April 17, 1945. L. M. S. LEJEUNE 2,373,899

METHOD FOR MANUFACTURING BALLS FOR GAMES

Original Filed Jan. 12, 1939

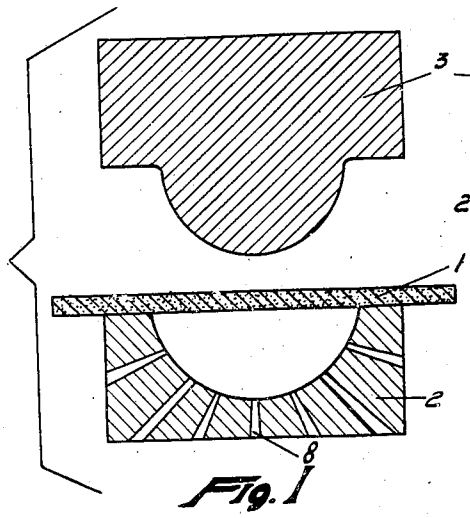


Fig. 1

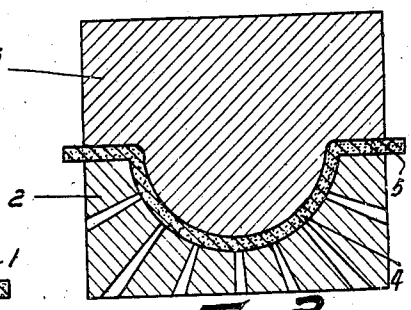


Fig. 2

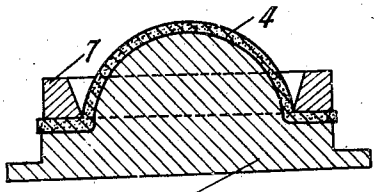


Fig. 3

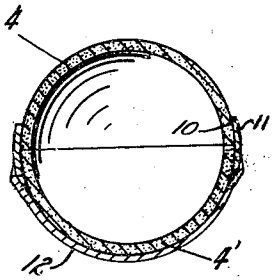


Fig. 4

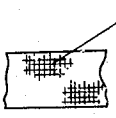


Fig. 5

Fig. 6

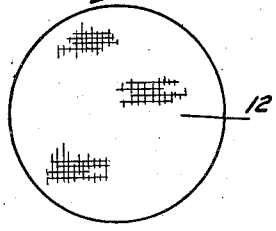
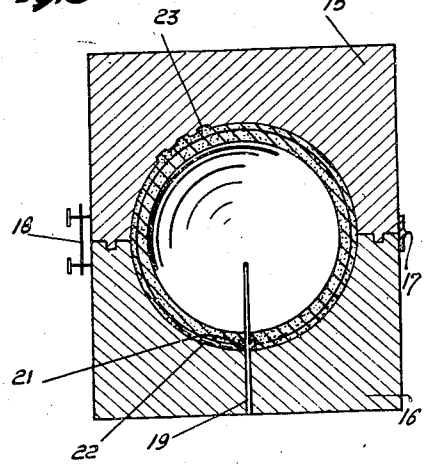


Fig. 7



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METHOD FOR MANUFACTURING BALLS FOR GAMES

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Original application January 12, 1939, Serial No. 250,617. Divided and this application September 29, 1939, Serial No. 297,182. In France August 9, 1938

4 Claims. (Cl. 154—16)

The present invention is a division of my copending application Ser. No. 250,617 filed on January 12, 1939.

My invention relates to balls for games, chiefly for tennis and to the method for manufacturing same.

Tennis balls are submitted to very strict conditions imposed by regulations which are in more or less distant relationship with the requirements of the game itself. The manufacturer has to give the ball a certain hardness through inflation; when the ball impinges on the racket, the initial velocity of the ball remains very high, but is immediately afterwards reduced by the braking action on the felt hairs of the coating, which action increases with the length of these hairs and reversely.

It will be noted that the ball does not remain the same throughout its existence as it lets out its air slowly and thus has a decreasing initial velocity. The felt hairs shorten and become less close by reason of the wear of the felt. The ball is thus progressively less energetically braked and bounces higher so that the initial conditions, viz: high initial velocity, braked speed in air and slow reception on the racket are transformed in an irregular manner. The two drawbacks constituted by the air let out of the ball and by the wear of the felt cover, render the life of the ball very short and irregular.

I may conclude in stating that the balls now in use do not assist a good player and do not allow the entire possible progress of tennis playing as regards rapidity and regularity of play.

The short life of the balls used to this day makes the game expensive whereas in contradistinction my improved ball has entirely different properties and advantages.

In the first place my improved ball cannot let its air out for the simple reason that it is not inflated.

This ball has a constant bounce which does not vary with the temperature. Its initial speed has a constant very high value which remains the same during the whole life of the ball. There is no damping effect noticeable upon impinging on the ground as in the case of felt so that the speed remains very high between the ground and the receiving racket. The bounce from ground to racket is thus a rapid and regular one as there is no wear of felt. The ball is easily visible by reason of its constant whiteness, the ball being washable. It is sensitive neither to cold, nor heat, nor dampness and remains therefore unaltered in any weather.

This ball is chiefly characterized by the fact that its cover is constituted by a textile impregnated throughout with rubber. This ensures a rigidity such that it is possible to do away on one hand with any outer textile coating for the ball and on the other with any inflating thereof. It may even be of advantage in certain cases to allow the inside of the finished ball to be in communication with the atmosphere through one or more perforations. Under such conditions there is established between the atmosphere and the inside of the ball an equilibrium of pressure and temperature which ensures remarkably constant bouncing properties for the ball.

The ball is provided on its outside with hollowed or relief parts which makes the speed and direction of motion more regular.

The method of manufacture consists primarily in impregnating a fabric with an emulsion or solution of rubber, natural, synthetic or regenerated, completely or partly vulcanized or not vulcanized, and containing in the latter case the reagents required for vulcanization and preservation of the rubber, cutting in this impregnated fabric suitably shaped parts and stamping same to form hemispherical segments after coagulation of the rubber through any suitable means. This stamping has for its effect to drive out part of the coagulation water and the hemispherical segments are thereafter dried and stuck together two by two. The ball is, if desired, covered with a coating constituted by a fabric welded through calendering to non vulcanized rubber and the whole is made fast through vulcanization.

The fabric used may be constituted by vegetable or animal threads or fibres. It will preferably be a balanced fabric, i. e. one in which the composition of the threads and their tension and degree of twisting are the same in the warp and weft, so that the fabric is in equilibrium in all directions. Such fabrics may be produced by having uniform weft and warp threads subjected to the same tension, or if these conditions are not fulfilled, by superposing two or more layers of a farbic so placed that any inequalities in the weave balance one another. Such a fabric will absorb rubber in a uniform manner in the warp and weft threads and will have the same elasticity in the direction of the warp and weft threads respectively.

The impregnation is performed through any known means but in a manner such as will distribute uniformly and regularly the same weight of emulsion or dissolution over equal surfaces for a given thickness.

The coagulation is obtained through any known means and the hemispherical segments are cut out and stamped immediately after coagulation, i. e. when the rubber in incorporated with the fabric, but still bathing in its coagulation water. During the deformation due to stamping, part of this water is expelled but a certain amount remains in the fabric and is removed by drying.

During this drying process, there occurs of necessity a deformation of the hemispherical segments. For this reason, as the manufacture of tennis balls must be very precise, the drying is performed on a hemispheric support having exactly the shape and size required for the segment. It is of advantage during the drying to hold the edge of the segment on the support, for instance by means of a ring urged downwards, so as to ensure perfect adherence between the segment and the support and to avoid any irregular shrinking.

The welding of two segments through their edges is performed for instance by means of a solution of non vulcanized rubber.

Preferably I apply then on the seam a band of fabric welded through calendering to non vulcanized rubber and on each hemispherical segment a circular element of the same fabric also welded through calendering to non vulcanized rubber, so as to form a complete coat round the ball. The whole is then vulcanized inside a mould which may be smooth or else provided with suitable asperities so as to give the outer surface of the ball the rugosity required for reducing or increasing its speed in air.

It is of advantage during this vulcanization inside an autoclave to provide a communication between the inside of the ball and the outside of the mould whereby the pressure of the steam entering the ball ensures a better application of the wall or cover of the ball against the inner wall of the mould together with a much more speedy vulcanization. This also avoids any contact of air with the wall of the ball during vulcanization, air being as well known a detrimental agent for vulcanization.

A considerable advantage of my improved ball consists in that it is possible to suitably adjust the rigidity of the cover by suitably measuring the proportion of textile material, rubber and charge or vulcanizing elements absorbed, with a view to producing perfectly standardized balls as concerns their initial velocity and height of bounce. It is thus possible for instance to produce a whole series of balls to be used by different players according to their experience and skill.

By way of example it may be stated that for obtaining a hardness comparable to that of the balls used to this day, there may be used a fabric weighing 435 grs. per sq. m. impregnated with a latex bath the concentration of which is 58%, the wringing out of the water being obtained in a regular manner by a roller weighing 1 kg. travelling over a 10 cm. wide strip. The superposition of two plies provides the desired hardness.

Appended drawing shows diagrammatically by way of example different stages of the method of manufacturing the ball.

Figs. 1 and 2 are cross-sectional views of the device used for stamping the hemispherical segments for two successive positions thereof.

Fig. 3 is a cross-sectional view of the drying means.

Fig. 4 is a cross-sectional view of the ball at the moment of the application of the reinforcing belt.

Fig. 5 shows, in plan view, a portion of this reinforcing belt.

Fig. 6 is a plan view of one of the reinforcing circle shaped parts.

Fig. 7 is a cross-section of the vulcanizing mould during vulcanization of the ball.

After the fabric has been impregnated throughout with an emulsion or a solution of rubber, natural, synthetic or regenerated, containing the reagents necessary for its vulcanization and preservation, the coagulation is provided by any suitable means. A circular part 1 (Fig. 1) is then punched out of the material and placed on a stamping machine including a female mould 2 and a male stamping part 3. The mould 2 is provided with channels 8 for removal of the water.

The stamping being performed (Fig. 2), a hemispherical segment 4 is obtained with a flange 5. This segment is then transferred on to a drying mould or support 6 (Fig. 3) the shape and size of which are exactly those desired for the finished segment. Round the mould and over the flange 5 is then arranged a ring 7 the weight of which is such that it is urged downwards and holds the flange of the segment well applied against the mould. The segment finishes drying on the latter after which the periphery thereof is cut to its final shape.

Two finished segments 4 and 4' are then immersed entirely, for instance by suspending them through a suitable hook, in a rubber solution after which they are dried and applied one against the other as shown in Fig. 4. A band of fabric constituted for instance by a ribbon of canvas 10 welded by calendering to a sheet 11 of non vulcanized rubber is then used. This band has the length required for forming a belt round the ball, the two ends overlapping slightly one another and being cut if desired along a bevel so as not to form any supplementary thickness. The band considered is applied over the joint between the two segments 4—4'. I then apply over the segments themselves two circular parts 12 of the same material as the band 11 i. e. formed of canvas or other fabric welded through calendering to a sheet of non vulcanized rubber. The size of the circular parts 12 is chosen in a manner such that after application over the hemispherical segments their edges overlap slightly the corresponding edges of the band 11.

The ball thus formed is then carried inside the vulcanizing mold (Fig. 7). This mould comprises two halves 15—16 connected through a hinge 17 and held securely together by the bolt 18. A hollow needle 19 passes into the inside of the mould which communicates thus with the inside of the autoclave used for heating the mould and ball inside same. The hollow needle is protected at the point where it passes inside the mould by a metal bushing 21 fitted over said needle. The mould is provided with projections 22 and/or recesses 23 arranged in accordance with a predetermined pattern.

After opening the mould the ball ready for vulcanization is arranged in the half-mould 16 and pushed into its housing, its cover being thus transfixed by the needle 19. The mould being then closed, the bolt 18 is drawn in and the mould carried into a steam-heated autoclave for vulcanizing the ball. The vulcanization being performed, the ball is removed and there is introduced inside the opening left by the bushing 21 a stopping part provided with a calibrated hole which allows the reduction to the desired cross-

sectional area of the passage allowed for the air through the cover of the ball.

If required and/or desired the channel left open by the bushing and needle in the cover may be entirely closed.

What I claim is:

1. A method of making a ball for games, including the steps of impregnating a fabric with an aqueous emulsion of rubber, cutting pieces from said fabric, shaping said pieces into hemispherical segments, after coagulation but while the mass is still wet, in such manner as to expel a part of the water of coagulation, drying the hemispherical segments, sticking two of said segments together to form a ball by means of a rubber solution with application of said hemispherical segments one against the other through their peripheries, applying over the joint between said two segments a strip of fabric welded through calendering to non vulcanized rubber, applying over each hemispherical segment a circular part of similar fabric welded through calendering to non vulcanized rubber, said strip and said circular parts forming a complete coating for the ball constituted by the hemispherical segments, and then vulcanizing the whole.

2. A method of making a ball for games, including the steps of impregnating a fabric with an aqueous emulsion of rubber, cutting pieces from said fabric, shaping said pieces into hemispherical segments, after coagulation but while the mass is still wet, in such manner as to expel a part of the water of coagulation, drying the hemispherical segments, sticking two of said segments together to form a ball by means of a rubber solution with application of said hemispherical segments one against the other through their peripheries, applying over the joint between said two segments a strip of fabric welded through calendering to' non vulcanized rubber, the ends of said strip overlapping one another applying over each hemispherical segment a circular part of similar fabric welded through calendering to non vulcanized rubber, said strip and said circular parts forming a complete coating for the ball constituted by the hemispherical segments, and then vulcanizing the whole.

3. A method of making a ball for games, including the steps of impregnating a fabric with an aqueous emulsion of rubber, cutting pieces from said fabric, shaping said pieces into hemispherical segments, after coagulation but while the mass is still wet, in such manner as to expel a part of the water of coagulation, fitting each hemispherical segment for drying over a hemispherical mold the diameter of which is that desired for the internal diameter of the finished ball, placing a heavy ring over the periphery of each hemispherical segment to hold it firmly on the mold while drying, drying the segments, removing the heavy ring from the periphery of each segment, removing the dried segments from the molds, sticking two of said segments together by means of a rubber solution to form a ball and then vulcanizing the whole.

4. A method of making a ball for games including the steps of superposing a plurality of layers of a fabric, impregnating said fabric layers with an aqueous emulsion of rubber, coagulating said emulsion of rubber in the impregnated fabric layers, cutting suitably shaped patterns out of the fabric layers, stamping the said patterns into hemispherical segments while the mass is still wet, in such a manner as to expel a part of the water of coagulation, drying the hemispherical segments, sticking two of said segments along their edges by means of a rubber solution to form a ball, applying over the joint between said two segments a strip of fabric welded through calendering to non-vulcanized rubber, applying over each hemispherical segment a disk of similar fabric welded through calendering to non-vulcanized rubber, said strip and said disks forming a complete coating for the ball constituted by the hemispherical segments, and then vulcanizing the whole.

LEON MAX SYLVAIN LEJEUNE.