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(71) Applicant: **GOSEN CO., LTD., No. 4 Bungo-Machi, Higashi-Ku Osaka (JP)**
Applicant: **Van Rijswijk, Jacob, Postbus 123 Industrieweg 53D, NL-2650 AC Berkel Rodenrijs (NL)**

(72) Inventor: **Ohara, Tamanosuke, 254, Yura, Yura-cho, Sumoto-City Hyogo-ken (JP)**

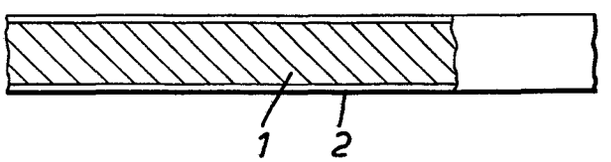
(74) Representative: **Barry, Patrick James et al, ABEL & IMRAY Northumberland House 303-306 High Holborn, London, WC1V 7LH (GB)**

(54) Improvements in and relating to racket strings.

(57) A racket string is provided comprising a string body having an outer coating which is formed from a dispersion of particles of fluororesin having an average diameter of substantially less than 20 microns in a suitable dispersing medium.

Suitably the fluororesin is a fluorinated ethylene resin, especially a tetrafluoroethylene resin. Such a resin preferably has an average particle diameter in the range of from 0.1 to 10 microns, especially of 0.3 microns.

Such a racket string has been found to withstand high tensions present during stringing and also, when incorporated into a racket, wear of the string due to hitting and due to adherence of sand and dust, etc. during play.



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"Improvements in and relating to racket strings".

The invention relates to racket strings and more particularly to a racket for use in tennis, badminton, squash, etc., incorporating such a string.

Generally, materials for natural or synthetic strings suitable for use as strings for rackets are conventionally classified into natural materials such as animal parts (commonly referred to as gut), e.g. intestines of sheep, whale tissue, etc., and synthetic polymeric material, for example, synthetic resins such as polyamide, nylon, etc. In stringing a racket, the synthetic resin or natural string is stretched onto the racket and after the longitudinal strings have been formed, the lateral strings are threaded through the longitudinal strings at a high tension; in so doing friction between the longitudinal and lateral strings may readily cause damage to the strings. It has been usual to apply oils, for example, paraffin oil or silicone oil, to the string at the time of stretching the string onto a racket or to apply such oils or polyolefin or various wax emulsions to the string at the time of manufacture of the string to reduce the incidence of damage to the string during racket stringing and wear of the string due to frictional heat produced between longitudinal and lateral strings during play.

With racket string coatings of this kind, their effectiveness is often short-lived and the protection against friction damage is often reduced during stringing to high tension, after prolonged play or because grit, sand, dust, etc. sticks to the string.

It is an object of the present invention to provide an improved racket string, which prevents, for a substantial period of time, damage to the string at the time of stringing the racket or wear of the string when the racket is in use. It is a further object of the present invention to produce a racket string which can withstand the very high frictional wear occasioned by stringing rackets to a high tension.

The present invention provides:

a racket string comprising a string body having an outer coating characterised in that the coating is formed from a dispersion of particles of fluororesin having an average diameter of substantially less than 20 microns in a suitable dispersing medium.

Suitably the fluororesin is a fluorinated ethylene resin, especially a tetrafluoroethylene resin. Such a resin preferably has an average particle diameter in the range of from 0.1 to 10 microns, especially of 0.3 microns.

A string constructed in accordance with the present invention will now be described, by way of example only, with reference to the accompanying drawings in which:-

Figure 1 is an enlarged longitudinal sectional view of a string, and

Figure 2 is a perspective view of a racket as used in a frictional cutting test of a racket string.

Referring to Figure 1 of the accompanying drawings, the string generally includes a string body 1 made, for example, of synthetic resins, for example, polyamide group synthetic fibres, or natural materials, for example, intestines of sheep and whale tissue, and a coating film 2 formed around the surface of the string body 1. The coating film 2 is formed by applying a dispersion of particles of a fluororesin, suitably a tetrafluoroethylene resin (dispersed either in a solvent or in a molten resin liquid), to the surface of the string body 1. The coating may be applied with a spray, or by passing the string body 1 through the dispersion, after which the coating film 2 is dried.

It has been found that a string when provided with the coating film 2 is less susceptible to damage than conventional strings, the coating providing a bearing or low friction effect which improves the wear resistance of the string.

To improve the adherence of the fluororesin dispersion to the surface of the string, the string may be formed with recessed portions. In the case of a string made from two or more synthetic polymeric monofilaments such recesses can be formed by the gaps between the monofilaments if they are twisted or plaited together or if one or more monofilaments are wound (preferably helically) round a core (formed by one or more monofilaments).

It has also been found that best results are obtained if the fluororesin (preferably tetrafluoroethylene resin) particles have an average particle diameter in the range of from 0.1 microns to 10 microns and preferably of about 0.3 microns.

If the average particle diameter is 20 microns or more the aforesaid bearing effect is less pronounced and the wear-resistance of the string is commensurately reduced. It is thought that this is because not enough of the fluororesin particles adhere to the string (even if the particles are incorporated in a suitable dispersion) during the coating process and, as a result, the final coating is made up predominantly of the dispersing medium.

A result of a frictional cutting test (described in detail below) using three specimen strings A, B and C, will now be described. Specimen A is prepared by passing a string body of polyamide resin prepared by an ordinary method (for example, a 0.16 mm diameter winding string wound doubly around a 0.8 mm diameter core string) through a dispersion of 4%, by weight, tetrafluoroethylene powder or paste having an average particle diameter of 0.3 microns in a dispersing medium mainly composed of 1, 1, 1 trichloroethane, and drying the coating sticking to the string body. Specimen B is a conventional string having a similar body to string A but not treated with tetrafluoroethylene and Specimen C is prepared by applying tetrafluoroethylene powder or paste having an average particle diameter of 20 microns to a string body (again similar to that of string A).

(Specimen)	(No. of times for cutting longitudinal string)	(Average No. of times)
A	39 - 47	41
B	1 - 3	2
C	3 - 5	4

As shown in Figure 2, the frictional cutting test can be performed after 18 columns of longitudinal strings 11a have been stretched on an ordinary (e.g. wooden) tennis racket 10 at a tension of about 70 pounds and seven rows of lateral strings 11b have been stretched on the racket 10 from the longitudinal uppermost portion thereof at a tension of 70 pounds. The portion of string extending (by about 1.5 m) to one side of the racket 10 is then repeatedly pulled (e.g. manually) to its full length (i.e. 1.5 m per stroke) until any of the longitudinal strings 11a is cut apart.

As can be seen from the above test results, the string A has a 10 to 20 times greater wear resistance than a conventional string or a string coated with a dispersion of tetrafluoroethylene particles of average particle diameter of 20 microns.

String A can not only better withstand high tension during stringing of the racket, but also lessens wear of the string produced at the points of intersection between longitudinal and lateral strings at the time of hitting of balls and wear due to the presence of sand and dust, etc., at the time of playing when incorporated into a racket.

Claims:

1. A racket string comprising a string body having an outer coating characterised in that the coating is formed from a dispersion of particles of fluororesin having an average diameter of substantially less than 20 microns in a suitable dispersing medium.

2. A racket string as claimed in claim 1, wherein the fluororesin is a tetrafluoroethylene resin.

3. A racket string as claimed in claim 1 or claim 2, wherein the particles have an average diameter of in the range of from 0.1 to 10 microns.

4. A racket string as claimed in claim 3, wherein the particles have an average diameter of 0.3 microns.

5. A racket string as claimed in any one of claims 2 to 4, wherein the dispersion used contains 4% by weight of tetrafluoroethylene particles.

6. A racket string as claimed in any one of claims 1 to 5, wherein the dispersing medium is an inert organic solvent or a mixture of two or more such solvents.

7. A racket string as claimed in claim 6, wherein the solvent comprises 1,1,1-trichloroethane.

8. A racket string as claimed in any one of claims 1 to 5, wherein the dispersing medium is a molten resin.

9. A racket string as claimed in claim 8, wherein the molten resin comprises molten polyamide resin.

10. A racket string as claimed in any one of claims 1 to 9, wherein the dispersion is sprayed onto the string and the coated string is then dried.

11. A racket string as claimed in any one of claims 1 to 9, wherein the string body is passed through the dispersing medium and the coated string is then dried.

12. A racket string as claimed in any one of claims 1 to 11, in which the string is provided with recessed portions to facilitate adherence of the fluororesin particles.

13. A racket which incorporates a string as claimed in any of claims 1 to 12.

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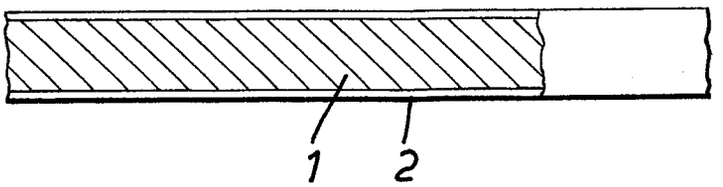

FIG. 1.

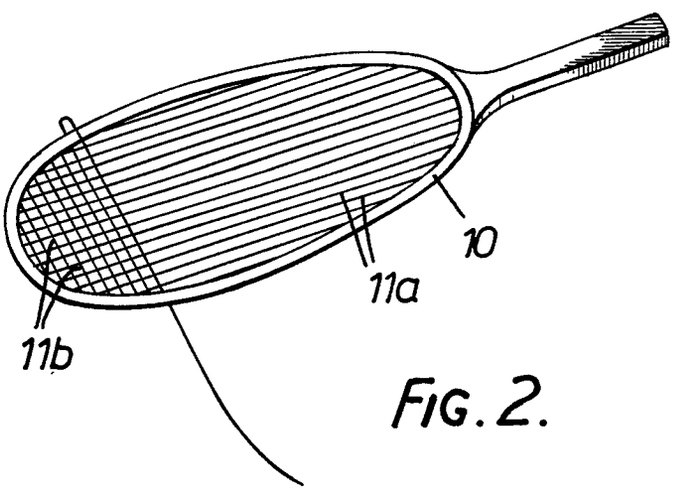

FIG. 2.

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EUROPEAN SEARCH REPORT

0086285
Application number

EP 82 30 0662

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)
X	US-A-3 920 658 (BENSON) * Column 1, line 42 - column 3, line 21; claims *	1-4,6-9,11	A 63 B 51/02 A 63 B 51/10
A		5,13	
X	US-A-4 238 262 (FISHEL) * Column 2, lines 11-27; figures *	1,10	
A		6-9,13	
X	DE-A-1 428 810 (BABUCKE) * Page 2, paragraph 3; page 3, paragraphs 1-3 *	1,10, 11	
A		2-4,9, 13	TECHNICAL FIELDS SEARCHED (Int. Cl. ³) A 63 B
A	US-A-4 306 410 (NAKAMURA) * Column 4, lines 7-28; figure 1 *	1,2	
A	US-A-4 300 343 (NAKAMURA) * Claims 1-4 *	1,2	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	10-11-1982	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
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E : earlier patent document, but published on, or after the filing date
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L : document cited for other reasons

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