Oct. 12, 1954

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IMPROVED METHOD OF MAKING BALLS HAVING A COVERING OF FELTED FIBERS

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2,691,403

Fig. 1.

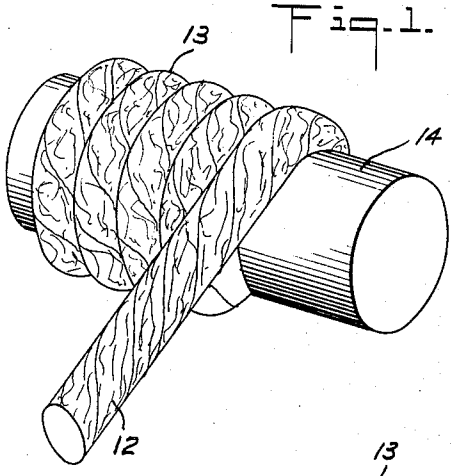
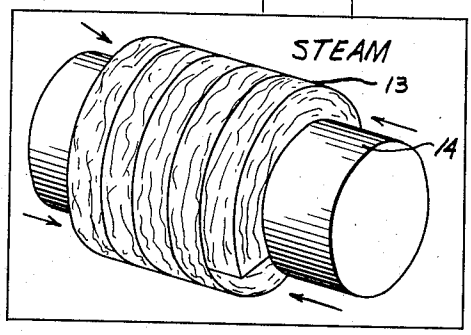


Fig. 2.



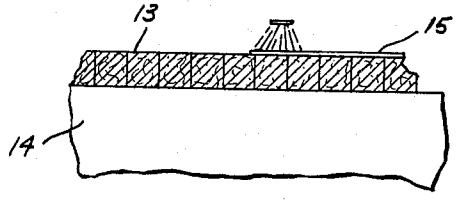


Fig. 3.

Fig. 4.

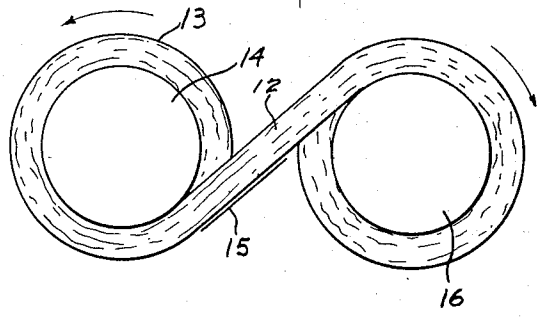
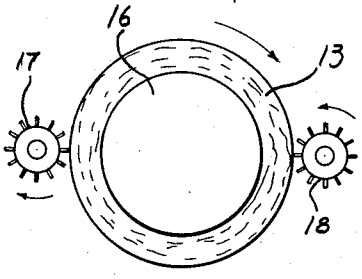


Fig. 5.



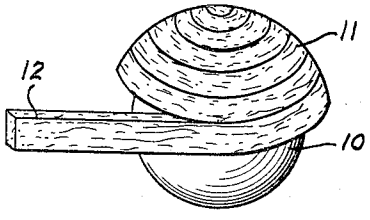


Fig. 6.

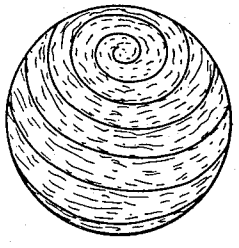


Fig. 7.

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IMPROVED METHOD OF MAKING BALLS HAVING A COVERING OF FELTED FIBERS

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Application January 30, 1952, Serial No. 269,127

13 Claims. (Cl. 154—16)

1

This invention relates to a method of making inflated balls, such as tennis balls, having a covering of felted fibres.

My present invention provides a method of making balls having felt covered inflated cores, particularly tennis balls, wherein raising of the covering is facilitated and is under a greater degree of control than in methods previously described.

According to the invention a method of making a tennis or like ball having a felt covered inflated core comprises temporarily mounting a yarn of feltable material upon a backing member, raising fibres of the exposed surface of the yarn, removing the yarn from the backing member, covering an inflated core with the yarn with the raised fibres on the outside, effecting adhesion of the yarn to the core and felting the covering in position on the core.

Preferably a cylindrical drum is used as a backing member and the feltable yarn is set in a substantially square cross-section before being wound helically on the drum.

The invention is illustrated by way of example in the following method of making a tennis ball and with reference to the accompanying drawings in which,

Fig. 1 is a diagrammatic view showing the manner of wrapping the yarn helically on a mandrel;

Fig. 2 is a diagrammatic view showing the manner of compressing and steaming the helix of yarn on the mandrel;

Fig. 3 is a fragmentary longitudinal section of a part of the mandrel and the helix of yarn formed thereon being coated with a layer of adhesive;

Fig. 4 shows diagrammatically the manner of transferring the yarn from a mandrel to a raising drum for raising the fibres;

Fig. 5 is a diagrammatic end view of the raising drum and fillet rolls for raising the fibre of the yarn on the raising drum;

Fig. 6 shows diagrammatically the manner of wrapping the yarn onto an inflated core;

Fig. 7 shows the core having the yarn wrapped thereon.

The ball comprises a standard inflated tennis ball rubber core 10, Fig. 6 and a covering layer 11 of a wool yarn. The yarn 12, in this particular embodiment, is a feltable yarn having a low twist as described in co-pending patent application Ser.

2

No. 256,617, filed November 15, 1951, and comprises eleven untwisted wool rovings of .5 West of of England's count, twisted together with one T. P. I. (turn per inch). The yarn is wound in a close helix 13 on a cylindrical mandrel 14 of about 6" diameter as shown in Fig. 1 and then steamed as shown in Fig. 2 to set the yarn whilst at the same time the coils are compressed axially of the mandrel as indicated by the arrow in Fig. 2 to form the yarn into substantially square cross-section.

The yarn is allowed to dry and an adhesive rubber solution 15 is sprayed onto the outside of the coils of the yarn as shown in Fig. 3. When the rubber solution is substantially dry the yarn is wound off the mandrel to a raising drum 16, Fig. 4, of about 4" diameter. The yarn is applied to the drum in the form of a close-coiled helix with the solutioned side of the yarn adjacent the drum, the two ends of the yarn being firmly anchored to the drum.

The drum is then fitted into a raising machine to be rotated about its axis whilst two raising rollers 17 and 18, Fig. 5, covered with raising fillet and rotated in opposite directions on axes parallel to that of the drum, are pressed into contact with the yarn on the drum. The surface speed of the rollers differs slightly from that of the yarn on the drum and the consequent plucking effect causes the wires in the raising fillet to break up and comb out the surface fibres of the yarn.

The surface speeds of the raising rollers relative to each other and relative to the surface speed of the yarn on the drum may be adjusted, and in this way various raising effects may be obtained; moreover the degree of raising may be closely controlled over the whole of the yarn. The raising effect also depends upon the degree of pressure between the raising fillet and the yarn which is controlled by adjusting the distance between the axes of the drum and the raising rollers. As raising is carried out a comparatively light initial pressure is employed so that the raising fillet acts on the fibres in the region of the surface of the yarn; the pressure is then gradually increased so that the raising fillet makes its way deeper into the yarn.

When the raising has been carried out as described, the raising drum is removed from the machine and the yarn is taken off the drum. The

rubber core is sprayed with adhesive rubber solution and a single covering of the yarn is applied to the core with the solutioned side of the yarn in contact with the core, in a spiral starting and finishing at diametrically opposite points on the core, the coils of the spiral being contiguous so that the yarn covers the core. Since the yarn is of substantially square cross-section, adjacent coils on the core lie flush against each other and provide a more uniform covering for the core than composite yarn of more or less circular cross-section.

The twist in the yarn results in different component rovings being coated with adhesive along the length of the yarn and thus assists in the effective adhesion of the yarn to the core.

The covered core is placed in a mold which is then closed and heated at 110° C. for 10 minutes, thus causing an increase in the pressure of gas within the inflated core. The ball is thus molded under heat and pressure and the adhesive becomes plastic and penetrates into the coils of the yarn, thus ensuring satisfactory adhesion of the wool fibres to the core.

After molding, the covering is felted by milling the ball in a 10% sodium oleate solution for about 40 minutes, the surfaces of the ball being repeatedly distorted to cause migration and felting of the wool fibres to form a felted covering on the core.

The ball is washed after felting and then given a final molding to impart a good finish and good appearance to the ball surface. If desired the ball may be treated with an aqueous dispersion of polymethyl methacrylate before the final molding, in which case the polymethyl methacrylate softens during molding and helps to consolidate the felt by assisting adhesion between the fibres in the covering.

In an alternative embodiment of the invention the yarn for the covering layer comprises 25 singles of wool yarn of 6's West of England's count, each with an initial twist of 3.5 Z T. P. I. The yarn is raised, applied to the rubber core, felted and molded as described in connection with the previous embodiment.

In another embodiment of the invention the core covering comprises a composite yarn as described in co-pending patent application Ser. No. 198,012, filed November 28, 1950, now Patent No. 2,652,251, the composite yarn comprising a single thread wrapped with a helix of yarn or roving of feltable material. A suitable composite yarn comprises a central cellulose acetate thread of 1100 denier wrapped with a close helix of 15 untwisted wool rovings of .5 West of England's count, twisted together with a Z twist of 1.5 T. P. I. The twisted rovings are wound onto the central thread in a right circular helix of 4.5 T. P. I. and the composite yarn is set in an atmosphere of steam to ensure a substantially relaxed condition.

Instead of the yarns described in the examples, yarns containing a proportion of polyamide fibres, for example, nylon, or polyester fibres, or other non-feltable synthetic fibres, e. g. cellulose acetate, may be used. When the yarn comprises thermoplastic fibres which soften at the temperature of molding the ball, these help to consolidate the felt by assisting adhesion between the fibres in the covering.

In general a satisfactory felted surface is not obtainable with a yarn which contains more than 50% of non-feltable fibres and it is preferred to use not less than two parts of wool fibres to one part of the non-feltable fibre.

Having described my invention, what I claim is:

1. A method of making a covered, inflated ball, having a felt-covered inflated core comprising temporarily mounting a yarn of feltable material upon a backing surface, raising fibres of the surface of the yarn, removing the yarn from the backing surface, covering an inflated core having an adhesive surface with the yarn with the raised fibres on the outside, to provide adhesion of the yarn to the core and felting the covering in position on the core.

2. A method according to claim 1 wherein the yarn is set in a substantially square cross-section on said surface.

3. A method according to claim 2 wherein the yarn is sprayed with an adhesive solution after being set.

4. A method according to claim 2 wherein the fibres on the exposed surface of said yarn are raised by rotation in contact with rotating fillet surfaces.

5. A method according to claim 1 wherein the yarn is wound onto the inflated core in a spiral of contiguous coils starting and finishing at diametrically opposite points on the core.

6. A method according to claim 1 wherein the covering yarn is caused to adhere to the core by molding under heat and pressure prior to felting.

7. A method according to claim 1 wherein the covering is treated with an aqueous dispersion of polymethyl methacrylate and given a finishing molding after felting.

8. A method according to claim 1 wherein the yarn comprises a single thread wrapped with a helix of yarn of feltable material.

9. A method according to claim 1 wherein the yarn contains a proportion of thermoplastic fibres.

10. A method of making a covered inflated ball having a felt covered inflated core which comprises temporarily mounting a yarn of feltable material in helical formation on a cylindrical backing surface, compressing said helically wound yarn axially of said cylindrical surface and steaming said yarn to set it in coils of square cross-section, applying a rubber adhesive to the outer surface of the coils of said yarn, permitting said adhesive to dry, rewinding said yarn in close coiled helix on a second cylindrical surface with the adhesively coated surface adjacent said cylindrical surface, raising the nap of the exposed surface of said yarn on said second cylindrical surface, applying said yarn to an adhesively coated core with the adhesive side of the yarn adjacent said core in closely contacting coils extending from one point of said core to the diametrically opposite point thereof.

11. The method of claim 10 in which said core and applied yarn are molded under heat and pressure to consolidate said covering of yarn into a continuous uniform covering.

12. A method of making a covered inflated ball which comprises winding a yarn of feltable material in contiguous coils on a cylindrical surface, steaming said coils and compressing them axially of said cylindrical surface to set the yarn to a square cross-section, winding said yarn on an adhesively coated inflated core in a spiral of contacting coils from one point of said core to the diametrically opposite point and molding said core thus covered to set said covering to a uniform structure.

13. A method of making a covered inflated ball which comprises winding a yarn of feltable material in successive helical turns on a surface, com-

pressing said coils axially of said surface and steaming said coils to set said yarn to a square cross-section, rewinding said yarn on a second cylindrical surface in close helix formation, raising the nap of the exposed surface of said yarn on said second cylindrical surface, winding said yarn in a close spiral from one point of an adhesively coated core to the diametrically opposite point and with the raised nap surface of said yarn on the outside of the covering thus formed and molding said covering of yarn on said core under heat and pressure to a uniform felted surface.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
2,639,920	Milner et al.	May 26, 1953

FOREIGN PATENTS

Number	Country	Date
230,554	Great Britain	Mar. 16, 1925
436,100	Great Britain	Oct. 4, 1935
441,874	Great Britain	Jan. 27, 1936
485,086	Great Britain	May 13, 1938