1 This invention relates to play balls of the type having a fibrous cover applied to a spherical rubber or like centre and is particularly though not exclusively directed to tennis balls. The cost and difficulties encountered in the manufacture of tennis balls are increased by the various regulations imposed by local or international tennis associations, which require that the felt or fabric cover must impart or not detract from certain playing qualities of the ball. While the spherical rubber shell of the ball has reached a high degree of standardization at comparatively low cost of production, to attain the desired characteristics of control, hardness, bounce and balance, the application of a felt or fabric cover to the ball to retain those characteristics, presents a number of problems in view of the method now employed.

It is the customary practice to cut out and apply blanks of felt or fabric to the ball by the use of a suitable adhesive, the operation requiring the use of skilled operatives and involves considerable wastage of high quality felt or fabric, thereby contributing substantially to the cost of production. Importantly the resultant cover includes a number of seams joining the above blanks, either stitched or filled with rubber, which seams with the areas there between provide varied playing characteristics upon impact with the racquet or playing surface. There is also a tendency of the cover to break and lift at the seams whilst in play.

The principal objective of the present invention is to provide for a play ball of the type specified an improved durable cover that will contribute to ensure uniform playing characteristics by the ball substantially at all times.

A further object of this invention is to provide an effective and economical method of applying the cover to the ball.

With the above stated objective in view, a tennis or like play ball, according to this invention, is provided with a seamless cover composed of felted fibres.

With the second recited objective in view, according to this invention, the method of applying the felt cover to the ball comprises forming a substantially even layer of loose fibres around the rubber or like spherical centre of the ball, and subjecting the fibres to a felting operation so as to resolutely contract onto and conform to the shape of the centre of the ball. The term “fibres” herein includes natural wool or a mixture of natural wool with synthetic fibres which will felt with the wool or assist the wool in felting.

Thus a tennis ball having a seamless one piece felt cover is provided having many enhanced playing qualities since there are no seams to provide impact areas which have different playing characteristics to the areas of the cover between the seams, and furthermore the original surface characteristics are retained throughout the useful life of the ball. Moreover production costs are considerably reduced, for the reason that special fabrics or felts are not required and the waste in cutting cover blanks and necessity for skilled operatives for applying the blanks to the ball are eliminated.

In one practical application the felting operation is effected by exposing and subjecting a layer of sheep’s wool fibres to heat and moisture, with or without the assistance of felting accelerating substances, whilst subjecting the outer fibres of the layer to gentle movement to initially effect felting of said outer layer of fibres.

In the continuous felting operation, the felting of the outer fibres of the layer, causes contraction of the latter, and imparts pressure and movement to the inner fibres whereby the felting is progressively effected from the outer fibres to the inner fibres of the layer, such operation being continued until a required degree of hardness of the felt cover is achieved.

This practical application of the invention will now be described with reference to the accompanying drawings which illustrate practical examples of the application of a seamless felt cover to a tennis ball.

In these drawings—

Fig. 1 is a view in elevation of a tennis ball, illustrating in section a layer of loose wool fibres surrounding the rubber centre of the ball.

Fig. 2 is a view similar to Fig. 1 illustrating the felting of the outer layer of the wool fibres surrounding the rubber centre.

Fig. 3 is a similar view illustrating the wool fibres felted into a compact felt cover on the ball.

Fig. 4 is a view in section of a wire mesh cage into which the rubber centre shown in Fig. 1 is placed and moved to effect felting of the wool fibres.

Fig. 5 is a diagrammatic view of treating rollers to effect initial or further felting of the wool fibres.

Fig. 6 is a view in sectional elevation of an apparatus for effecting a final felting operation, and

Fig. 7 is a section on line 1—1 of Fig. 6.
Referring now to the drawings, to apply a felt cover to a tennis ball, the rubber spherical centre 5 formed in any known manner, has placed evenly therearound a layer of loose sheep's wool fibres indicated generally at 6. The rubber centre 5 may be first coated with an adhesive e.g. rubber latex emulsion or rubber gum to assist in positioning the layer of loose fibres about the rubber centre.

In order to apply a layer of loose wool fibres around the rubber centre 5 a thin sliver, such as the condenser sliver obtained from the carding machine used in the manufacture of woolen goods, is wound evenly around the rubber centre.

The quantity of wool used in forming the layer 6 is determined by the thickness of the cover to be placed on the ball and the weight of the finished ball. For example, to produce a ball of 2 ounces, a cover of %" thick on a ball of 2" diameter a layer of loose Merino wool of 60s quality approximately %" deep is laid around the ball 5.

The layer 6 of wool on the centre 5 is then subjected to a felting operation, which is achieved by placing the ball with the layer, into a wire mesh cage 1 as viewed in Fig. 4. The cage 1 is formed in two halves 8 and 9, each having edges 10 and 11 forming a sliding fit one within the other to enable the halves 8 and 9 to be separated to permit the centre 5 to be inserted into and removed from the cage 1.

The cage 1 and enclosed wool covered centre 5 are then submerged in a bath of warm water to which is added soap or other felting accelerating substance to form a felting solution. The temperature of the solution is maintained between the range of 60° C. to 80° C. and the ball 5 is immersed for a period of 2 to 5 minutes. An effective felting accelerator is a solution of soap and water, obtained by mixing 55 parts of water and 5 parts of soap. Another felting accelerator is a 2% aqueous solution of sulphuric acid; if it is used the acid is removed by washing after completion of the felting operation.

The ball 5 is then caused to gently roll within the cage 1 whilst immersed in the felting solution to thereby impart pressure upon and movement to the inner fibres of the wool, and resultantly the felting of the latter fibres. Such felting operation is continued until the layer of felted fibres 12 is sufficiently compacted or firm enough to permit the centre 5 and partly formed cover thereon to be subjected to further felting treatment.

The above described felting operation may be initially effected or continued, by placing the core 5 with loose wool layer 6 thereon, on two spaced rollers 14 and 15 arranged to rotate in the same direction, as diagrammatically illustrated in Fig. 5. The wool layer 6 on the core 5 is arranged to contact both rollers 14 and 15 to be rotated thereby and is moved mechanically or manually along the rollers to ensure that all the outer surface of the wool layer contacts the rollers.

When the rollers 14 and 15 are employed to effect the initial felting operation, the wool layer 6 is sprayed with solution of soap and water as above described at a temperature of 60° C. to 80° C. This operation is continued for a period of 2 to 5 minutes or until the layer of wool 6 has felted to a sufficient degree to permit the layer to be subjected to pressure.

If the initial felting operation has been effected in the cage 1 the treatment on the rollers 14 and 15 is effected in the presence of steam at atmospheric pressure to give the necessary heat and moisture for felting the layer 6 to a sufficient degree to permit the layer to be subjected to pressure.

To impart the required degree of hardness to the felted layer of wool on the core 5, the ball is placed in a treating chamber as shown in Figs. 6 and 7. The treating chamber comprises a casing 16 having a removable cover 17. A rotatable shaft 18 passes through the casing 16 and has mounted thereon a disc 19 adapted to rotate with the shaft 18. On each side of the disc 19 and spaced therefrom are stationary discs 20 and 21, each urged by springs 22 and 23 towards the disc 19. A covered core 5 is positioned between the discs 19 and each stationary disc 20 and 21 and the disc 19 is subjected to movement by rotation between the rotating disc 19 and the stationary discs 20 and 21 whereby pressure is imparted to layer of wool 6 by the influence of springs 22 and 23 urging said stationary discs towards the disc 19.

Steam at atmospheric pressure is fed into the casing 16 through pipe 24 to provide the necessary heat and moisture while the layer 6 on the core 5 is felted to the required degree of hardness. Optimum conditions for felting may be determined with the assistance of the findings of J.B. Speckman.

In lieu of sheep's wool fibres alone a mixture of sheep's wool fibres and synthetic fibres, which will felt with the wool or assist the felting of wool, may be employed. A mixture of up to 50% synthetic fibres such as plied or filched cellulose acetate fibres and synthetic protein fibres, e.g. casein, egg albumen and vegetable proteins, may be used.

All types of play balls whether the centre is of natural, synthetic rubber or other substitutes, may be covered as above described with a seamless felt cover.

Herein the term "rubber centre" means the centre of a ball of the type specified, whether hollow as in a tennis ball or solid, and composed of natural or synthetic rubber, balata or like rubber material.

We claim:

1. A tennis ball comprising a rubber center and a seamless substantially homogeneous felt cover thereon, said cover consisting of a substantially uniform layer of windings felted and contracted compactly onto said center, said windings comprising a sliver of natural wool.

2. A tennis ball comprising a rubber center and a seamless substantially homogeneous felt cover thereon, said cover consisting of a substantially uniform layer of windings felted and contracted compactly onto said center, said windings comprising a sliver of natural wool, and up to 50% synthetic fibers.

3. A tennis ball comprising a rubber center, a layer of elastic adhesive, and a seamless substantially homogeneous felt cover secured to the rubber center by the adhesive, said cover consisting of a substantially uniform layer of windings felted and contracted compactly onto said center, said windings comprising a sliver of natural wool.
4. The method of forming a seamless substantially homogeneous felt cover on a tennis ball comprising winding about a rubber center a condenser sliver of wool into a substantially uniform even layer and felting and contracting said windings compactly onto said center.

5. The method of forming a seamless substantially homogeneous felt cover on a tennis ball comprising coating a rubber center with a layer of elastic adhesive, winding about said layer of adhesive on said rubber center a sliver of wool into a substantially uniform even layer and felting and contracting said windings compactly onto said center.

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