

DRAWINGS ATTACHED

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(54) IMPROVEMENTS IN OR RELATING TO RACKET FRAMES

(71) We, CARLTON SPORTS COMPANY LIMITED (formerly THE CARLTON TYRE SAVING COMPANY LIMITED), a British Company of Dunlop House, Ryder Street, St. James's, London, S.W.1. (formerly of Shirehill, Saffron Walden, Essex), do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to rackets and more particularly to frames for stringing for use in rackets such as badminton, tennis and squash rackets.

In this specification the term "frame" means the looped portion of a racket within which stringing is carried out, as distinct from the shaft of a racket which connects the frame to a handle.

According to the invention there is provided a racket having a frame for stringing, a shaft and a handle, in which the frame is of carbon-fibre-reinforced plastics material.

The racket frame, which contains suitable holes or apertures to receive the stringing, may be of unitary construction or of two or more sections. Where the frame is of two or more sections, the sections may be designed to interlock together and/or may be adhered together using a suitable adhesive or cement.

The frame may suitably be made, for example, by a moulding method and may therefore be moulded as a unitary construction or as a number of complementary sections. The plastics material from which the frame is made may be any suitable material and may be either thermosetting or thermoplastic. Examples of thermosetting materials that may be used include epoxy, polyester and phenolic resins and a frame made from such resins may suitably be formed by compression moulding.

Examples of thermoplastic materials that may be used include nylons, polycarbonates, polyphenylene oxides, (including modified polyphenylene oxides such as Noryl — supplied by General Electric Corporation, "Noryl" being a registered Trade Mark), polypropylene, polymethylpentene, polysulphones and acetal resins. A frame made from a thermoplastic material may suitably be formed by injection moulding.

The carbon fibres with which the plastics material is to be reinforced can be manufactured from organic polymeric fibres by controlled pyrolysis at temperatures up to 3,000°C. The resulting fibres of pure carbon have remarkable strength. The crystals of graphite in the fibres are preferentially aligned along the fibre axis rather than having a random orientation and the tensile strength of the fibres may be as high as 250,000 pounds per square inch or higher. The highest strength and highest modulus fibres are obtained from polyacrylonitriles and lower strength fibres are obtained from rayon.

The proportionate amounts of fibre and plastics material to be used in the racket frames of the invention may vary from for example 20% up to 75% by weight of carbon fibres. One example of a suitable material is "thermosetting moulding compound Grade XI", supplied by Courtaulds Ltd. This is an epoxy resin containing about 20% by weight of carbon fibres. However, as indicated above, compounds containing a much higher percentage of carbon fibres may be used if desired. Examples of suitable thermoplastic materials include a number of compounds supplied by Courtaulds Ltd., each containing 20% by weight of carbon fibres. These include nylon 6, nylon 66, polypropylene and polymethylpentene moulding compositions.

The shaft and handle of the racket of the

invention may be made of any material conventionally used. For example, the shaft may be of wood or metal or moulded plastics material and may be attached to the frame in any suitable manner, for example by means of adhesives. Where the shaft is of metal it may be tubular (i.e. hollow) or solid and it may be in the form of a single shaft or double shaft, as desired. The handle may be, for example, in the form of strip material which is wrapped around an end portion of the shaft, or a separate moulding which fits over the end of the shaft, to which it is adhered by any conventional means.

In an alternative embodiment, the shaft and/or the handle may also be formed from carbon-fibre-reinforced plastics material. Thus it is possible, if desired, to form the racket frame, shaft and handle as an integral moulding, or to mould the frame and shaft integrally for the attachment of a separate handle, or to mould the shaft and handle integrally for attachment to a separate frame.

As indicated above, the frame may be made as a unitary construction or as a number of complementary sections. In the preferred form of the latter embodiment the frame is moulded in two complementary sections. Preferably each section is a complete "loop" of the frame and the two sections mate together to give the required thickness of the frame. In other words the frame is made up of two sections which meet in a plane containing or parallel to the stringing of the finished racket. In one form of this embodiment the frame of the racket is formed from two sections which are identical mouldings. Each section of the racket frame therefore forms one half of said frame as defined by a plane bisecting the frame and containing the area to be strung. In this case, therefore, if the shaft and handle are also formed of carbon-fibre-reinforced plastics material, one half of each of said shaft and handle may be moulded integrally with each section of the frame. Thus a complete racket, apart from the stringing, can, if desired be formed from two mouldings secured together. Alternatively, as previously described, the shaft and/or handle may be separately formed items suitably assembled together with the frame.

In a further embodiment the racket frame is formed in two moulded sections which fit together in such a manner as to provide the required apertures for stringing. Again each section forms one half of the frame as defined by a plane bisecting the frame and containing the area to be strung. Thus each section is in the form of a looped moulding, and one side of each section is provided around said loop with a plurality

of protuberances, conveniently in the form of short right circular cylindrical projections. The protuberances may extend across the width of the respective section or may be set back from one or both edges thereof, but preferably said protuberances are set back from the edge of the section which is to be at the outer side of the frame so that recesses are formed at said outer side for accommodating stringing between adjacent apertures in the frame.

One specific form of this latter embodiment will be further described with reference to the accompanying drawings in which:

Figure 1 is a side elevation of a portion of a racket frame of two sections, and

Figure 2 is a sectional view along line 2-2 of Figure 1.

The racket frame consists of two moulded looped sections 11 and 12 of carbon-fibre-reinforced plastics material. Section 11 is provided with a row of integrally moulded protuberances 13 spaced along its inner face and section 12 is similarly provided with protuberances 14. The two sections of the frame are brought together to interlock so that stringing apertures 15 are provided between the protuberances. As shown in Figure 2 the protuberances are so positioned on the frame sections that a recess 16 is provided around the outside of the racket frame to accommodate the racket stringing 17 between adjacent apertures in the frame.

The two sections of the frame may conveniently be cemented together.

It will be apparent that the embodiments shown in the drawings may be varied in a number of ways. For example, the protuberances may be provided on one only of the two frame sections. Also one or both of the two sections may be provided with integrally moulded studs arranged to engage in corresponding holes or recesses in the other section so as to provide locating and additional joining means for the two sections. By way of example the studs may be provided on the projecting ends of the protuberances, the studs being of smaller size than the protuberances so that an annular shoulder is formed on the projecting end of each protuberance.

It will be appreciated that the racket frame formed as described above with reference to the drawings will have apertures therethrough from the inside to the outside of the frame, which apertures are arranged to be suitable for the application of stringing to the frame.

Furthermore, the apertures for stringing may, if desired be formed after the formation of a looped member for the racket frame, for example by drilling rather than

being provided by the shape of the frame itself. This is particularly applicable where the racket frame is formed as a unitary moulding.

- 5 The use of carbon-fibre-reinforced plastics material for a racket frame has the advantage that the frame can be made both stiff and strong and yet light in weight. Moreover, carbon-fibre-reinforced plastics material has the property of high elasticity
10 which is desirable for racket frames, especially tennis racket frames.

WHAT WE CLAIM IS:—

- 15 1. A racket having a frame, as hereinbefore defined for stringing, a shaft and a handle, in which the frame is of carbon-fibre-reinforced plastics material.
20 2. A racket according to Claim 1, in which the frame is a unitary moulding.
3. A racket according to Claim 1, in which the frame is formed as two complementary mouldings.
25 4. A racket according to Claim 3, in which each of said complementary mouldings forms one part of the frame as defined by a plane bisecting the frame and containing the area to be strung.
5. A racket according to Claim 3 or 4,

in which one or both of the complementary 30 mouldings are provided with a plurality of spaced protuberances, the protuberances and spaces between them defining stringing apertures in the frame when the two mouldings are brought together. 35

6. A racket according to any one of the preceding Claims, in which the shaft and handle are also of carbon-fibre-reinforced plastics material.

7. A racket according to Claim 6, which 40 is a unitary moulding.

8. A racket according to any one of the preceding Claims, in which the plastics material is a thermosetting resin.

9. A racket according to Claim 8, in 45 which the thermosetting resin is a polyester, epoxy or phenolic resin.

10. A racket according to any of claims 1-7, in which the plastics material is thermo- 50 plastic.

11. A racket according to Claim 1, substantially as hereinbefore described.

12. A racket substantially as hereinbefore described with reference to and as shown in the accompanying drawings. 55

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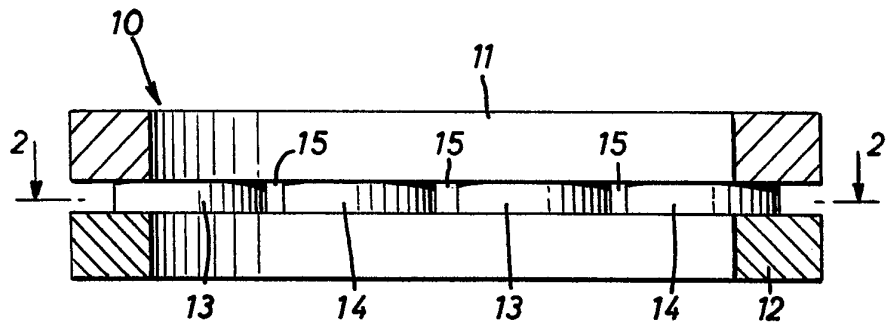


FIG. 1

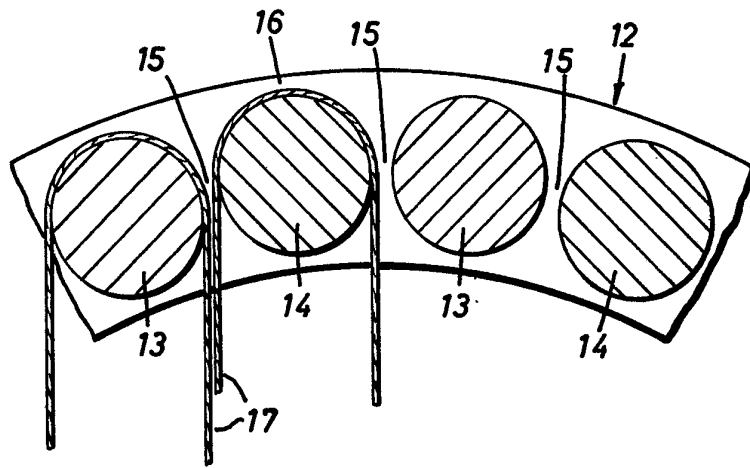


FIG. 2