July 20, 1926. 1,593,211

F. J. FAULKNER ET AL

METHOD OF COVERING TENNIS BALLS

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Fig. 1.

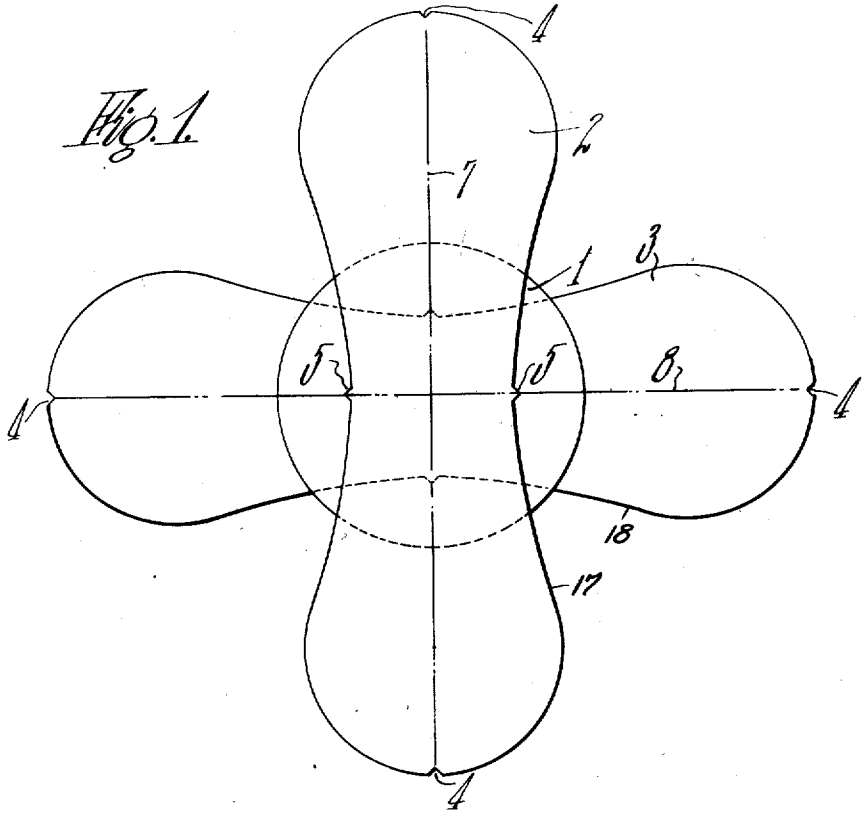
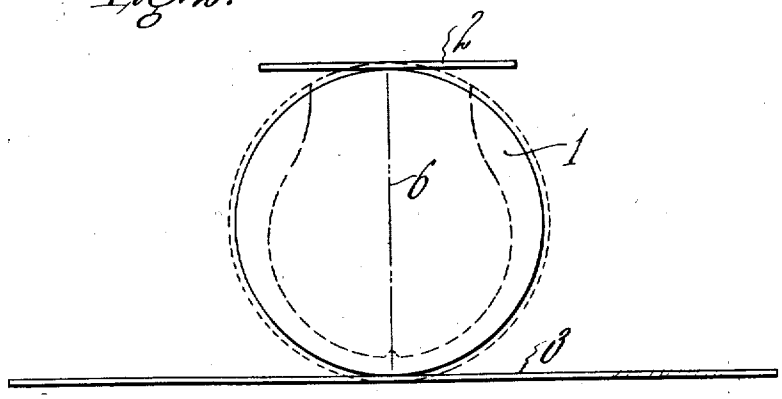


Fig. 2.



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Fig. 3.

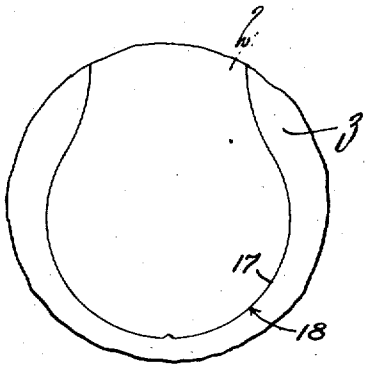


Fig. 5.

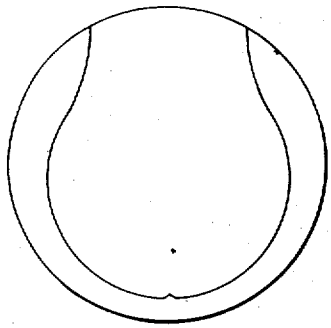
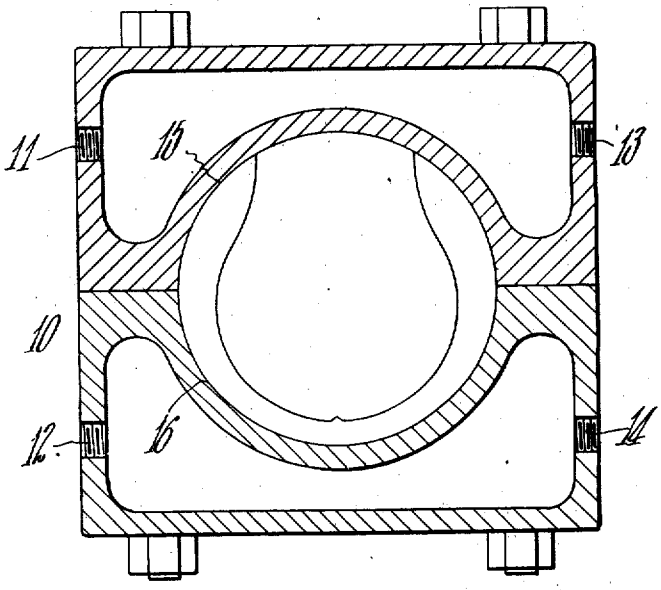


Fig. 4.



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Fig. 6.

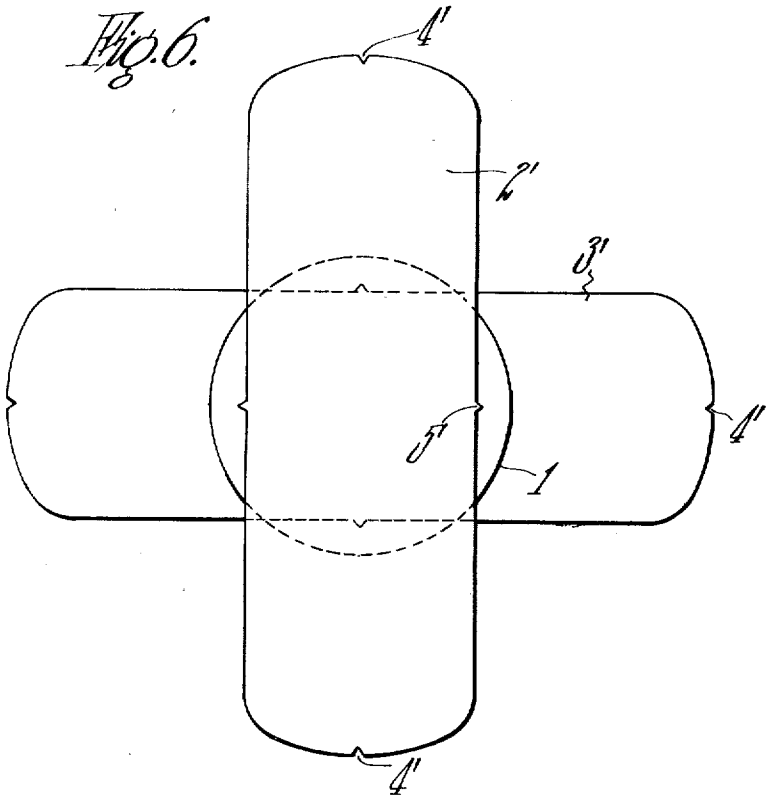
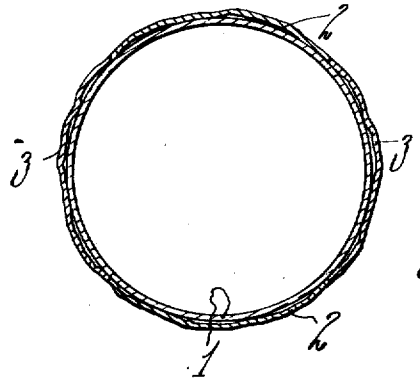


Fig. 7.



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Patented July 20, 1926. 1,593,211

UNITED STATES PATENT OFFICE.

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METHOD OF COVERING TENNIS BALLS.

Application filed March 16, 1920. Serial No. 366,399.

The present invention relates to an improved method of covering tennis balls and the product thereof, and has for its object more particularly, a method of attaching the cover to the rubber-center in a satisfactory manner without the use of stitches at the seams.

A further object of the invention is to apply a fabric cover to a rubber center in a manner to provide an excess of fullness in the fabric so that the cover of the finished ball will have a greater capacity for stretch in unison with the rubber center when the ball is in play. This excess of fullness in the fabric provides for a greater stretch of the fabric than when without fullness and lessens the tendency of the cover to separate at the unstitched seams.

The method heretofore commonly employed for covering tennis balls consists in first preparing the cement coated cover in two pieces shaped somewhat like a figure 8. These pieces are then separately stretched by hand onto the rubber-center in such a manner that the felt covers will be under tension when in place on the rubber-center so as to fit smoothly and tightly about the same. Since the rubber-centers are not always of exactly the same size,—although the margin of variation is kept within certain narrow limits,—the practice has been to cut one semi-cover slightly larger than the other so that the larger overlaps the smaller at the edges. This over-lapping of the edges of the semi-covers in the old process also takes care of any slight lack of symmetry in the disposition of the semi-covers upon the rubber-center, which lack of symmetry in positioning the semi-covers follows necessarily as a result of the manner of stretching the same on the rubber-centers. In finishing the ball under the old process, the over-lapped edge of the larger semi-cover is then trimmed off with scissors giving to the trimmed off edge a more or less bevelled cut. After this trimming operation, the edges are sewed together by blind stitching for the purpose of preventing the semi-covers from pulling apart or peeling off during the use of the ball in play.

The objectionable features of a tennis ball made under this former process are that the seams although sewed together as described, do not hold together when subjected to the severe blows of a hard-fought game, the cover soon breaks loose from the rubber center and the edges curl up and peel off. In the former type of tennis balls, the sewed seams of blind stitches have not sufficient strength to withstand the tendency of the covers to pull apart at the seams. This tendency to pull apart is caused by the fact that every time the ball receives a blow, as from the racket or the ground, it naturally flattens on the contacting surface, causing the rest of the ball to bulge or stretch out into a distorted shape. It is easy enough for the rubber-center to accommodate itself to this bulging shape because of its inherent elasticity. The felt cover, however, is not sufficiently elastic to yield with the rubber center and moreover such elasticity as the fabric might normally have, has been stretched out of it during its application to the rubber-center under tension, as above described. In other words, the felt cover is stretched practically to its elastic limit on the rubber-center before it receives a blow tending to distort it. Inasmuch as the cover cannot stretch further in following the stretch of the rubber-center, it must necessarily weaken its cemented hold on the rubber-center, creep slightly with respect thereto and pull away at the seams. This tendency to pull away at the seams breaks the stitches and the loosening of the cover on the rubber-center soon allows the unsewed edges at the seams to curl and peel off.

The present process aims to avoid the objections heretofore described in connection with the method of making tennis balls as formerly practiced. We have found that by applying the fabric cover to the rubber-center with an excess amount of fullness in the material or in a manner to compact or compress the fibers and the weave of the fabric together, that there will be imparted to the fabric a capacity to stretch and yield. In other words, instead of taking all the stretch out of the fabric in applying it to the rubber-center, the present process proposes to increase the capacity of the fabric to stretch when applied to the rubber-center, whereby, when the finished ball is

subjected to a blow, causing the aforesaid flattening or distortional effect, the fabric cover will accommodate itself to and follow the rubber-center in assuming the new shape without loosening its cemented hold upon the rubber-center.

This result is accomplished in a general way by applying the fabric semi-covers, having a cement coated surface as heretofore, loosely to the rubber center taking care to position said semi-covers symmetrically and uniformly on the rubber center but with no attempt to smooth down the fabric on the rubber-center until the symmetrical positioning of the semi-covers in place has been completed. Furthermore, in the present process, the semi-covers are of sufficient area to more than cover the rubber-center, in other words, an over-size fabric cover is applied to the rubber center, so that there is a surplus of material for providing the excess of fullness in the fabric. After the over-size semi-covers have been symmetrically placed in position upon the rubber-center, they are not trimmed to size as was the former practice but are compacted upon the rubber-center as hereinafter described so as to compress or pack the surplus of material into a smooth, tightly fitting cover for the ball. This packing and compressing of the surplus fabric into place effects both good adhering contact between the cement coated covers and the rubber-center and also provides for the excess of fullness in the fabric so that it has a capacity for greater stretch when called upon to do so by the distortion of the ball in play. By "excess of fullness" in the attached cover, we mean that the fibers and weave of the fabric material are compacted and compressed more closely together so as to have a greater capacity for stretch than when in their normal state. For example, an unstretched or uncompressed fabric may be said to have its normal degree of fullness, a stretched fabric may be said to have little or no fullness, while a fabric compacted or compressed into a smaller compass, as in the present invention, may be said to have an excess of fullness.

A further advantage of the present process resides in the fact that the semi-covers when over size need not necessarily be cut in the figure 8 shape with concave sides, but may be cut with straight sides and rounded ends as hereinafter described, thus shortening the necessary length of the semi-covers and also resulting in economy in the cutting of the semi-covers from a strip of felt. The edges of the straight side cover pieces are not adapted for as close fitting abutment as in the contour shaped cover pieces during the preliminary step of wrapping the ball but it is found that the surplus material will be readjusted by the subsequent molding action to finish the ball with the edges closely abutting throughout their length.

The drawings illustrate different stages in the carrying out of the process and may be briefly described as follows,—

Fig. 1 is a top plan view of the rubber center having, above and below the same, a semi-cover;

Fig. 2 is an elevation of the same parts and showing in dotted lines the semi-covers wrapped about the rubber-center in one of the preliminary stages of the process;

Fig. 3 is a view of the completely wrapped rubber-center and before the ball has been placed in the mold for compressing the cover thereon;

Fig. 4 is a sectional view of a mold with the ball therein; and

Fig. 5 is a view of the completed ball;

Fig. 6 is a view similar to Fig. 1 in which a different configuration of semi-cover is employed; and

Fig. 7 is a cross section of the ball showing the over-size cover loosely applied thereto and before being compacted by the molds.

Referring more particularly to the drawings, the present process is preferably carried out as follows:

Semi-covers or cover pieces of fibrous material, preferably felt, such as now employed in covering tennis balls, are prepared and cut in the shape shown either in Fig. 1 or Fig. 6, one of said cover pieces being indicated at 2 and the other at 3. The semi-covers are preferably cut to the same area, each one slightly larger than one-half of the surface area of the rubber center 1. The rubber center 1 at present preferred by us for the carrying out of this process is of the fixed standard size heretofore commonly employed for tennis balls—namely, a hollow rubber sphere, preferably vulcanized and inflated, before being covered, to the size and resiliency desired in the finished ball. The invention is not limited, however, to the use of a rubber center vulcanized before being covered, since vulcanization of the center may be completed during the compacting operation of the cover thereon, as hereinafter described. To facilitate the alignment of the semi-covers 2 and 3 in symmetrical position about the rubber-center, markers are provided consisting of interfitting notches and nibs at the ends and sides of said semi-cover as shown, the notches being indicated at 4 and the nibs at 5. These nibs 5 and notches 4 are preferably located at the ends of the longer and shorter axes of each semi-cover as shown, although they may be located at other points if desired so long as they are made for proper interfitting.

Both the rubber-center and the semi-covers before being united are coated with suitable cement such as air-drying pure rub-

ber cement heretofore commonly used in attaching felt covers to tennis balls. A solution of high-grade rubber in naphtha is a typical cement of this character, but the invention is not confined to the use of any particular cement. The semi-covers are positioned at opposite sides of the rubber-center at right angles to one another as shown in Fig. 2, care being taken to see that the symmetrical center of each semi-cover lies in the same axis, indicated at 6, of the rubber center.

The ends of the semi-covers are then wrapped lightly about the sides of the rubber center, the ends of the semi-cover 3 for instance being folded up and the ends of semi-cover 2 being folded down until the nibs 5 of each semi-cover fit into the corresponding notches 4 of the other semi-cover. In this wrapping operation care should be taken to wrap the ends of each semi-cover about the largest circumference of the ball so as to be symmetrically disposed thereon. This symmetrical disposition of the semi-covers will be obtained automatically by bringing the corresponding markers 4 and 5 into register. When symmetrically disposed the normal planes through the longitudinal axes 7 and 8 of each semi-cover will intersect one another at the center of the rubber-center and at right angles. In thus wrapping the semi-covers about the rubber-center, it is desirable to press lightly only the portions of the semi-covers adjacent the markers into contact with the rubber center without folding down the edges of the semi-covers as shown in Fig. 2. Little or no pressure need be exerted upon the semi-cover, for at this stage of the process there is no necessity for making a permanent adhesive contact between the semi-covers and the rubber center.

After the semi-covers have been wrapped about the rubber center as shown in Fig. 2 the square cut edges 17 and 18 of the semi-covers are then brought into abutment as shown in Fig. 3. In this part of the process the cover is not pressed with any injurious pressure into contact with the rubber center for there is no necessity for attempting to secure any smooth fit of the whole cover on the rubber center. At this stage, the ball has the appearance of being covered with an ill-fitting and over-size cover, lumpy and loosely attached. The entire operation of wrapping the semi-covers about the rubber-center and in bringing the edges of the semi-covers into abutment is performed in the absence of any distorting pressure upon the rubber center and without stretching the fabric into place as has been the practice heretofore.

The ball is now ready to have the cover compacted and compressed thereon into its smooth tightly fitting shape. This may be accomplished by suitable pressing and ironing devices although we prefer carrying out this part of the process in a heated confining mold under internally-created pressure as will now be described. As shown, a mold is provided consisting of upper and lower halves 9 and 10, each mold half having a semi-spherical interior molding surface 15, 16. The mold is heated in any suitable way and for illustration is shown as hollow for the admission of steam at inlets 11 and 12 and the discharge of steam at outlets 13 and 14. Any convenient means (not shown) may be employed to clamp the mold halves together during the molding operation. The interior molding surfaces 15 and 16 are of such size when locked together as not to compress the covered rubber center to a smaller diameter but merely to confine the covered rubber center against the expansion tendency of the heated gas or air within the ball during the molding operation. In other words, the mold has an interior diameter equal (as nearly as it is possible to make it) to the diameter of the standard size rubber center and cover combined and consequently the mold neither permits any substantial expansion of the rubber center nor causes any substantial contraction of the same while the ball is within the mold.

In molding the cover upon the rubber center the ball is placed within the molds and while the molds are held tightly together they are heated to raise the temperature of the ball within the mold sufficient to create considerable pressure at the surface of the ball due to the expansion tendency of the heated gas or air within the ball. This molding pressure compresses the loose oversized cover into firm cementing contact with the rubber center, compacts the cover with its surplus material into a smooth snug fit upon the rubber center and thereby imparts to it the excess of fullness and stretchable character for accommodating itself to the various changes of shape which the ball must undergo in play. The ball is subjected to this internal pressure sufficiently to firmly cement and compress the cover thereon. When a previously vulcanized rubber center is to be covered, the heat for creating the internal pressure should not be sufficient to over-cure or substantially change the chemical character of the rubber center and thereby possibly lessen its resiliency and durability. If, however, a partially vulcanized rubber center is to be covered, the heat of the mold may be maintained sufficient to complete the vulcanization of the rubber center simultaneously with the compacting of the over-size cover thereon. An essential feature of the process is to maintain the rubber center at substantially its fixed standard size within the mold and neither contract nor expand the same while

the over-size cover is being compacted thereon.

After the ball has been sufficiently heated, to compact and firmly cement the cover thereon, the molds and the ball therein are cooled to normal temperature before opening the mold halves and removing the ball. This may be effected by passing water or cold air through the hollow interiors of the mold halves at the end of the heating operation. The purpose of cooling the ball before removal from the mold is to restore the normal internal pressure within the rubber center and thus obviate any tendency for the center to expand after its removal from the mold. Since, as before stated, the rubber center is maintained at its standard size while in the heated mold, there will be no tendency for the same to either contact or expand when removed from the mold. After the removal from the mold in the manner described, the ball is finished and ready for play.

When cover pieces 2′, 3′, of the shape shown in Fig. 6, are employed to cover the ball they are also cut of slightly larger total area than the surface area of the rubber center. The cover pieces are lightly wrapped about the rubber center as heretofore described and the surplus material allows the edges to be abutted although perhaps not as evenly as in the case of the cover pieces shown in Fig. 3. It is not necessary however, to bring the abutting edges into touching contact at all points prior to the molding operation. If the edges are brought into opposed relation, the subsequent molding and compacting action of the molds will readjust the surplus material of the cover pieces so as to finish the ball into substantially the same appearance as in Fig. 5, and thus bring the edges of the cover pieces into close abutment. An excess of fullness is also imparted to the fabric by the compacting action of the mold when cover pieces of this shape are employed.

It will be understood that various minor changes and modifications may be made in the process as above described without departing from the invention as hereinafter claimed.

What we claim is:—

1. The process of covering tennis balls which consists in applying to a rubber center, an over-size cover of fabric and compacting said over-size cover down into a smooth snug fit upon the rubber center.

2. The process of covering tennis balls which consists in applying to a rubber center, an over-size fabric cover and compacting said cover with its surplus fabric down upon the rubber center into a smooth snug fit, thereby provide an excess of fullness in the cover giving it a capacity to stretch.

3. The process of covering tennis balls which consists in applying to a rubber center, an over-size fabric cover and compacting by heat and pressure said cover with its surplus fabric down upon the rubber center into a smooth snug fit to thereby provide an excess of fullness in the cover giving it a capacity to stretch.

4. The process of covering tennis balls which consists in applying to a rubber center a multi-piece fabric cover of larger total area than the surface area of the rubber center by first abutting the edges of the cover pieces and then compacting the cover with its surplus material down upon the rubber center into a smooth snug fit.

5. The process of covering tennis balls which consists in applying to a rubber center an over-size cover of fabric and compacting said over-size cover down into a smooth snug fit upon the rubber center by heating the same within a confining mold.

6. The process of covering tennis balls which consists in applying to a rubber center, an oversize cover of fabric, confining the same within a mold of sufficient size to confine the ball in its cover without substantial pressure before the ball is heated, and then heating said mold to create an internal pressure within the ball for compacting the oversize cover into a smooth, snug fit upon the rubber center.

7. The process of covering tennis balls which consists in applying to a rubber center an over-size cover of fabric and compacting said over-size cover down into a smooth snug fit upon the rubber center by heating the same within a confining mold, and cooling the ball before removing the same from the confinement of said mold.

8. The process of covering tennis balls which consists in wrapping the cover pieces of a multi-piece fabric cover around a rubber center and abutting the edges of said cover piece all in the absence of distorting pressure upon the rubber center, said cover pieces being of larger total area than the surface area of the rubber center and compacting said over-size cover into a smooth snug fit upon the rubber center by heating the same within a confining mold.

9. The process of covering tennis balls which consists in applying to a rubber center of the ultimate size determined upon, an oversize cover of fabric, confining the same within a spherical mold having an internal diameter substantially equal to the diameter of said rubber center and cover combined, and then heating said mold to create internal pressure within said ball for compacting the over-size cover into a smooth, snug fit upon the rubber center.

10. The process of covering tennis balls, which consists in wrapping two semi-cover pieces of fabric in symmetrical position about a rubber center, said cover pieces hav-

ing substantially straight long sides and curved short sides, and molding said cover pieces into a completely enclosing smooth snug-fitting contact with said rubber center by confining the same within heated molds.

11. A tennis ball comprising, a rubber center and a fabric cover, the fabric of said cover having an excess of fullness therein.

12. A tennis ball comprising, a rubber center and a smooth snug-fitting fabric cover compacted thereon with an excess of fullness in the fabric.

13. A tennis ball comprising, a rubber center and a fabric unstitched cover cemented thereto, the fabric of said cover having an excess of fullness therein.

14. A tennis ball comprising, a rubber center and a fabric cover of surplus material compressed into a smooth snug fit upon said rubber center so as to have an excess of fullness therein.

15. A tennis ball comprising a rubber center and having an unstitched fabric cover secured thereto, said cover comprising two pieces of substantially the same shape and area, said semi-covers being of long and narrow contour each provided with markers at the ends of its longer axis arranged to interfit with markers at the ends of the shorter axis of the other whereby said markers when in interfitting registration insure the symmetrical position of said separate cover pieces on said ball.

In testimony whereof we have affixed our signatures.

FRANK J. FAULKNER.
CHARLES B. WHITNEY.

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CHARLES B. WHITNEY.

Certificate of Correction.

It is hereby certified that the name of the assignee in Letters Patent No. 1,593.211, granted July 20, 1926, upon the application of Frank J. Faulkner, of Lynn, and Charles B. Whitney, of Springfield, Massachusetts, for an improvement in "Methods of Covering Tennis Balls," was erroneously written and printed as "A. G. Spaulding Bros.," whereas said name should have been written and printed as *A. G. Spalding & Bros.*, as shown by the records of assignments in this office; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 14th day of September, A. D. 1926.

[SEAL.]

M. J. MOORE,
Acting Commissioner of Patents.

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[SEAL.]

M. J. MOORE,
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