

**SPECIFICATION
Sports Equipment**

5 The present invention relates to sports equipment and particularly to a method for producing a racket frame using carbon fiber reinforced plastics or fiber reinforced plastics.

10 The carbon fiber reinforced plastics (CFRP) and fiber reinforced plastics (FRP) have the advantages of high strength, good elasticity, high rigidity, good moisture-resistance, light weight, and good resistance to collision, damages, high temperature, and corrosion. Due to the above said advantages, the CFRP and FRP are utilized very widely.

15 One type of known racket frame has been made of CFRP or FRP material to utilize the advantages of said materials especially for their good strength, elasticity, rigidity, moisture-resistance, creep-resistance, and shock-attenuation. However, the method for producing the known racket frame is not ideal and results in high manufacturing costs and low manufacturing speed.

20 There are two conventional methods for producing FRP and CFRP racket frames in the art. The first one adopts a mould which can form the frame, throat piece, shaft, and handle of the racket integrally by a single operation, a rubber tube filled with high-pressured gas is used there as the core of the mould. The CFRP or FRP resin-soaked material in the tube shape is placed in the mould and becomes hard by hot-pressing. The rubber tube is then pulled out from the mould and a kind of liquid foam plastics is poured into the core of the mould. Although this is a rather precise method, these complex manufacturing processes have caused this method to be discarded.

25 The second method for producing the conventional CFRP or FRP racket frames comprises a first process to insert the resin-soaked material in the mould and then a plastics film pipe filled with foaming material is arranged as the core of the mould. The whole racket frame can be hot-pressing moulded integrally by a single operation. This second method has become very popular recently. However, it still has some disadvantages. Referring to Fig. 1 which shows a sectional view of a racket frame manufactured by this method, there are a plurality of layers of plastics film 103 between the CFRP or FRP layer 101 and the foaming material core 102, therefore the whole racket frame is not a single body. Besides, the foaming material core 102 can not be reinforced by the CFRP or FRP layer 101. When an external force F is applied to the frame as shown in Figs. 2 and 3, the foaming material core 102 breaks from time to time causing the center of gravity of the racket to deviate from its normal position and causing an unpleasant noise.

30 The reason layers of plastics film 103 must be provided is to protect the foaming material from leakage and losing internal pressure. There is a string hole 13 on the frame of Fig. 1.

65 The second method for producing the known racket frame is much simpler than that of afore-said first method. The cost is lower too. However the quality of the racket products is decreased. In addition, the two methods have a common disadvantage, that is, a thin shaft, such as a badminton racket shaft with a core having a diameter around one millimeter can not be produced by said two conventional methods.

70 The present invention provides a method for producing a frame for a racket, comprising the steps of soaking carbon fibre reinforced plastics or fibre reinforced plastics material in a high polymer epoxy resin forming a pipe from said material before or after soaking said material in said resin introducing a solid foaming material into the center of said pipe; and hot-pressing moulding said materials under high temperature whereby the carbon fibre reinforced plastics or fibre reinforced plastics material is caused to become hard and the foaming material therein caused to foam simultaneously to form said frame wherein said carbon fibre reinforced plastics or fibre reinforced plastics material and the foaming material are integrally moulded.

75 Preferably the racket frame has a thin racket shaft with a core having a diameter around one millimeter.

80 The present invention is further described hereinafter by way of example, with reference to the accompanying drawings, in which:

85 Fig. 1 is a sectional view of the frame of a racket produced by a conventional method;

90 Fig. 2 is a sectional view of the frame of Fig. 1 showing the fracturing or cracking thereof;

95 Fig. 3 is another sectional view of the frame of Fig. 1 showing the crack produced by working;

100 Fig. 4 is the perspective view of the mould and the embryo material of the racket frame according to the present invention;

105 Fig. 5 is a sectional view of the frame taken along a line A—A' in Fig. 4;

110 Fig. 6 is a sectional view of the shaft taken along a line B—B' in Fig. 4;

115 Fig. 7 is a sectional view of the frame after being hot-pressing moulded according to the present invention; and

120 Fig. 8 is a sectional view of the shaft after being hot-pressing moulded according to the present invention.

125 Referring to Fig. 4 which shows a perspective view of the mould and the embryo material of the racket frame.

The mould is made of heat resistant metal and comprises a top mould 5, a bottom mould 7 and a pair of middle moulds 6a and 6b for moulding the frame 10, throat piece 20, shaft 30 and handle 40.

Referring to Figs. 5 and 6, which show the sectional view of the frame and shaft of the embryo material. The CFRP or FRP materials are soaked in the high polymer epoxy resin to form into sheets and then formed into a pipe shape. Alternatively the material can be soaked in resin after forming into a pipe shape. In the center of

the CFRP or FRP pipe, there is filled with a solid foaming material 102 which is made of thermo-plastics mixed with foaming agent by pressing.

The pipershaped CFRP or FRP material together with the foaming material involved therein is placed into the mould for hot-pressing moulding. The CFRP or FRP material will become hard and the foaming material therein will foam simultaneously under the same temperature.

The sectional view of the frame and the shaft of a racket frame after being hot-pressing moulded are shown in Figs. 7 and 8.

It is to be noted that the racket produced by the method according to the present invention is an integral article from the handle to the netting frame thereof. Besides, the CFRP or FRP layer is integrally formed with the internal foaming materials so as to achieve a perfect reinforcing effect. The process required by the present

invention is quite simple and a thin shaft with a core having a diameter around one millimeter can be produced directly from the present method.

Claims

1. A method of producing a frame for a racket comprising the steps of soaking carbon fibre

reinforced plastics or fibre reinforced plastics material in a high polymer epoxy resin and forming a pipe from said material before or after soaking said material in said resin; introducing a solid foaming material into the center of said pipe; and hot-pressing moulding said material under high temperature whereby the carbon fibre reinforced plastics or fibre reinforced plastics material is caused to become hard and the foaming material therein caused to foam simultaneously to form said frame wherein said carbon fibre reinforced plastics or fibre reinforced plastics material and the foaming material are integrally moulded.

2. A method as claimed in Claim 1 wherein said solid independent foaming material is a thermo-plastics material with a foaming agent mixed therein by pressing.

3. A method as claimed in Claim 1 or 2 wherein said solid foaming material forms a center having a diameter of approximately one millimeter for producing a thin shaft of a badminton racket.

4. A method of producing a frame for a racket substantially as hereinbefore described with reference to the accompanying drawings.

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10 The sectional view of the frame and the shaft of a racket frame after being hot-pressing moulded are shown in Figs. 7 and 8.

It is to be noted that the racket produced by the method according to the present invention is an integral article from the handle to the netting frame thereof. Besides, the CFRP or FRP layer is integrally formed with the internal foaming materials so as to achieve a perfect reinforcing effect. The process required by the present

20 invention is quite simple and a thin shaft with a core having a diameter around one millimeter can be produced directly from the present method.

Claims

1. A method of producing a frame for a racket
25 comprising the steps of soaking carbon fibre

reinforced plastics or fibre reinforced plastics material in a high polymer epoxy resin and forming a pipe from said material before or after soaking said material in said resin; introducing a
30 solid foaming material into the center of said pipe; and hot-pressing moulding said material under high temperature whereby the carbon fibre reinforced plastics or fibre reinforced plastics material is caused to become hard and the
35 foaming material therein caused to foam simultaneously to form said frame wherein said carbon fibre reinforced plastics or fibre reinforced plastics material and the foaming material are integrally moulded.

40 2. A method as claimed in Claim 1 wherein said solid independent foaming material is a thermo-plastics material with a foaming agent mixed therein by pressing.

3. A method as claimed in Claim 1 or 2 wherein
45 said solid foaming material forms a center having a diameter of approximately one millimeter for producing a thin shaft of a badminton racket.

4. A method of producing a frame for a racket substantially as hereinbefore described with
50 reference to the accompanying drawings.

