

⑫

EUROPEAN PATENT APPLICATION

⑰ Application number: **83307758.9**

⑥① Int. Cl.⁴: **A 63 B 49/02, A 63 B 49/10**

⑳ Date of filing: **20.12.83**

④③ Date of publication of application: **26.06.85**
Bulletin 85/26

⑦① Applicant: **Lo, Kun Nan, No. 7-1 Lane 246 Chung Hsan Road Sec 3, Tan Tzu Hsiang Taichung Hsien (TW)**

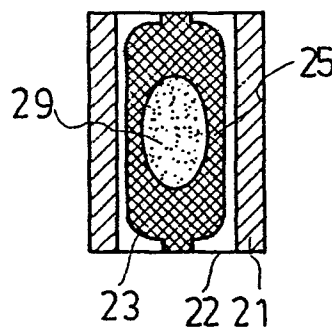
⑦② Inventor: **Lo, Kun Nan, No. 7-1 Lane 246 Chung Hsan Road Sec 3, Tan Tzu Hsiang Taichung Hsien (TW)**

②④ Designated Contracting States: **AT BE CH DE FR GB IT LI LU NL SE**

⑦④ Representative: **Gordon, Richard John Albert et al, F.J. CLEVELAND & COMPANY 40-43, Chancery Lane, London WC2A 1JQ (GB)**

⑤④ **Sports racquet.**

⑤⑦ A racket frame of sandwich construction which comprises two wooden strips (22) provided with two longitudinally extending grooves (23) respectively and sandwiching an interpositioned composite member which includes a fiber reinforced plastic shell (25) and a rigid foam core (29).



EP 0 145 820 A1

BACKGROUND OF THE INVENTION

This invention relates to racket frames, particularly to a racket frame of sandwich construction
5 using wood.

The earliest tennis racket were made of solid wood. These frames were heavy and had unsatisfactory playing characteristics. They were superseded by rackets of laminated wood construction such as maple and birch
10 laminates. Although the laminated wood construction offers improvements over solid wood, it suffers disadvantages such as relatively low tensile and compressive strength, poor life and lack of uniformity. In addition, it is difficult to manufacture to uniform
15 weight balance, density and mechanical properties.

There is also a sandwich construction made by adhering glass fiber layers over both faces of a wooden racket frame. These frames result in improved service life, and fatigue characteristic, but the tennis strings tend
20 to loosen and the weight reduction of the frame is limited.

Still another type of racket frame is obtained by embedding fiber reinforced plastic in the wooden frame. Although mechanical properties and weight reduction has
25 improved, there still remains a drawback in that the weight thereof is still not satisfactory. In these

frames, the fiber reinforced plastic is formed in a longitudinally extending channel of the wooden member. In many cases, the formed plastic and the wooden member can not achieve an intimate bond and this results in
5 difficulty in controlling the quality of the frame and undesirable defective products.

An object of the invention is to provide a racket frame of sandwich construction which is of lighter
10 weight, has improved shock absorption and mechanical strengths.

Another object of the invention is to provide a sandwich construction in which the fiber reinforced plastic can be intimately bonded to the wood.

15 The foregoing and other objects can be achieved in accordance with the invention through the provision of a racket frame comprising a structural member which comprises: two elongate first wooden strip members which are respectively provided with longitudinally extending grooves on
20 one sides thereof; an interpositioned composite member sandwiched between said one sides and filling said channel, said member including a shell of fiber reinforced plastic and a plastic foam core.

It is advantageous that said groove is a curve shape
25 in its cross-section. The racket frame may further comprise two second strip members for respectively adhering to other sides of said first strip members opposite to said one sides.

The presently preferred exemplary embodiment will be described in detail with reference to the following drawings, wherein;

5 Fig. 1 shows a racket frame of a preferred embodiment of the invention;

 Fig. 2 is a sectioned view of the frame taken along the line A-A of Fig. 1; and

 Figs. 3a to 3e illustrate the positioning for a
10 racket frame while conducting tests 1 to 5.

 Referring to the drawings, there is shown a racket frame 10 which includes a looped member 11, a shaft 12, and a handle 13. A throat piece 15 is provided between
15 the looped member and the shaft 12.

 The racket frame 10 is made of a structural member which includes two elongate ash strips members 22 which are respectively provided with grooves 23 at one sides thereof. Each ash strip 22 is further adhered to a
20 peach strip 21 to form a lamination. A thermosetting resin impregnated fiber is rolled to form a hollow member 25 and inside it is introduced a suitable amount of foamable polyurethane composition 29. The resultant resin impregnated fiber roll is then placed in the groove
25 23 of one ash strip 22 and then coupled to another ash strip 22 in such a manner that the resin impregnated fiber roll is sandwiched between the grooved sides of the

ash strips 22. The sandwich strips are then put into a mold and heated. Upon heating, the polyurethane composition expands and generates a pressure to cause the fiber reinforced plastic shell 25 to intimately bond to the inner side of the wood. In the fiber reinforced plastic shell 25 is formed a rigid polyurethane foam core 29. The presence of the foam core 29 contributes improvements in weight reduction and shock absorption characteristics to the racket frame 10.

10 The racket frame 10 constructed according to the invention exhibits improved mechanical properties when it is compared with two selected conventional racket frames of sandwich construction A & B by being subjected to the following tests.

15 TEST 1 (see Fig. 3A)

 The racket frame is clamped firmly at its handle end H and at point O of the looped head. A load of 30 kg is applied to the frame at a position 34.25 cm distant from point O. The deflection of the frame at the load point is then measured.

TEST 2 (See Fig. 3B)

 The racket frame is firmly clamped at its handle end H and a load of 6.9 kg is applied to the frame at point P which is 52.10 cm distant from the fixed end H. The deflection of the frame at the load point is measured.

TEST 3 (see Fig. 3C)

 The racket frame is firmly clamped at points Q and R of the looped head and successive impact forces are applied

to the point between Points Q and R by means of a hydraulic apparatus at a rate of 20 mm/ min. The maximum impact force exerted upon to the frame at the point of failure is then measured.

5 TEST 4 (see Fig. 3D)

The racket frame is suspended with its handle end being upward and clamped. A ball is shot to strike the racket frame with a pressure of 2000-3000 cm of water per sq.cm from an automatic ball shooting machine. The maximum
10 number of strokes that act on the frame until the point of failure is counted.

TEST 5 (see Fig. 3E)

The racket frame is clamped firmly at its handle end and at point S of the looped head. An impact pressure of
15 3.5 kg/sq.cm is successively applied to the frame and the number of impacts until the point of failure is measured.

The resultant data is shown in the following.

	Frame 10	Frame A	Frame B
Test 1	4-5 mm	5-6 mm	7-8 mm
20 Test 2	16-19 mm	18-21 mm	26-29 mm
Test 3	160-180 kg	150-170 kg	80-100 kg
Test 4	over 60,000	under 50,000	under 20,000
Test 5	over 60,000	under 50,000	under 50,000

25 With the invention thus explained, it is apparent that obvious modifications and variations can be made without departing from the scope of the invention. It is

therefore intended that the invention be limited only as indicated in the appended claims.

5

10

15

20

25

CLAIMS:

1. A racket frame having a looped member, a shaft, and a handle comprising a structural member which comprises:
two elongate first wooden strip members 22 which are
5 respectively provided with longitudinally extending
grooves 23 on one sides thereof;
an interpositioned composite member sandwiched between said
one sides and filling said channel, said member including
a shell 25 of fiber reinforced plastic and a plastic foam
10 core 29.
2. A racket frame as claimed in Claim 1, wherein said
groove 23 is a curve shape in its cross-section.
3. A racket frame as claimed in Claim 1, further
comprising two second strip members 21 for respectively
15 adhering to other sides of said first strip members 22
opposite to said one sides.

20

25

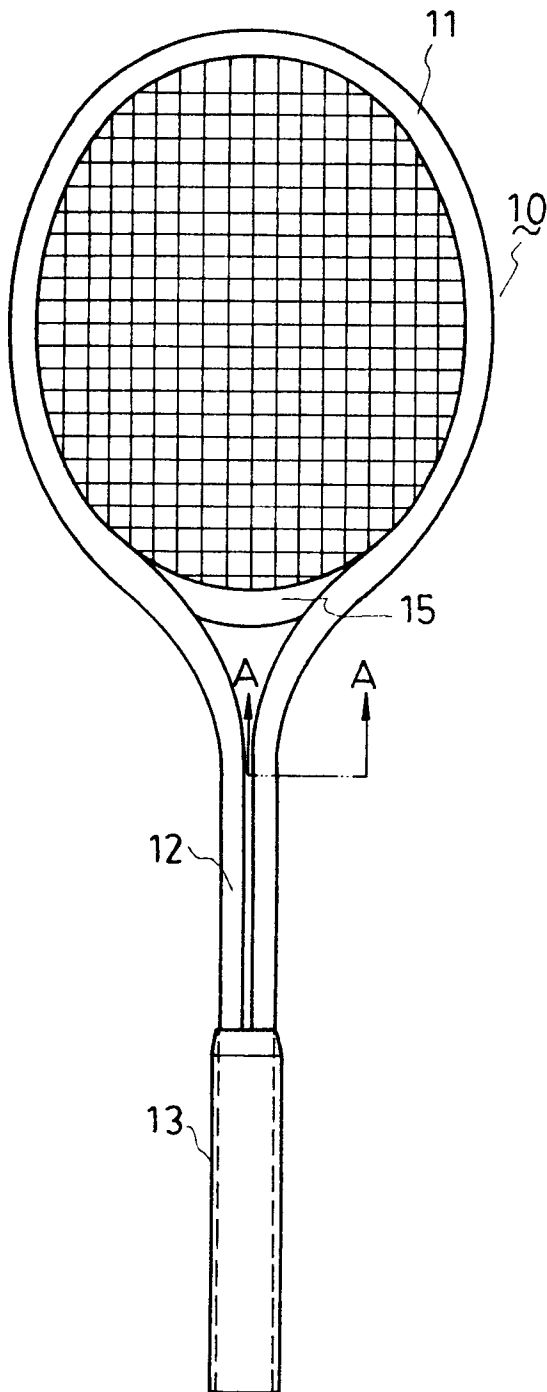


FIG. 1

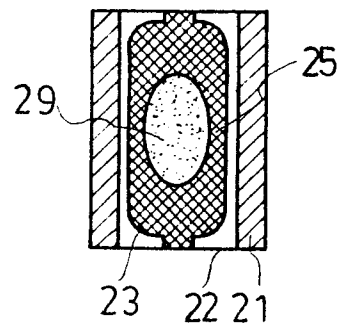


FIG. 2

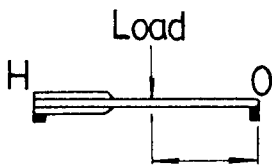


FIG. 3A

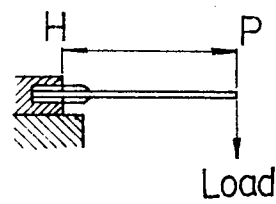


FIG. 3B

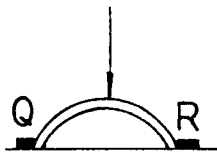


FIG. 3C

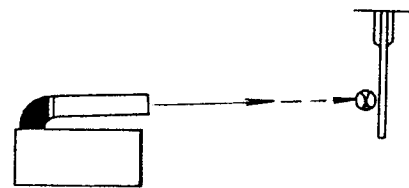


FIG. 3D

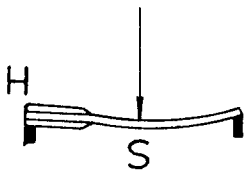


FIG. 3E



DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)
A	FR-A-2 507 090 (YOU) * Page 2, lines 13-28; figures 1,4,5,6 *	1-3	A 63 B 49/02 A 63 B 49/10
A	FR-A-2 115 776 (DONNAY) * Claims 1-4; figures *	1,3	
A	GB-A- 627 240 (DUNLOP) * Page 3, lines 5-16; figure 2 *	1	
A	FR-A-2 383 678 (GERBET)		
			TECHNICAL FIELDS SEARCHED (Int. Cl. ³)
			A 63 B
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 15-08-1984	Examiner GERMANO A.G.
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			