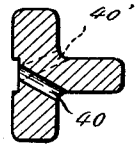


FIG. 29.

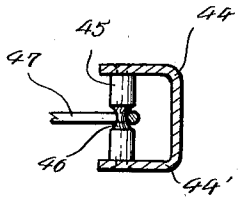


FIG. 30.

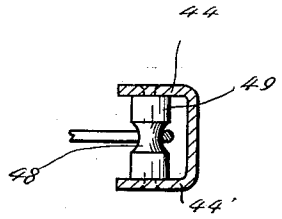


FIG. 31.

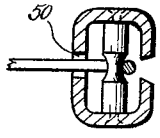


FIG. 32.

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Patented Apr. 2, 1963

3,083,968

GAME RACKET CONSTRUCTION

Yoshiaki Takahashi, 46 1-chome Oike-machi, Nagoya City, Japan

Filed Dec. 17, 1958, Ser. No. 780,991
1 Claim. (Cl. 273—73)

This invention relates to game racket construction and more particularly to the construction of a light, strong, resilient, warp-proof badminton racket suitable for mass production.

Heretofore, for the manufacture of rackets, wood or other material has been used and this required hand-finishing to give a delicate and variable shape to the frame and to other parts in order to improve swing-balance and also to maintain the strength. Hence, not only is it a very inefficient method, but also, it is difficult to obtain a uniform quality at moderate price.

An object of the invention is to provide a game racket construction and manufacturing method wherein, the three-forked part of the frame is pressed and fixed by means of a synthetic resin to provide a strong, resilient, warp-proof and durable racket.

Another object of the invention is to provide a game racket construction and manufacturing method wherein the frame and the shaft of the racket are made separately then joined in an unbreakable manner.

A further object of the invention is to provide a racket wherein the shape and direction of the gut of the frame is made so as to obtain a strong, resilient and warp-proof racket.

The invention also contemplates providing a racket wherein construction of the racket grip is contrived so as to increase its strength and regulate its swing-balance.

Other objects and advantages of the invention will become apparent from the following description of the invention.

The accompanying drawings are illustrative embodiments of the invention in which:

FIG. 1 shows a racket wherein the frame and the shaft of the racket are made of one single piece of material;

FIG. 2 is a front elevation and diagram showing the frame part;

FIG. 3, a front elevation of one embodiment of a three-forked part in another example;

FIG. 4 is another embodiment of a three-forked part;

FIG. 5 is a front elevation of a racket constructed according to the invention showing details of construction;

FIG. 6 shows a racket wherein the frame and shaft are made separately;

FIG. 7 is a front elevation of another embodiment of the invention similar to that depicted in FIG. 6;

FIG. 8 is a sectional view of the shaft in FIG. 7 on the line 1—1;

FIG. 9 is a front elevation of a frame part;

FIG. 10 is a sectional view of the frame in FIG. 9 on 2—2;

FIG. 11 is a sectional view of the shaft in FIG. 9 on 3—3;

FIG. 12 is another sectional view of the racket in FIG. 9 on 4—4;

FIG. 13 is a sectional view similar to FIG. 10 of another embodiment of the invention;

FIG. 14 is a sectional view of another practical example corresponding to FIG. 11;

FIG. 15 is another front elevation of the racket according to this invention;

FIG. 16 shows an embodiment of the invention wherein the frame and the shaft of the racket is made of a synthetic resin;

FIG. 17 is a side view of FIG. 16;

FIG. 18 is a sectional view of FIG. 16 on 5—5;

FIG. 19 is a front elevation of another embodiment;

FIG. 20 is a sectional view of FIG. 19 on 6—6;

FIG. 21 shows the grip part of the racket in front elevation;

FIG. 22 is a sectional view of FIG. 21;

FIG. 23 is a sectional view of the FIG. 21 on 7—7;

FIG. 24 is a front elevation of a racket frame;

FIG. 25 is a sectional view of the FIG. 24 on 8—8;

FIGS. 26 to 29 are other embodiments similar to FIG. 25;

FIG. 30 is a sectional view of the frame according to still another embodiment of the invention;

FIGS. 31 and 32 show other embodiments similar to FIG. 30.

Referring to the drawings for more specific details of the invention, the rackets shown in FIGS. 1–5 are shaped of a light, solid and straight material of metal, wood or bamboo (bar or pipe) and these are bent and both the shaft 1 and the frame 2 shaped into a single and continuous shape; the lower end of the shaft 1 is fitted with a grip 3 and on the three-forked part extending from the upper part of the shaft 1 to the ground i.e., bottom 4 of the frame, synthetic resin material such as acetylcellulose, a shock resistant styrol, etc. is pressed by means of a metal moulding.

According to this invention, since the three-forked part of the frame is pressed and fixed with a synthetic resin, there is no danger of breakage and no need to provide the shaft with rivets; the shaft is thus possessed of both durability and the appropriate resilience. The manufacturing method of the racket according to this invention, depends upon a simple process such as bending of metal or other material and moulding of a synthetic resin and therefore it is well suited for mass production of uniform quality with low manufacturing costs. If the part applied with a synthetic resin extends to the upper part of the frame ground 4, as shown in FIGS. 1 and 2 it will be stronger and more resilient but, if desired, it may be applied only to the upper end of the shaft 1 and the frame ground 4, as shown in FIG. 3. Furthermore, if the three terminal edges of the applied synthetic resin are made into a big neck 6 as shown in FIG. 4, a better result with the synthetic resin can be obtained. It is well to select especially a shock resistant synthetic resin in order to get a more resilient racket. If necessary, the upper end of the shaft may be fitted with rivets similar to those shown in FIG. 6. Moreover, if the synthetic resin is applied not only on the three-forked part 5 but also on the whole surface of the frame 2, the racket will look like that in FIG. 5 and different results as mentioned above can be had. If the sectional area of the frame is made smaller, sufficient strength can be obtained by properly distributing the synthetic resin on every surface of the frame of the racket; thus swing-balance is easily regulated by means of said synthetic resin.

In the above description, the frame and the shaft of the racket are made of a single piece of homogeneous material. However, it is desirable that the frame be made of a light and strong material and the shaft, of a strong and resilient material. Therefore, the frame and the shaft need to be shaped separately. From this viewpoint, those rackets shown in FIGS. 6–15 have been designed, in which, as in FIG. 6, a straight shaped material such as bar, or pipe of a light metal, wood or bamboo is bent into a racket frame 2; and separately from this, a straight bar or pipe of light alloy treated with a special hardening process and thus made into a strong and resilient material, is shaped into a shaft 1. The lower end of the frame 2 and the upper end of the shaft are joined together by appropriate means to form the

joined part 7. As shown in FIG. 6, the synthetic resin is applied and pressed on the surfaces of the upper part of the shaft 1, the joined part 7 as well as the ground 4 of the frame; and a grip 3 is fitted to the lower end of the shaft 1. As for the construction of the joined part 7 of the frame 2 with the shaft 1, the one shown in FIG. 6 consists of the upper part P of the shaft 1 inserted into a gap of two perpendicular parts h, h_1 on the lower end of the frame 2. If necessary, the upper end P and said perpendicular parts h, h_1 may be clamped together by means of rivets 9 and 9', then the device placed into a metal mould where the plastic reinforcement 8 is molded around junction 7. As a matter of fact, parts h, h_1 and P may be tied together by means of wire instead of riveting. This construction of the joined part is particularly suited when a metal bar is used for the shaft 1 resulting in a large surface area of the joined part; here, the application of the synthetic resin can be performed easily and solidly. This is the main advantage of this method. For the joined part shown in FIGS. 7–8, a pipe is used for the shaft 1; inside the mouth on the upper end of the pipe shaft 1 are inserted two perpendicular parts h_2, h_3 on the lower end of the frame 2. If necessary, the joined parts are clamped with rivets 9, 9'. The racket of this construction is extremely solid and resilient and the manufacturing process is very simple. Therefore, this racket is well suited for mass production.

As mentioned above, the drawings in FIGS. 9–14 illustrate the manufacturing method whereby the joined part may be either pressed or not and shaped by means of a synthetic resin but in any case, obtaining a solid joined part. In FIGS. 9–12, a shaped material (rolled or otherwise) of a light metal such as aluminum alloy, etc. is bent in such a way that the channel 10 is extruded outside to form the frame 2 and two perpendicular parts h_4, h_5 on the lower end of said frame, are welded together (FIG. 11). Said perpendicular parts h_4, h_5 are inserted into the mouth on the upper end P_3 of the shaft 1 made of a pipe or a resilient material such as aluminum alloy, etc. and by applying external force to the shaft 1 from outside of the upper end P_3, the channel 10 is pushed and inserted into the outside wall of said upper end P_3. Both the concave channel 11 and said upper end P_3 into which said parts are inserted are rivetted together by means of the rivet (shown as a dotted line in FIG. 11) with the perpendicular parts h_4, h_5 between them. The joining of the frame with the shaft thus obtained is so strong that it needs no other strengthening means. However, it is desirable that the joined part 7 is fitted with a tube of a synthetical resin or some other material on its circumference so as to cover the joined part. In the drawing, 14 shows a gut hole. FIGS. 13 and 14 show another mode of the joined part formation, wherein the frame 2 formed by bending a shaped material of a rolled light metal such as aluminum alloy, etc. to the direction where the channel 10 is extruded outside. In the gap between two perpendicular parts h_4, h_5 on the lower end of said frame is inserted the upper end of the shaft, provided with a cavity adapted to the shape of the channel 15 inside and between said perpendicular parts h_4, h_5; the shaft is also shaped to produce a rolled part 18 supported by the opposed edges 17, 17' of said perpendicular parts h_4, h_5. The shaft is made of a resilient pipe of a light alloy pressed and shaped, and the perpendicular parts h_4, h_5 of the frame are fastened together by means of a rivet (shown as dotted lines in FIG. 14) with the upper end P_3 of the shaft between them. Hence, as shown in FIG. 14, the upper part P_3 of the shaft 1 has a rolled part 18, which has a resilience against the fastening power of the rivet 12 so that the joined part thus made is extremely strong. The modes described in FIG. 9 and below may be used without applying a synthetical resin to the joined part 7. However, if a synthetic resin is applied to it, it will be endowed with a better resilience as well as warp-proof properties. The racket, the joined part of which is thus made has superiority over other rackets, particularly where the frame and the shaft are made of a single material, because it is difficult to find in a single material both strength for the frame and resilience for the shaft. Here because the frame and the shaft are made separately of materials having desirable properties, the very best racket is produced. Moreover, the joining mode is very simple and provides a very solid joint.

In the example shown in FIG. 15, the synthetic resin is applied not only on the joined part 7 above the shaft 1 and the outer surface of the frame ground but also on the whole surface of the frame 2. In this way, not only the above-mentioned different results can be obtained but also even if the sectional area is reduced, a sufficient strength can be obtained and a better fixing of the synthetic resin insured. Moreover, as it enables appropriate distribution of the synthetic resin on every part of the frame, the swing-balance of the racket is easily regulated by means of said synthetic resin.

FIGS. 16–20 explain a manufacturing process of the racket, wherein the frame 2, the shaft 1 and the grip 3 are shaped, each one separately and the upper end of the shaft 1 is inserted into a hole made on the lower end of the frame 2 and held by means of an adhesive material and at the same time fastened with a pin 20. The lower end of the shaft 1 is inserted into the hole 21 of the grip 3 and held with an adhesive material and fastened with a pin 22. The frame 2 may be shaped with a synthetic resin or may include a metal bar, pipe or shaped material in its center. Moreover, in the latter case when a metal frame material is included, the synthetic resin may be applied approximately on the lower half-part or on the whole surface of the frame. The shaft 1 may be formed by means of a synthetic resin reinforced with a glass wool or cloth, or a built-up pipe of the same material, or a pipe or bar of aluminum alloy. Moreover, the front and the back surfaces 23 of the frame 2 are provided with intermittent long and shallow channels 25, 25' separated with a partition wall 24 so as to lighten the frame 2 as well as to regulate the length and the depth of said channels 25, 25', etc. and also to ameliorate swing-balance of the racket. As shown in FIG. 18, because of this special sectional shape of the frame 2, the strength and warp-proof quality of the racket are insured. In this case, if more lightness is required, a continuous, long and shallow channel 26 may be provided in the shape of the frame 2 as shown in FIG. 19. In the above drawings, gut hole 14 is shown in channel 27, the channel being made on the outer circumference of the frame.

As mentioned above, the frame and the shaft are made, each one separately and the upper and the lower ends of the shaft are inserted respectively into the lower end of the frame and into the upper end of the grip and fastened together to complete the racket. This manufacturing process is extremely simple and suited for mass production of a uniform quality.

FIGS. 21–23 relate to a grip part of the racket. Usually several processes are needed for the finishing of the shaft part and the grip part and still uniform strength can not be obtained, while in the present invention, the shaft is made of a pipe or bar of a light alloy and by means of a synthetic resin shaping, the shaft and the grip are made instantly into a combined structure of uniform strength. The shaft 1 is made of a pipe or bar of aluminum alloy, superficially treated with nickel plating. The lower end of said shaft is appropriately cut with concave nicks. Said lower end is inserted inside the metal mould and by means of a synthetic resin material such as acetylcellulose, a shock resistance styrol or urea resin, the grip 3 and shaft 1 are shaped by jet or press into a single structure.

As shown in FIGS. 21 and 23, the grip 3 is provided with concave and convex nicks 28 for friction on the outside and inside is a cavity 31 formed with a thick wall

30. The ribs 29 protrude out of the inner wall along the length of the grip and the open lower circumference of the handle is provided with a protruding band 32 to which is fitted a cover 33 of a hard polyethylene resin, etc. Since the racket is constructed as mentioned above, it is not only suitable for mass production, but also the combination of the grip with the shaft is very strong and if the cover is taken off, appropriate weighting material can be put inside to regulate the swing-balance of the racket as well as to adapt the tare of the racket with the user.

FIG. 24 shows the results of study on the sectional shape of the frame, and FIG. 25 shows a cross section of the frame 2 in FIG. 24. Said frame 2 is composed of an outside part 36 exposing a wide part 34 and a thick part 35 on both the front and the back surfaces of the racket. The inside part 39 comprises a thick part 37 facing inwardly and nearly at right angle to said outside part 36, thus having a T-shape cross section. The wide part 38 of said inside part 39 is provided with gut holes 40 nearly at right angle to the gut stringing surface of the racket. As shown in FIG. 25, the gut hole 40 provided with an arch 41 is preferably narrow in the center, becoming gradually thick toward both open ends. In that case, the breakage of the gut is much reduced. In the above construction, the frame having a T-shape cross section is extremely strong for all kinds of external force, and the racket gut holes are made at right angle to the gut stringing surface so that the metal mould for shaping the frame with a synthetic resin can be easily made.

Moreover, as the gut can be easily passed through the holes, its stringing operation can be performed with increased efficiency and, as a matter of fact, consumption of the gut can be reduced. Even if the gut is tightly strung, no warping of the frame will occur with said construction. FIGS. 26–28 show another frame having a T-shape cross section, in which in FIG. 26, the outside part 36 and the inside part 39 are shaped, each one separately and the inside part 39 is fastened with the outside part 36.

FIGS. 27 and 28 show the T-shape cross section shaped so that the metal material part 42 is enveloped with a synthetic resin 43. As shown in FIG. 29, the gut hole 40 having appropriate inclination to the gut stringing surface and another gut hole 40' having a reversed inclination are made alternately. This is also very useful for reducing warping of the frame due to stringing.

FIGS. 30–32 show another cross section of the frame in which FIG. 30 shows a frame having nearly C-shape cross section, and between two edges 44, 44' exposed on the front and the back surfaces, is riveted a cross arm 45, a plurality of said cross arms 45 are fitted all around the frame at appropirate intervals and provided with a concave channel nearly in center. In the drawings, 47 shows the gut. Owing to this construction, the frame is made very light and as the cross arm 45 is inserted and fitted between the edges 44, 44', not only is it very strong but also stringing is very easily accomplished. If concave channel 46 is provided in the center of the cross arm 45, the damage of the gut will be much more reduced; at the same time as the gut goes sliding into said concave channel, its own traction in the channel during stringing provides a tight and a smothly strung surface formed by the gut. Further, in FIG. 30, said cross arm 45 is covered with a cylinder 49 having a concave part 48 in the center, which is rotatable around the outer circumference of the former, by this means, the fitting of the gut 47 is made easier and the damage due to friction is reduced even more. Furthermore, FIG. 32 shows the case when the edges 44, 44' are turned to the outside of the racket and a gut hole 50 is made in the wall thus providing a stronger frame.

The present invention may be embodied in other specific forms without departing from the spirit thereof. It is therefore desired that the present embodiments be considered in all respects as illustrative and not restrictive, reference being had to the appended claim rather than to foregoing description to indicate the scope of the invention.

What is claimed is:

A game racket, comprising in combination,

a T-shaped cross-sectional length of thin, tubular material shaped at its central portion as an ellipse defining a racket frame with the wide portion corresponding to the roof of the T being towards the outside of said frame, the ends of said length being outwardly bent in the plane of the long diameter of said ellipse;

an elongated hollow member, one end of which engages said bent ends by receiving said bent ends in an open mouth at said one end of said hollow member;

fastening means fastening said bent ends and said member;

a grip member attached at the lower part of said hollow member;

a molded plastic reinforcing member encompassing the junction of said hollow member, said fastening means and said ends and extending partially around said ellipse; and

hour-glass shaped aperture walls extending through the inwardly facing narrow portion corresponding to the center bar of the T, said walls forming gut-holes.

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