F. T. ROBERTS.

INFLATED BALL.

APPLICATION FILED DEC. 29, 1914.

1,151,396.

Patented Aug. 24, 1915.

2 SHEE S—SHEET 1.

FIG. 1.

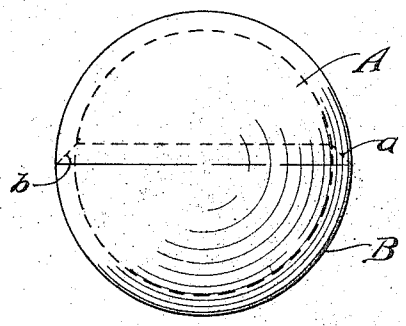


FIG. 2.

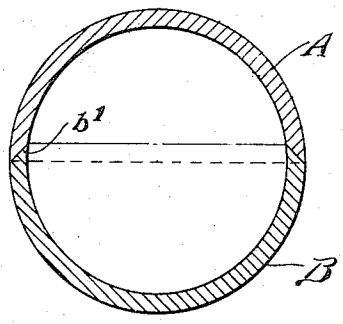


FIG 4

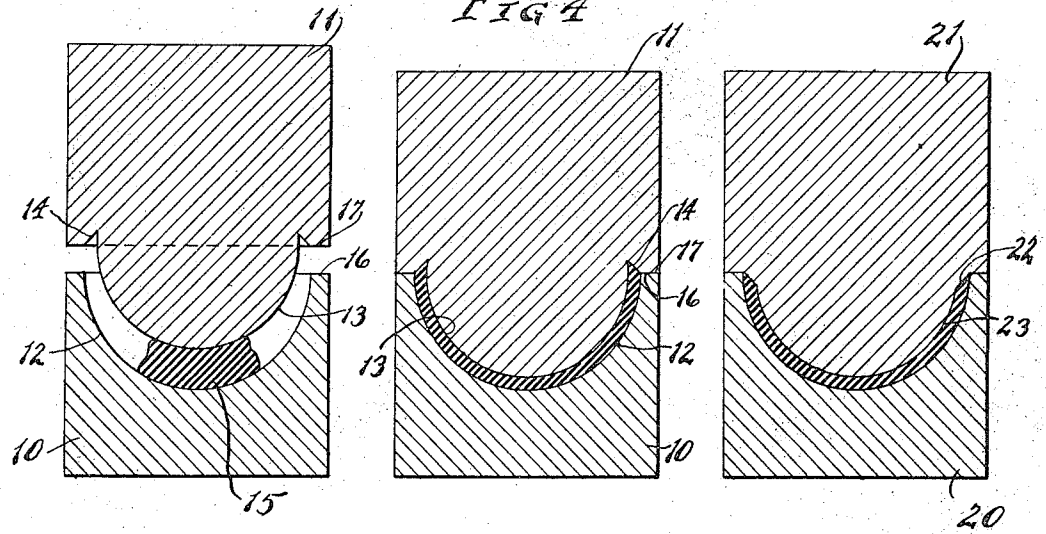


FIG. 3.

FIG. 5.

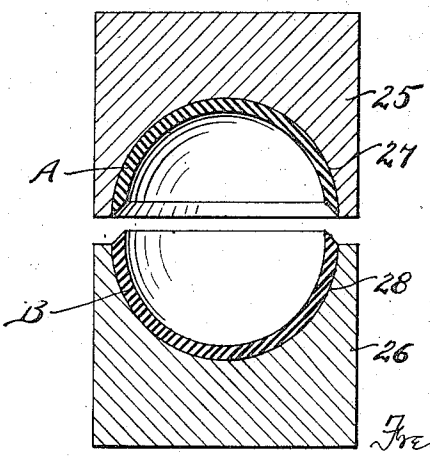


FIG. 6.

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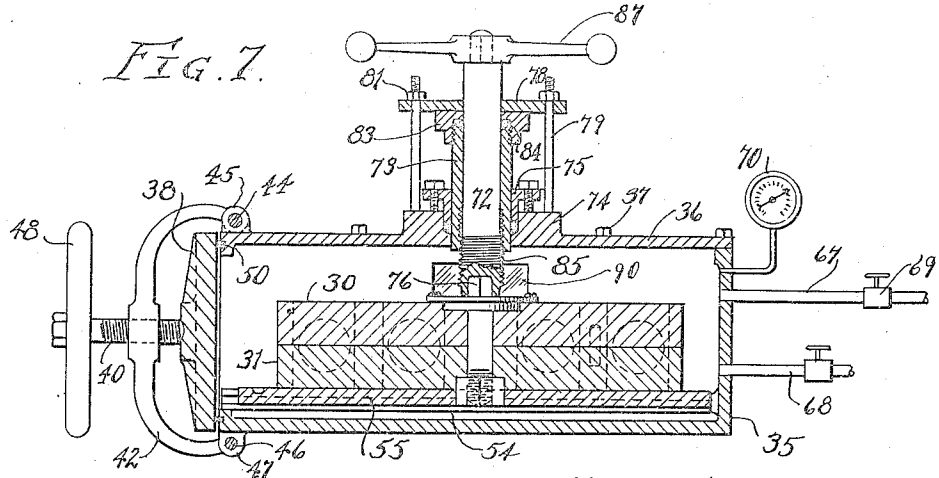
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2 SHEETS—SHEET 2.

FIG. 7.



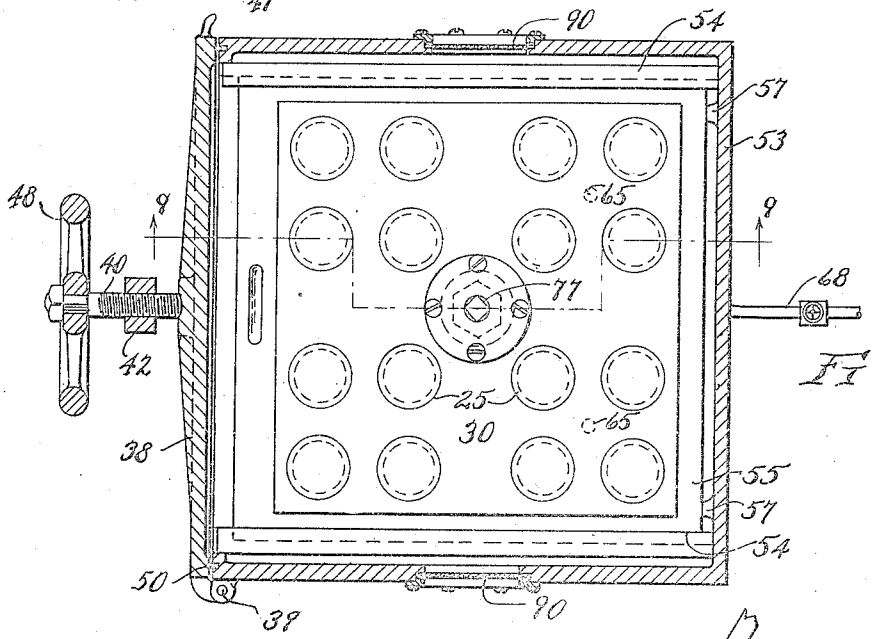
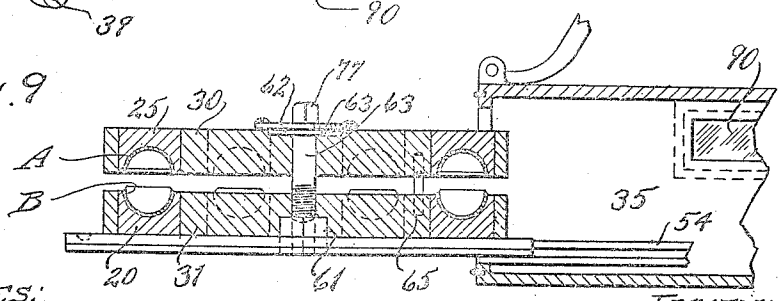


FIG. 8.

FIG. 9



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UNITED STATES PATENT OFFICE.

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INFLATED BALL.

1,151,396. Specification of Letters Patent. Patented Aug. 24, 1915.

Application filed December 29, 1914. Serial No. 879,556.

To all whom it may concern:

Be it known that I, FRED THOMAS ROBERTS, a citizen of the United States, residing at Trenton, in the county of Mercer and State of New Jersey, have invented a certain new and useful Improvement in Inflated Balls, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings.

This invention relates to inflated balls such as tennis or other playing balls.

The general object of the invention is to provide an inflated playing ball which shall be very evenly balanced, resilient and durable.

It has been the common practice heretofore, in making rubber tennis balls and the like, to cement together sections which constituted the ball, and provide a soft rubber button or boss on the inner surface of the ball. The sections were then vulcanized, the vulcanizing pressure being usually obtained by the vaporization by heat of some readily volatilizing substance placed within the ball. After vulcanization and the cooling of the ball, it was necessary to inject expansible fluid under pressure, to inflate the ball to give it the proper resiliency for use. This was accomplished by piercing the ball through the boss, with a hollow needle and blowing air through such needle, the boss being pinched together after the needle was withdrawn, the cohesion of the boss being relied on to seal the opening. The withdrawal of the needle was always accompanied by the escape of some of the air, which being of varying amounts, left the remaining pressure indeterminate. Moreover, there was usually a continual leakage of air at the point where the ball was pierced, which gradually reduced the air pressure and allowed the ball to shrink, resulting in the ball losing its resiliency and causing rapid deterioration when in play. The expansible chemicals heretofore employed to give the vulcanizing pressure have tended to make the rubber brittle, also reducing the durability as well as the resiliency of the ball. The interior projection, or any irregularity of the thickness of the wall, has the effect of throwing the ball out of balance, causing it to bounce irregularly.

I overcome the above disadvantages by producing a hollow ball inflated with air under pressure and having a wall of substantially uniform thickness throughout.

My prior application No. 793,025, filed October 2, 1913, describes and claims a method for making such an inflated ball as above described. The ball itself forms the subject matter of this application, and is hereinafter more fully described in connection with the drawings, the essential characteristics being set out in the claims.

In the drawings, Figure 1 is an elevation of a tennis ball made in accordance with my invention; Fig. 2 is a central section through the same; Figs. 3, 4 and 5 are vertical central sections through dies for making the halves of the ball; Fig. 6 is a similar section through dies carrying these halves and in which they are brought together for vulcanization; Fig. 7 is a vertical section through a suitable device for bringing two die holders together in a closed chamber; Fig. 8 is a horizontal section through the chamber showing a plan of the die holders, and Fig. 9 is a vertical section through the die holders, taken substantially on the line 9—9 of Fig. 8, illustrating a convenient means for placing the die holders in the chamber.

The ball shown in Fig. 1 consists of two hemispherical shells A and B, having overlapping beveled edges *a* and *b*. These edges are vulcanized together, providing a spherical cavity within the ball, which is filled with compressed air or other elastic fluid as desired. It will be seen that this overlapping joint provides edges on each shell nesting one into the other, and also that these beveled edges are wider than the thickness of the shell, thereby providing the desired breadth of vulcanizing surface, without the usual thickening on the inner surface at the joint.

In making the ball, in the preferred way, two hemispheres with reversely beveled edges, are produced of semi-cured rubber, and the two beveled edges are covered with a suitable cement and the two parts (mounted in hemispherical cavities in suitable flasks) are brought together in an atmosphere of compressed air, entrapping a portion of such compressed air between the shells. The pressure of the surrounding atmosphere on the exterior of the ball is then relieved, and heat supplied to effect the vul-

canization, the interior pressure, acting outwardly, pressing the shell tightly against the dies in which it is held during vulcanization, as fully set forth in my prior application above referred to. This internal pressure is particularly advantageous in that it acts outwardly on the inner projecting edge portion *b'* of the shell B, thereby holding the edges *a* and *b* tightly together during vulcanization. The internal pressure is preferably higher than that of steam of a vulcanizing temperature, and this enables the vulcanizing heat to be conveniently provided by steam freely surrounding the flasks.

The ball when finished, comprises a hollow spherical shell having no external or internal projections, being of substantially even thickness throughout. The compressed air within the hollow rubber shell, which preferably has a pressure of many pounds to the square inch (for example thirty pounds in a tennis ball) acts to considerably expand the shell when released, causing all portions thereof to be under tension. This greatly adds to the resiliency of the ball. The internal pressure is retained for a very long time so that the ball keeps its desired "liveliness" indefinitely. This absence of leakage is of further value in tennis balls in that it insures the fabric cover remaining tight at all times. This is a very desirable feature, because with playing balls of this character, leakage would allow the cover to become loose in a comparatively short time, causing it to be torn very soon in play.

In producing the hemispherical shells forming the ball of this invention, I may employ dies such as shown in Figs. 3 to 5 inclusive. The die 10 has a hemispherical recess 12 and the die 11 a concentric projection 13. Adjacent the base of such projection, is an annular gutter 14, V-shaped in cross section. With these dies, a block of rubber, as illustrated at 15, is placed in the cavity 12 and the dies are brought together until their flat surfaces 16 and 17 substantially contact, as shown in Fig. 4, producing the semi-cured hemispherical shell B of the form appearing in that figure, the annular gutter 14 being so shaped as to form the beveled edge *b*, heretofore described.

In Fig. 5 are illustrated corresponding female and male dies 20 and 21 respectively, for producing the other semi-cured hemispherical shell A. The die 20 in this case is identical with the die 10, but the die 21 has a frusto-conical male portion 22 between the hemispherical projection 23 and the flat face, instead of the gutter 14. Accordingly, when these dies are brought together, the hemispherical shell A is produced, having the outwardly beveled edge *a*, heretofore described. Any excess of rubber, in making either the male or female shell, passes outwardly between the mold blocks, in the form of an annular fin, and is afterward pared off.

In making the ball, I find it convenient to bring these two hemispherical shells just described, together, so that the beveled edges overlap and contact with each other, by the use of dies such as shown in Fig. 6. Each of these dies 25 and 26 is provided with a hemispherical cavity as at 27 and 28 respectively, in which the shells are placed and the dies are then brought together in a surrounding atmosphere of compressed air, or like fluid. The dies are then held together while the pressure of the surrounding atmosphere is relieved, and the parts are vulcanized together while the compressed air remains entrapped between them.

To facilitate the manufacture of the balls, I find it desirable to mount a number of sets of dies 25 and 26 in cavities in plates 30 and 31, shown in Figs. 7 to 9, which illustrate a suitable apparatus for handling plates in which these dies are secured and for bringing them together in a surrounding atmosphere of compressed air. Such an apparatus comprises a box-like chamber 35, having a removable cover 36 at the top, shown as secured by set screws 37 and having an open side closed by a door 38 hinged to the box at 39. This door may be held closed by a screw 40 threaded through a yoke 42 adapted to swing about a pin 44 extended through ears 45 carried by the cover and adapted to be secured at the other end by a similar pin 46 passed through ears 47, between which the end of the yoke is brought when in the position shown in Figs. 7 and 8. The screw 40 is preferably provided with a suitable hand wheel 48 for pressing the door tightly to the box, with which it makes an air-tight fit by bearing against packing 50, shown as set in the metal surrounding the opening. Extending from this open side to the opposite wall 53, are grooved ways 54, slidably engaging laterally projecting tongues on a flat slide 55. This slide is adapted to carry the plates 30 and 31 and provides for conveniently placing them in the chamber, as they may be set upon the slide when in the position shown in Fig. 9 and then moved to the position shown in Fig. 8, the inner edge of the slide abutting stops 57, preferably formed on the wall opposite the opening.

The plates 30 and 31 when placed in the chamber, are separated as shown, and they may be brought together by means of a screw 60 engaging a nut 61 in the plate 31, preferably extending below the plate to engage an opening in the slide 55, thereby acting to center the plates. The screw 60 is provided with an annular shoulder 62 fitting a recess in the plate 30 and is rotatably held in proper relation with the plate by

means of a washer-like member 63 secured to the plate 30 and engaging this shoulder. One of the plates is provided with dowel pins 65 occupying recesses in the other to mutually position them.

In operation, the plates are properly located on the slide by means of the nut 61; the slide is then pushed in until it abuts the stops 57. The door 38 is then closed and tightly pressed to position by the screw 40. Air under pressure is brought to the chamber through a suitable pipe 67, and the plates are brought together by rotating the screw 60. The air is then relieved through a suitable pipe 68. A pressure gage may be provided as shown at 70, and the pressure controlled by a valve 69. To rotate the screw, I have provided a socket wrench 72, threaded in a vertically slidable sleeve 73, fitted into an opening in a boss 74, and alined with the screw 60 when the plates are in position. The sleeve 73 is surrounded by a stuffing box member 75, preventing leakage of air past the sleeve and acting as an additional guide for the same. When it is desired to bring the plates together, the sleeve 75 and the wrench are moved downwardly until the socket 76 on the wrench 72 engages a square head 77 of the screw 60 and it is there held against the internal pressure in the chamber, by a cross yoke 78. This yoke is secured by vertical studs 79 mounted in the boss 74 and having nuts 81 engaging this yoke. Beneath the yoke is a cap member 83, threaded onto the sleeve 73, being provided with packing 84 around the shank of the wrench 72. This wrench is provided with threads 85 at its lower end engaging threads in the sleeve 73 which are of the same pitch as the threads of the screw 60. Accordingly when the wrench is brought into engagement with the square headed screw and the wrench rotated by suitable handles as shown at 87, the threads 85 will cause the wrench to follow the screw downwardly and retain its engagement with the square head of the screw. To facilitate bringing the wrench into engagement with the square head of the screw, I may provide windows 90 in the sides of the box-like chamber, through which this operation may be watched.

After the ball-sections are brought together, entrapping the air as described, and the external pressure relieved, the door of the apparatus is opened, and the mold plates (held firmly together) are slid out and transferred to a suitable vulcanizing apparatus. After vulcanization, the plates are separated and the balls taken out ready for use or to receive their covers in the usual manner.

Having thus described my invention, what I claim is:

1. A hollow rubber ball composed of two hemispherical sections having beveled edges fitting one into the other and so united together as to make the wall of substantially even thickness throughout.

2. A hollow rubber ball composed of two hemispherical sections, one having an outwardly beveled edge and the other an inwardly beveled edge, these edges being fitted together and vulcanized, the ball being inflated with air under pressure.

3. A hollow inflated rubber ball composed of two hemispherical sections having beveled edges fitting one into the other and vulcanized together.

4. A hollow rubber ball composed of two previously formed hemispherical sections, one having an outwardly beveled edge and the other an inwardly beveled edge, these edges being fitted together and vulcanized.

In testimony whereof, I hereunto affix my signature in the presence of two witnesses.

FRED THOMAS ROBERTS

Witnesses:

H. R. Strauss,

Charles A. Comp.