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N. G. MADGE ET AL

2,091,999

RACKET STRING

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Fig. 1.

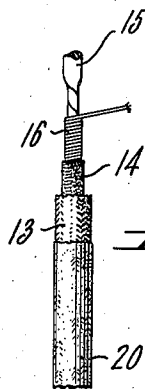
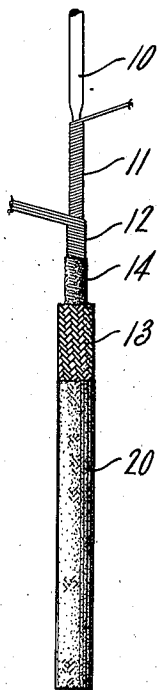


Fig. 3.

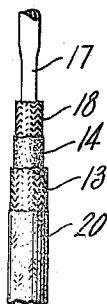


Fig. 4.

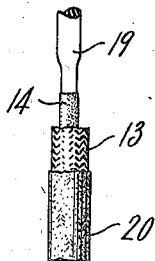


Fig. 5.

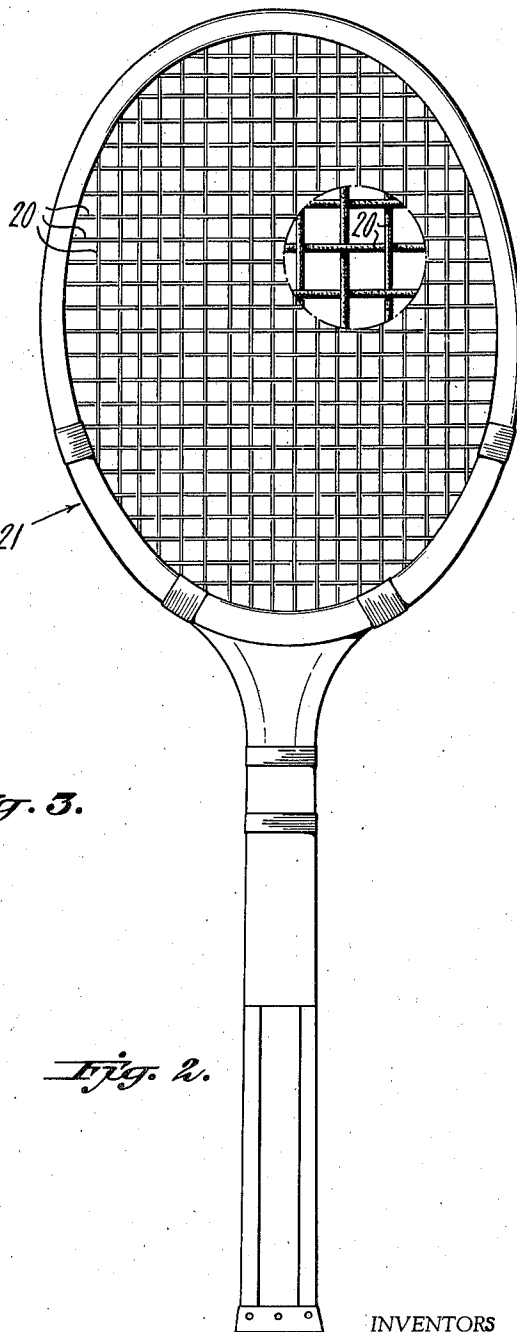


Fig. 2.

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RACKET STRING

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6 Claims. (Cl. 96—26)

This invention relates to a braided string which is approximately as strong as a high grade gut string of the same size and is sufficiently resilient and durable to remain tight and alive when used in a racket.

Tennis rackets for many years have been strung with carefully prepared gut strings, and while high grade gut when strung tight forms an excellent racket, such strings are expensive and are injuriously affected by the moisture of the atmosphere.

Silk strings have also been employed heretofore in stringing rackets and while silk strings are cheaper than gut and are less sensitive to moisture, they lack the resiliency or aliveness of gut strings.

The present invention, therefore, relates to a strong, durable and resilient string that is well adapted for use in rackets as a substitute for gut and which compares favorably to gut in strength, durability and resiliency, while it is less sensitive to moisture than gut.

The string of the present invention consists primarily of a rubber core having a strong outer cover tightly braided thereupon to form a tube that holds the core longitudinally extended and circumferentially compressed. The effect of this is to provide the braided tube with an internal cushion that exerts an expanding pressure upon the inner wall of the tube to keep it inflated.

This is important because when braid is subjected to a strong longitudinal tension the crossing strands tend to move into parallel relation to exert a scissor-like cutting action upon each other. This scissor-like action is avoided in the present construction by the inflating pressure of the compressed core upon the inner wall of the braid, as the longitudinal pull upon the braided strands is resisted by their pressure upon the core rather than by the shearing pressure of one strand against another.

Strings have been proposed heretofore consisting of a non-elastic core and a braided tubular covering but if these strings are subjected to severe longitudinal tension the core may be ruptured before the tubular braid breaks, in which case a gap is formed in the core that permits the diameter of the tube to contract at this point. This allows the braided strands to exert a shearing action upon each other at this point. Through the employment of an elastic core as herein contemplated the core will stretch with the braid and internally support the braided tube throughout its length to thereby prevent

the crossing strands of the braid from exerting a scissor-like action upon each other.

One important feature of the present invention resides in a resilient string which is capable of exerting a longitudinal contractive force far in excess of the strength of its rubber core. This is secured by applying the braid so tightly about the rubber core that it holds the core longitudinally extended and circumferentially compressed, with the result that when the braided tube is stretched longitudinally and then released the lateral expanding action of the core upon the inner wall of the tube apparently expands the tube to impart a strong longitudinal contracting force to the braid.

Another important feature resides in a construction in which the rubber core is not only tightly embraced by the surrounding braid but is also strongly bonded thereto by an adhesive binder that prevents slippage between the braid and the core as the braided string stretches and contracts.

A further feature resides in a construction in which the tightly braided tube is rendered substantially impervious to moisture by a coating of water-proofing material.

The above and other features of the invention will be more fully understood from the following description when read in connection with the accompanying drawing illustrating good practical embodiments thereof, wherein:

Fig. 1 is a side elevation of a resilient braided string constructed in accordance with the present invention;

Fig. 2 is a plan view of a tennis racket strung with the string of Fig. 1;

Fig. 3 is a view similar to Fig. 1 showing a modified construction in which a single spirally wound cover is provided between the rubber core and outer braid;

Fig. 4 shows a further modification in which a braided cover is provided between the rubber core and outer braid; and

Fig. 5 shows a further modification in which the inner cover has been omitted between the core and outer cover.

The resilient string of the present invention may be employed in tennis, squash and badminton rackets and for other purposes, and as shown in Fig. 1 comprises a rubber core 10 about which is helically wound in one direction a first cover 11 and is helically wound in the opposite direction a second cover 12. The cover 11 is shown as formed of a single strand of textile material such as cotton while the second cover 12

is formed of three such strands laid side by side.

The covered core of Fig. 1 is held under considerable tension while the braided outer cover 13 is being formed thereupon, and before the braid is applied a thick coating of a plastic adhesive binder 14 is preferably applied to the cover 12 so that this binder will work its way in between the strands of the covers 11 and 12 and between the crossing strands of the braid 13 so as to firmly bond these covers together to prevent the stretched rubber core from slipping or creeping in the braided tube when the finished strand is in use. After the braid is formed the excess adhesive may be wiped from the outer face thereof.

It is important that the braid 13 be extremely strong and be tightly applied about the core 10 while the diameter of the core is reduced by the stretching of the core at this time. The braid is preferably formed of silk strands which in the construction shown are braided together by the well known two-up and two-down construction shown. It is also important that the adhesive binder be strong and flexible so that it will not be injured by the stretching, flexing and bending of the finished string but will bond the covers together.

After the braid is applied and before the adhesive binder sets, the string is preferably stretched under high tension and dried in this condition, and the string may be repeatedly wetted and dried under tension to stretch the same to approximately its limit of elongation. As the adhesive 14 sets or solidifies in the interstices of the braid it will hold the core and braid well extended, but the present string, even when stretched to approximately its limit of elongation will not take a permanent set but will retain its resilient property to a substantial degree.

The term resilient has been herein used to designate that property of the highly stretched string to exert a contractive force far in excess of that possessed by the rubber core alone. It is this property which produces a "live" racket and keeps the strings tight over a long period of use. The various elements which serve to impart this resilient property to the string are not fully understood but it is believed it is caused primarily by the lateral pressure which the rubber core exerts upon the inner wall of the braided tube to yieldingly resist the elongation of the tube.

In order that a clearer understanding of the construction of the resilient string of the present invention may be had, an example of one satisfactory construction is given as follows:

Round rubber core of extruded latex size 30's
 Inner cover-----cotton-- 1-24/1
 Second cover-----do----- 3-24/1
 Braided outer cover formed of 16 braided strands each comprising 1 end of 20/22 9 thread 3 ply glazed boiled-off silk.

The adhesive binder 14 may be formed of a mixture containing animal glue, glycerine and castor oil, and the covered core is preferably maintained at over 100 percent stretch while the outer cover is being braided thereupon.

The foregoing example is but one of a number of constructions that have been made. Obviously many variations may be made in the size of the core 10 and in the construction of each of the covers 11, 12 and 13 and the binder 14 within the scope of the present invention.

In the modification of Fig. 3 the rubber core 15 has a single textile cover 16 wound helically

about the core and the core is shown as twisted in an opposite direction to that of the winding of the cover 16 to produce a balanced effect. The elastic yarn 15, 16 may be provided with a plastic adhesive binder 14 and outer braided cover 13 such as above described. In the construction of Fig. 4 the rubber core 17 is provided with an inner braided cover 18 over which is applied the binder 14 and outer braided cover 13, and in the construction of Fig. 5 no textile cover is provided between the rubber core 19 and outer braided cover 13, but the outer cover is applied directly over the core and is secured thereto by the binder 14. In each of these constructions the size of the rubber core or inner core should be such that the outer braided cover 13 will hold the core circumferentially compressed.

After the resilient string of the present invention has been repeatedly stretched by wetting and drying the same under tension as above described, it may be rendered waterproof by treating its outer surface with a flexible waterproofing material such as lacquer 20. The finished string may then be strung in a racket 21 in the usual manner as shown in Fig. 2. This braided string is not only resilient, strong and durable but its braided surface appears to afford a better grip upon the ball than the racket strings used heretofore. Furthermore, the gut and silk strings used heretofore have depended largely upon the twist of the string for strength and durability and a slight untwisting of such string would materially reduce its strength and wearing property, by providing the present string with a braided outer cover this difficulty is avoided.

While it is not fully understood just why the present string remains resilient when stretched nearly to its breaking point and is capable of exerting a contractive force far in excess of the strength of the bare rubber core, it is found that when this string is used in a racket it has the property of deforming under the blow of the ball and of returning to its former taut condition like a high grade gut string. In this respect it differs from the twisted and braided silk strings proposed heretofore but which lacked the rubber core, for such proposed strings were deficient in this property of deforming under the impact of the ball and return to the original state.

Having thus described our invention what we claim and desire to have protected by Letters Patent is:

1. A resilient string approximately as strong as a high grade gut string of the same size, comprising a tensioned rubber core, a strong outer cover tightly braided about the core as a tube and adapted to hold the core extended longitudinally and compressed circumferentially to cause it to exert a lateral inflating pressure upon the inner wall of the braided tube to thereby impart to the string a contractive force far in excess of the strength of the rubber core.

2. A resilient string approximately as strong as a high grade gut string of the same size, comprising a tensioned rubber core, a textile cover formed about the core, a strong outer cover tightly braided about the covered core as a tube and adapted to hold the core extended longitudinally and compressed circumferentially to cause it to exert a lateral inflating pressure upon the inner wall of the braided tube to thereby impart to the string a contractive force far in excess of the strength of its rubber core, and a strong adhesive bond between said braid and covered core.

3. A resilient racket string strong enough to be

strung as tight as a high grade gut string of similar size, comprising a tensioned rubber core, a cover helically wrapped about the core, a strong outer cover tightly braided upon the covered core as a tube to hold the core stretched, and an adhesive bonding agent forming a bond between the braid and covered core and adapted to fill the interstices of the braid and hold the braid and core extended nearly to the maximum elongation of the former so that the rubber core exerts a strong inflating pressure upon the inner wall of the braided tube and causes the racket string to exert a contractive force far in excess of the strength of the rubber core.

4. A resilient racket string strong enough to be strung as tight as a high grade gut string of similar size, comprising a tensioned rubber core, a strong outer cover tightly braided about the core as a tube to hold the core stretched, and an adhesive bonding agent forming a bond between the braid and core and adapted to fill the interstices of the braid and hold the braid and core extended nearly to the maximum elongation of the former so that the rubber core exerts a strong inflating pressure upon the inner wall of the braided tube and causes the racket string to exert a contractive force far in excess of the strength of the rubber core.

5. A resilient racket string approximately as strong as a high grade gut string of the same size,

comprising a tensioned rubber core, a first and second cover wrapped helically about the core in opposite directions, a strong outer cover tightly braided upon the cover core as a tube to hold the core stretched, and a bonding agent forming a flexible bond between the braid and covered core and adapted to fill the interstices of the braid and hold the braid and core extended nearly to the maximum braid elongation so that the rubber core exerts a strong inflating pressure upon the inner wall of the braided tube and causes the racket string to exert a contractive force far in excess of the strength of the rubber core.

6. A resilient racket string approximately as strong as a high grade gut string of the same size, comprising a tensioned rubber core, a textile cover upon said core, a strong outer cover tightly braided upon the covered core as a tube to hold the core stretched, and a bonding agent forming a flexible bond between the braid and covered core and adapted to fill the interstices of the braid and hold the braid and core extended nearly to the maximum braid elongation so that the rubber core exerts a strong inflating pressure upon the inner wall of the braided tube and causes the racket string to exert a contractive force far in excess of the strength of the rubber core.

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