

TAKRAW BALLS

Introduction

This invention relates to takraw balls and it particularly relates to takraw ball strips of plastics material, takraw balls woven from takraw ball strips and methods of manufacture of takraw ball strips.

Background

Sepak Takraw is played by opposing teams passing a takraw ball across a chest-high net using feet, knees, head, shoulders etc., i.e. every part of the body except the player's hands and arms. The object of the game is to ground the ball in the opposing team's court; the rules of the game are similar to volleyball. Another form of takraw is hoop takraw, only one team plays at a time and the players co-operate to get the ball into a vertically orientated hoop some 5 meters above the ground.

Prior Art

Document GB-A-2,196,861 (Lorhpiat) describes the manufacture of traditional takraw balls by conventionally weaving split rattan strips into a spherical basket and the manufacture of takraw balls by forming strips of plastics material into interwoven hoops. As shown by FIG. 1 of Document GB-A-2,196,861, a takraw ball 1 has a spherical structure woven from strips 2, 3 of plastics material with a regular array of openings.

Document WO-A-95/28206 (Satian Industries Co. Ltd.) discloses a takraw ball woven from strips at least a majority of which are composite strips having one component part of soft material and another component part of springy material; the soft material and the springy material being selected to produce a given bounce characteristic. In an embodiment the composite strip is formed and arranged such that, when woven into a ball, at least the exposed outer surface of the ball is constituted by said soft part.

A problem with takraw balls made in accordance with Document WO-A-95/28206 is the maintenance of bounce characteristics with regulation ball weight and size against impact force absorption (softness). For example, a regulation Sepaktakraw ball shall be spherical of one woven layer having 12 holes, 20 intersections. It shall be made of synthetic fibre or natural rattan. If it is made of rattan, it shall consist of 9-11 strains.

The circumference shall not be less than 0.42 m and not more than 0.44 m (0.43 m to 0.45 m for women). The weight before play shall not be less than 170 gm and not more than 180 gm (150 gm to 160 gm for women). For more information see www.takrawworld.com. a reduction in diameter to 0.40 m is currently being
5 proposed, as is a larger 0.425m 190 gm ball.

Object

It is an object of the present invention to increase the impact or shock absorption of a regulation takraw ball, whilst retaining requisite bounce characteristics and/or
10 durability.

Statement of Invention

According to the present invention, a takraw ball strip of springy material has pads of soft material on one strip face with at least part of the periphery of each pad bounded
15 by the strip face. A takraw ball strip is herein defined as a strip of thin, elongate, springy material that can be joined by its ends to form a hoop and woven into a takraw ball. The strip face boundaries have one or more of the following functions:-

- to lend stiffness to the strip;
- to protect pad edges;
- 20 to assist in mounting pads onto the strips.

According to an embodiment of the present invention, each takraw ball strip has recesses to receive pads.

25 According to a further embodiment of the present invention, the takraw ball strip has a convex-side edge with a radially thickened boundary lip, at least in the vicinity of a recess.

According to a yet further embodiment of the present invention, the takraw ball strip
30 has a sinusoidal-side edge with a radially thickened boundary lip, at least in the vicinity of a recess.

The pads may have a rounded and longitudinally ribbed upper surface and taper both transversely and longitudinally.

A method of manufacturing a takraw ball strip according to the present invention comprises the steps of:-

- 5 i) moulding a strip of springy material;
 and,
 ii) moulding pads of soft material to a face of the strip;
the strip face being formed to bound at least part of the periphery of each pad.

An embodiment of the method of the present invention comprises the steps of:-

- 10 i) moulding the strip face with a series of recesses;
 and,
 ii) moulding the pads into the recesses.

15 The present invention also includes takraw balls woven from takraw ball strips in accordance with the present invention. In a takraw ball in accordance with an embodiment of the present invention, the pads are limited to only those areas of the takraw ball strip which, when woven into a ball, constitute the exposed outer surface thereof.

20 The above and further features of the present invention are illustrated, by way of example, in the Drawings, wherein:-

- Fig. 1 is a plan of a takraw ball strip in accordance with a first embodiment of the present invention and prior to moulding pads thereon;
- 25 Fig. 2 is an enlarged cross-section through a strip recess on the line I-I of Fig. 1;
- Fig. 3 is an enlarged plan detail of the strip and some of the recesses of Fig. 1;
- Fig. 4 is a plan of a strip in accordance with the first embodiment with pads moulded thereon;
- 30 Fig. 5 is an enlarged cross-section through a pad and recess on the line II-II of Fig. 4;
- Fig. 6 is an enlarged longitudinal section through a pad and recess on the line III-III of Fig. 4;

and,

Fig. 7 is an enlarged plan detail of the strip and some of the pads and recesses of Fig. 4.

- 5 The takraw ball of the present invention is a development of the takraw balls described in Document GB-A-2,196,861 (Lorhpiat) and WO-A-95/28206 (Satian Industries Co. Ltd.); both of which documents are incorporated by reference herein.

10 Figs 1 to 3 show a takraw ball strip 10 to be a, thin, elongate, generally flat moulding of springy, thermo-plastic material, such as an engineering plastic, having a convex-side edge 12 of constant radius and the other side edge of sinusoidally undulating profile having five equispaced peaks 14 and intervening troughs 16. Each trough is also asymmetric, with a notch 18 to one side thereof.

- 15 One end 20 of the strip 10 tapers to a point and has a hole 22 whilst the other end 24 has a depression 26 in the upper face 28; the depression 26 being shaped to accommodate the pointed end of the strip and leave a flush upper surface to the hoop joint. A pop rivet (not shown) is passed through hole 22 and a complimentary hole drilled through depression 26 to join the ends of the strip 10 together and form a
20 frusto-conical hoop.

The strip is approximately 40.5 cm. long, has a maximum width of 2 cm. and a maximum thickness of 3 mm. It is moulded from a polyolefin blend, that is a homogeneous blend including polyethylene and polypropylene the proportions of
25 which are varied to suit the particular application for which the takraw ball is to be used; from beginners to amateurs to professional competition players.

The upper strip face 28 has a series of five moulded, generally rectilinear recesses 30_{a,b,c,d,e} in the regions of the peaks 14 and equispaced between the troughs 16. The
30 boundaries of each recess define a side edge lip 32, parallel to convex-side edge 12, a pair of opposed transverse ends 34_{a,b} and a peak-side lip 36, parallel to peak 14. Each recess has a series of three longitudinal, U-section grooves 38_{a,b,c} and a fourth, flat-bottomed, wider groove 40, proximate peak-side lip 36. In an alternative,

unillustrated, embodiment the U-section grooves may be formed with an undercut; either during moulding or pressed-in after moulding.

Pads 42_{a,b,c,d,e} of soft resilient material are provided in respective recesses 30_{a,b,c,d,e}.

5 Takraw ball strips 10 are placed in a mould wherein the pads are injection moulded to the strip; the mould is arranged so that maximum temperature occurs at the or each cavity gate, which is aligned with a recess into which a pad is to be moulded. The temperature is sufficient melt the recess surface without melting the surrounding upper face of the strip and provides good adhesion between the pad and recess.

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We have found that, for a maximum pad thickness of 3 mm., spongy materials such as polyurethane (PU) or polyethylene (PE) foam do not provide sufficient shock absorption; although they have light weight. Elastomeric materials such as a thermoplastic elastomer (TPE) and synthetic rubbers, such as polypropylene (PP)

15 have proved to provide sufficient shock absorption within the above-given pad thickness limit. However, these materials are relatively heavy (PP density is 0.98, and TPE is 1). This constrains ball design. The greater the thickness of TPE, the softer the feel and greater shock absorbency, the ball can provide. However, the greater the thickness of TPE, the lighter the takraw ball strip has to be to meet overall total ball

20 weight. If the weight of the takraw ball strip is reduced, the thickness of takraw ball strip is forced to be thin with consequential loss of bounce. The design of takraw balls in accordance with the present invention has been optimised to provide a ball with requisite bounce characteristics, weight and circumference within the regulation range and sensible, soft feel and shock absorption.

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The takraw ball strip has been designed to have maximum bending moment or modulus with minimum weight. Referring to Fig. 2, maximum strip radial thickness has been retained along the whole length of convex-side edge 12; strip thickness tapering towards the sinusoidal edge 14, 16. This effectively leaves that boundary of

30 recess 30 parallel to strip side edge 12 as a stiffening lip 32. The grooves 38, 40 within the recesses both locally reduce strip thickness (saving weight) and provide mechanical keys to improve adhesion between pad and strip. The broader recess surface 44 between groove 38_c and 40 also helps to locally stiffen the strip and the increased surface area of groove 40 again improves the bond between pad and strip.

The mechanical bond is further improved by the aforesaid, unillustrated, undercut grooves.

The pads 42 are moulded to have a curved upper surface, as shown in Figs 5 and 6, with the peak-side edge 48 and transverse ends 54_{a,b} all lower than the opposed recess boundaries 36, 34_{a,b} respectively. Strip, peak-side, boundary 36 is a radially thickened lip higher than pad peak-side edge 48 so that, when a ball hits a floor surface, it falls on the "sweet spot" constituted by the pad surface proximate peak-side edge 48. If the ball hits the floor surface at a glancing angle, the pad peak-side edge will be subjected to a shear force generated by side thrust on the ball and this will tend to peel the soft pad from the takraw ball strip, little-by-little shortening the pad life. Strip recess peak-side boundary 36 is an upstanding lip protecting the pad from being damaged by such shear forces. As hooped strip side edges 12 abut one another in a woven takraw ball, there is no need to similarly protect pad side edge 50; indeed this edge need not be tapered and can be of equal or greater radial height than convex-side lip 32.

When a ball hits the floor or when it is struck, the whole ball is squeezed into an ovoid shape, with hooped strips displacing and sliding over one another, especially at intersection points (See Page 2 lines 95 to 110 of Document GB-A-2,196,861). One hooped strip often slides over or on top of the pad on an adjacent hooped strip, returning to an original, rest position when the ball bounces back from the floor and resumes a spherical shape.

We have found that moulding the pad to leave free an approximately 2 mm. wide length 52 of recess 30 immediately inside convex-side lip 32 and to leave transverse pad ends 54_{a,b} each short of recess transverse ends 34_{a,b} assists a displaced, overlying hooped strip to return to its rest position; i.e. it reduces overlying hoops from binding one on another. The coefficient of friction of the softer pad material is inevitably greater than that of the springy strip material and resists sliding of an overlying hooped strip. Also, this 2 mm free margin provides a flat surface to the edge of the pad mould so that, during the moulding process, pad material does not leak out of the designed pad area; to leave moulded strips with neat, clearly defined, flash-free edges that do not require post-moulding trimming.

The curved shape of the pad provides maximum height at the central area thereof, to maximise cushioning; whilst the transverse and longitudinal tapering of the pad also assist return of displaced hooped strips. Additionally, the taper of the pad surface
5 towards peak-side edge 40 assists in preventing peeling of that side edge from the recess.

The upper surface 56 of the soft pad 42 has longitudinal ribs, to reduce weight of pad material.
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The transverse taper of the strips and the curved shape of the pads also contribute to the overall spherical shape of a woven ball.

A takraw ball is woven from pairs of hooped strips; each formed by a takraw ball strip
15 10 as shown by Figs 1 to 7.

In a further, unillustrated embodiment the takraw ball is woven with an additional central hoop positioned between opposed side hoop pairs and is generally equivalent to central hoop 3 of Document GB-A-2,196,861 (Lorhpiat) or centre strip 26 of
20 Document WO-A-95/28206 (Satian Industries Co. Ltd.). The effect of a central hoop is that the weave of the ball can be looser than with a two-hoop ball; resulting in a softer feel to the ball and a reduction in the above-described displacement and binding of overlying hoops. This means that the takraw ball strips do not need side edge lip and/or pad-free recess length; such that the convex pad side edge is flush with the
25 convex strip side edge.

The foregoing is provided for the purpose of illustrating, explaining and describing embodiments of the present invention. Further modifications and adaptations of these embodiments will be apparent to those skilled in the art and may be made without
30 departing from the spirit of the invention or the scope of the following claims. For instance, different shapes and sizes of takraw ball strips than those illustrated can be used. Similarly, a takraw ball could be woven from differing numbers of strips.

CLAIMS:

1. A takraw ball strip of springy material with one face (28) constituted by component parts (42) of soft material **characterized in that** the strip (10) has pads (42) of soft material on one face (28) with at least part of the periphery (32,34,36) of each pad bounded by the strip face.
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2. A takraw ball strip as claimed in claim 1 **and further characterised in that** the strip (10) has recesses (30) to receive pads (42).
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3. A takraw ball strip claimed in claim 2 **and further characterised in that** the bottom of each recess (30) is provided with longitudinal grooves (38,40).
4. A takraw ball strip as claimed in claim 2 or claim 3 **and further characterised in that** the strip (10) has a convex-side edge (12) with a radially thickened boundary lip (32), at least in the vicinity of a recess (30).
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5. A takraw ball strip as claimed in any of claims 2 to 4 **and further characterised in that** the strip (10) has a sinusoidal-side edge (14,16) with a radially thickened boundary lip (36), at least in the vicinity of a recess (30).
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6. A takraw ball strip as claimed in any of claims 1 to 5 **and further characterised in that** the pad (42) has a curve upper surface (56).
- 25 7. A takraw ball strip as claimed in claim 6 **and further characterised in that** the pad (42) tapers transversely and/or longitudinally.
8. A takraw ball strip as claimed in any of claims 4 to 7 **and further characterised in that** the pad (42) leaves free a length (52) of recess (30) immediately inside the convex-side lip (32) and transverse pad ends (54) are short of recess transverse ends (34).
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9. A takraw ball strip as claimed in any of claims 1 to 8 **and further characterised in that** the upper surface (56) of the pad (30) is longitudinally grooved.
- 5 10. A takraw ball strip as claimed in any of claims 4 to 9 **and further characterised in that** the convex pad side edge (50) is flush with the convex strip side edge (12).
- 10 11. A takraw ball strip as claimed in any of claims 1 to 10 **and further characterised in that** strips (10) are moulded from thermo-plastic engineering plastics material.
12. A takraw ball strip as claimed in claim 11 **and further characterised in that** the engineering plastics material is a polyethylene and polypropylene blend.
- 15 13. A takraw ball as claimed in any of claims 1 to 12 **and further characterised in that** pads (42) are moulded from elastomeric material.
14. A takraw ball as claimed in claim 13 **and further characterised in that** the elastomeric material is a thermoplastic elastomer or a synthetic rubber.
- 20 15. A method of manufacturing a takraw ball strip comprising the steps of:-
i) moulding a strip (10) of springy material;
ii) moulding component parts (42) of soft material to a face (28) of the strip;
25 **characterized by the steps of:-**
iii) moulding pads (42) of soft material to the strip face (28);
and,
iv) forming the strip face to bound at least part of the periphery (32,34,36) of each pad.
- 30 16. A method as claimed in claim 15 **and further characterised by the steps of:-**
i) moulding the strip face (28) with a series of recesses (30);
and,

ii) moulding the pads (42) into the recesses.

17. A method as claimed in claim 16 **and further characterised by the steps of:-**

i) placing takraw ball strips (10) in a mould having a cavity gate aligned with each recess (42);

and,

ii) arranging mould maximum temperature to occur at the cavity gates, the moulding temperature being sufficient to melt the recess surfaces without melting the surrounding strip face (28).

18. A takraw ball woven from takraw ball strips as claimed in any of claims 1 to 14 or produced by the method claimed in any of claims 15 to 17.

19. A takraw ball as claimed in claim 18 **and further characterised in that** the pads (42) are limited to only those parts of strip faces (28) which, when woven into a ball, will constitute the exposed outer surface of the takraw ball.

20. A takraw ball as claimed in claim 18 or claim 19 **and further characterised in that** woven from pairs of hooped takraw ball strips (10).

21. A takraw ball as claimed in claim 20 **and further characterised in that** the paired, hooped takraw ball strips (10) are separated by a hooped centre strip.