

Nov. 12, 1940.

W. J. VOIT ET AL

2,221,533

ATHLETIC BALL

Filed Nov. 6, 1937

2 Sheets-Sheet 1

Fig. 1.

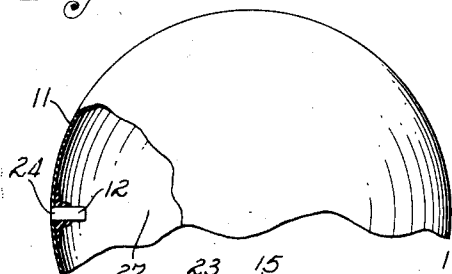


Fig. 2.

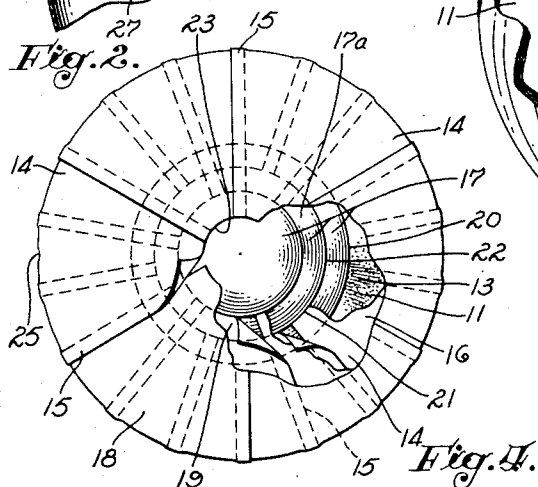


Fig. 4.

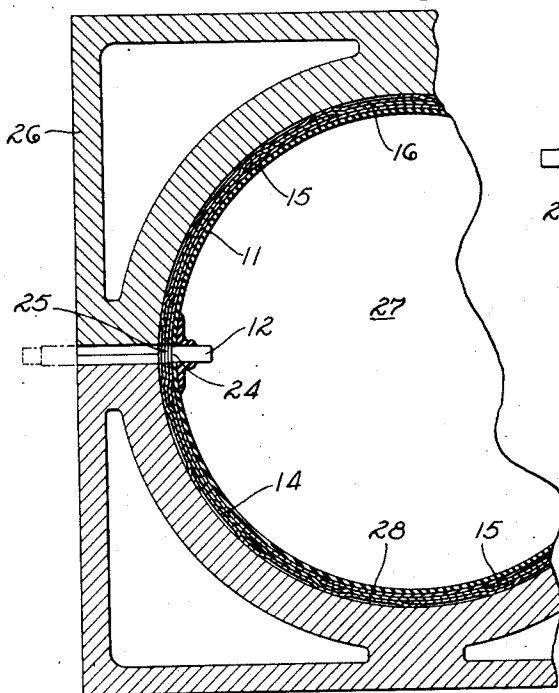


Fig. 3.

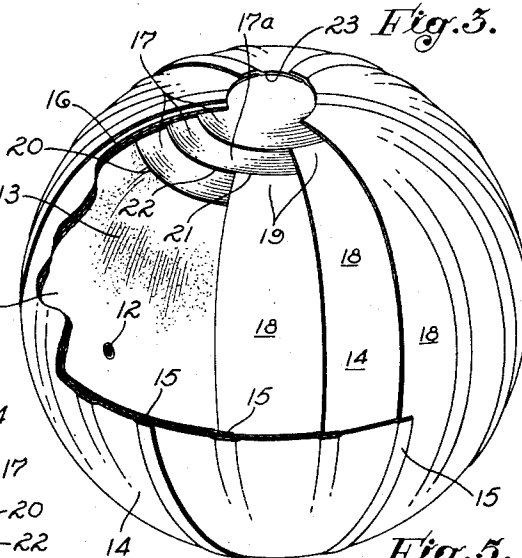
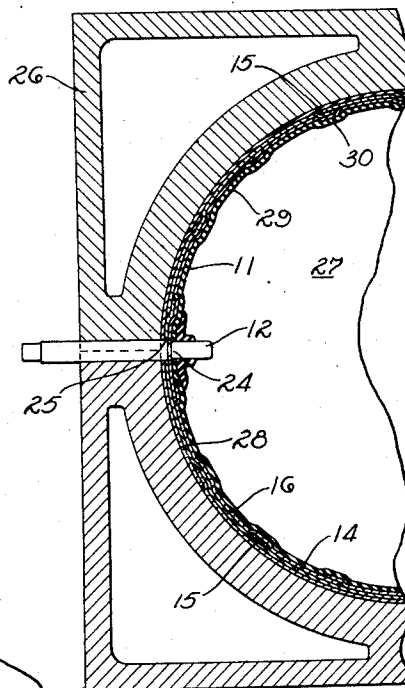


Fig. 5.



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2 Sheets-Sheet 2

Fig. 6.

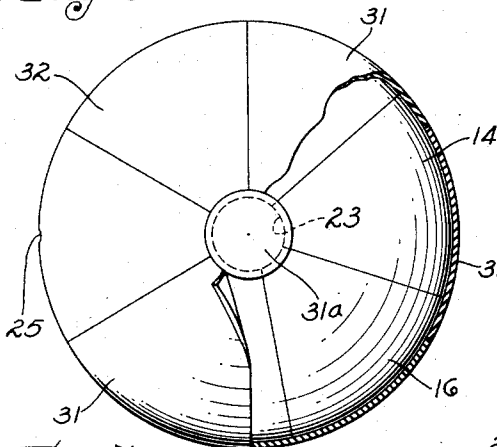


Fig. 7.

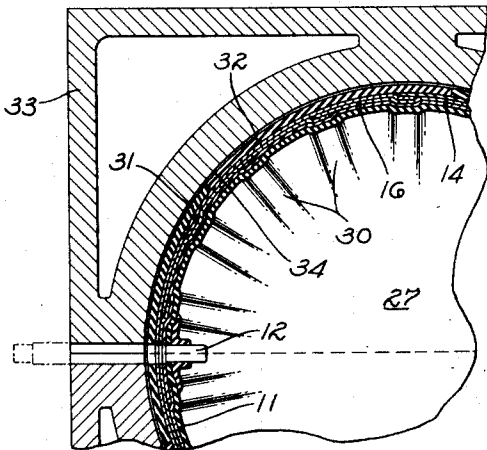


Fig. 8.

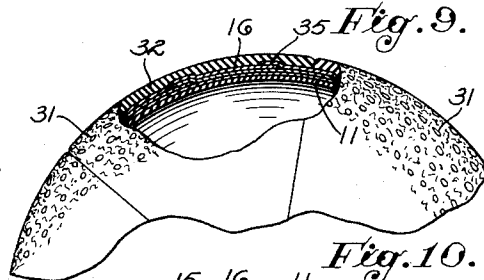
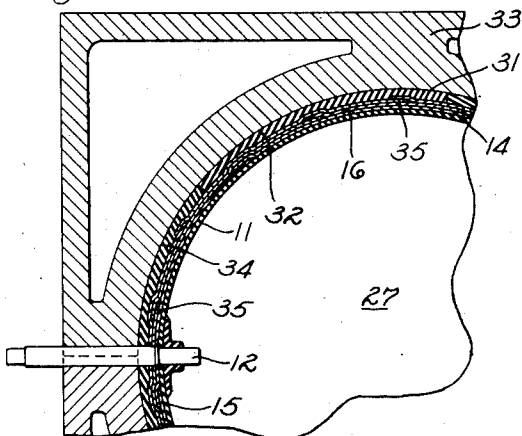


Fig. 10.

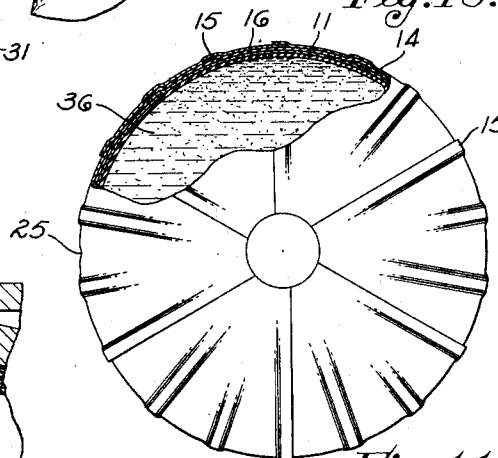
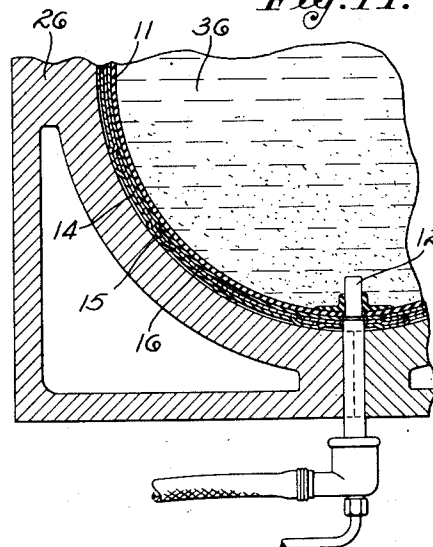


Fig. 11.



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UNITED STATES PATENT OFFICE

2,221,533

ATHLETIC BALL

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to said William J. Voit

Application November 6, 1937, Serial No. 173,158

11 Claims. (Cl. 273—65)

This invention relates to inflatable athletic balls.

It relates particularly to that class of inflatable athletic balls which comprise a central bladder to provide a means of inflation, an intermediate wall of relatively nonstretchable material, to give the ball a definite size and shape, and an outer protective covering of rubber, leather or other material, to resist surface abrasion and wear. While some features of our invention are usable with any type of outer cover or with no cover, we prefer to make the outer cover of rubber, which not only resists surface wear, better than leather or other materials, but provides a water-proof casing for the ball, which prevents the entrance of water, dirt and other deleterious matter into the substance of the intermediate layer, where such foreign matter would cause decay and mechanical destruction, with resultant disintegration of the material of this intermediate layer.

One of the objects of our invention is to provide an athletic ball of this type which can be made by a method which shall be rapid in operation, economical of the time of the factory operatives, and shall require a minimum of mechanical equipment.

In these athletic balls it is desirable to provide an intermediate relatively non-stretchable wall which shall be composed of a plurality of segments, facilitating accurate conformation of the wall to the central bladder, which segments shall be firmly united into one continuous wall capable of transmitting stresses in every direction throughout its entire extent.

Another object of our invention is to thus firmly unite these segments by the use of marginal seams, and to so dispose these seams that they will not cause the ball to have uneven elasticity, will not deform the outer surface of the ball with ridges or other objectionable deviations from true shape, and will act to prevent relative circumferential displacement of the outer cover and intermediate layer.

Another object of our invention is to provide a ball of this type in which the intermediate layer is so fabricated that it will almost completely resist stretching stresses. When the ball is inflated, the intermediate fabric layer will, because of this resistance to stretching stresses, prevent the ball from becoming larger than the size established by the regulations of the game for which the ball is designed. And this same resistance to stretching stresses will prevent the ball from being deformed by heavy blows against

floor, walls, or other objects, and will lengthen its life.

Another object of our invention is to provide a ball which shall be readily inflatable, will not stretch, will resist surface wear, be water-proof, and have no surface seams, ridges, or irregularities, and which shall in combination with these several attributes, be characterized by a continuous, integral webwork of vulcanized rubber from inner surface to outer surface, binding the entire structure together in a flexible whole, but yet in such a manner as to prevent relative movement of its component parts, and the resulting "break-down" of the walls of the ball which occurs when adjoining particles begin such a relative movement.

Another object is to provide a ball of this type which can be made by a method which makes possible a rapid and workmanlike application of the segments of a one-piece rubber cover to the intermediate fabric layer prior to molding the cover on the ball which object is attained by providing a fabric layer with a smooth surface without ridges or other elevations. Other features and advantages of our invention will appear from a reading of the specification and drawings, and will be presented in the claims.

Claims to a method of manufacture by which may be produced the article of manufacture which is the subject matter of this application are contained in our co-pending application Serial No. 268,682.

In the drawings:

Fig. 1 is a fragmentary elevational view, partly in section of the central bladder.

Fig. 2 is an elevational view of the partly finished ball, showing the manner of applying the fabric segments of the intermediate wall, with some of the segments broken away to more clearly disclose the construction.

Fig. 3 is a perspective view of the partly finished ball, showing it at the same stage of construction as that of Fig. 2, and also with some of the segments of the intermediate wall broken away.

Fig. 4 is a fragmentary sectional view of the partly finished ball of Figs. 2 and 3 and the mold in which it has been placed, and before the application of internal pressure.

Fig. 5 is a showing similar to that of Fig. 4, but after the application of internal pressure.

Fig. 6 is an elevational view showing the method of applying the segments of the outer rubber cover to the partly finished ball, some of the

segments being broken away to more clearly disclose the construction.

Fig. 7 is a fragmentary sectional view of the ball with the segments of the rubber cover in place, and with the ball in position in a second mold, but prior to the application of internal pressure.

Fig. 8 is a showing similar to that of Fig. 7, but after the application of internal pressure.

Fig. 9 is a fragmentary elevational view of the completed ball, partly in section.

Fig. 10 is an elevational view of a partly finished ball, shown partly in section, illustrating the use of alcohol as a forming filler for the bladder during the manufacturing process.

Fig. 11 is a sectional elevational view of the partly finished ball of Fig. 10 after being placed in a mold.

For reference purposes it is convenient to speak of the poles and the equatorial region of the athletic ball. In all of the figures of the drawings, except Fig. 3, the polar axis of the ball is a horizontal line perpendicular to the plane of the drawing sheet, and the equatorial line appears as a bounding great circle or an arc of a great circle, according to whether the view is complete or fragmentary. In Fig. 3 one of the poles is shown near the top of the figure. While the ball depicted in the drawings is spherical, our invention is equally applicable to athletic balls which are either elliptical in longitudinal cross section, or of some other shape suitable to the purpose for which they are designed. Whenever words applicable to a spherical ball appear in this description, it will be understood that it is for convenience of description only, and that corresponding words applicable to some other shape may be substituted throughout.

We can best explain the construction of a ball made in accordance with our invention by describing the several steps in its manufacture.

We first make in accordance with standard methods a thin walled rubber bladder 11 having a shape when inflated like that of the finished ball, and provide it with an air check valve 12 of the type usually used for this purpose. Through this valve we then admit air or any other suitable gas under pressure, and inflate the bladder until it reaches a size slightly less than that desired for the completed ball. The bladder is next completely coated with a rubber cement 13 by dipping the bladder in a bath of the cement or in any other suitable manner. Pieces or segments 14 of relatively non-stretchable rubberized fabric, commonly known as "friction fabric" are then applied to the cement coated bladder to form a continuous and complete layer or wall 16 on the exterior surface of the bladder. These pieces of fabric may be cut and applied in any one of a number of ways to present any one of a number of different patterns. And they may be applied in one or more thicknesses, as may be required to meet the conditions of any particular problem of ball design. But whatever the pattern of application or the number of thicknesses, we have found it preferable to give the several pieces a shape and size such that their meeting edges overlap to form thickened seams 15. The underface of the overlapping edge of one piece is preferably treated with rubber cement to cause it to adhere to the outer surface of the edge of the adjacent piece beneath it. When the pieces or segments, to complete one thickness of the fabric wall, have been applied the ball is again given a coating of

rubber cement, and the pieces constituting the next thickness placed in position.

Figs. 2 and 3 illustrate a preferred construction of the wall 16. Three thicknesses are shown, each comprising a circular polar piece or segment 17, and longitudinal segments 18. Each of these longitudinal segments overlaps corresponding polar pieces 17 at its two ends, respectively, and each longitudinal segment overlaps along one of its longitudinal edges, the next adjacent longitudinal segment, to form a seam 15. When the layer is made up of more than one thickness, we preferably extend the overlapping end 19 of each longitudinal segment beyond the circular edge 20 of its corresponding polar cap segment 17 to form a butt joint at 21 with the circular edge 22 of the next outer polar cap segment 17a. The polar edges 23 of the outermost layer of longitudinal fabric segments may be for ease of manufacture disposed a short distance away from the pole of the ball, and the small circle bound by these edges may be left unfilled by any fabric segment. That longitudinal segment or segments which are applied over the end 24 of the valve 12 are each provided with a small aperture 25 registering with the valve in the bladder.

After the one or more layers of rubberized fabric constituting the wall 16 have been placed in position upon the bladder, the ball with outwardly projecting seams 15, is put in a mold 26 of spherical shape, and of which the size is slightly less than that of the finished ball. As will be seen from an inspection of Fig. 4 of the drawings, the inner face of the mold is spaced from those portions of the outer surface of the outer layer of segments 18 which are between the seams 15. Air or other gas is then forced through the valve 12 into the interior chamber 27 of the bladder 11, and a pressure applied sufficient to force the wall 16 at all points of its outer surface into intimate contact with the inner face 28 of the mold. In practice it has been found that a pressure of approximately ninety pounds per square inch is required for this purpose. Those portions of the outer surface of the wall 16 between the seams 15 are raised until flush with the outermost portions of the seams, which thus disappear as features of the outer surface of the wall 16. At the same time, as shown in Fig. 5, ribs or seams 30 appear on the inner surface 29 of the bladder. At this juncture sufficient heat is applied to the mold, and for a sufficient time, to partially vulcanize the rubber component of the fabric segments 14 and the rubber cement used in assembling these segments. This heat partially hardens the rubber and fixes in rigid position the ribs 30 which project inwardly of the bladder wall.

The ball is then deflated and removed from the mold. While we prefer at this stage to apply a protective cover of rubber or other material, the process of manufacture as so far described may be employed to produce a completed ball, in which case the wall 16 becomes the outer wall of the ball. For some types of use and if the wall 16 is made of proper materials, an athletic ball without an additional protective wall may give satisfactory performance.

When the ball is to be provided with a rubber cover, it is, after removal from the mold 26 re-inflated, sufficiently to give it that degree of rigidity desirable for the next step in the process of manufacture. This step consists of the application of pieces or segments 31 of unvulcanized rubber. We prefer to cut six longitudinal segments 31 and one circular polar segment 31a. 75

The ball is first coated with rubber cement, by dipping or otherwise, and the segments 31, 31a applied and fitted upon the outer surface of the wall 16. The segments are so designed and cut that they fit together with butt joints to completely cover the wall 16 in one continuous rubber layer or wall 32. Fig. 6 shows the pattern according to which we prefer to apply these segments 31 and 31a.

The ball is then placed in the second mold 33, as shown in Fig. 7. This mold is, like mold 26, of the shape of the finished ball, and is also of the same size as that of the finished ball. As will be seen from an inspection of Fig. 7 of the drawings, the inner face of the mold is spaced from the outer surface of the wall 32. Air or other gas is then forced through the valve 12 into the interior chamber 27 of the bladder 11, and a pressure applied sufficient to force the wall 32 at all points of its outer surface into intimate contact with the inner face 34 of the mold. At the same time the intermediate wall 16 and the bladder 11 are pressed outwardly, the wall 16 against the rubber wall 32, and the bladder against the wall 16. The wall 16 as it moves outwardly is stretched. When a sheet of rubberized fabric, such as that used in making the wall 16, is stretched by tensile stresses applied longitudinally of the sheet, seam ridges, such as those at 30, tend to disappear and corresponding seam ridges tend to appear on the opposite face of the sheet. In accordance with this principle, when a pressure of approximately ninety pounds is applied within the ball, when in position in the mold 33, the ridges 30 tend to disappear and corresponding ridges 35 appear on the outer surface of wall 16. The ridges 30 are also flattened out, and the ridges 35 correspondingly produced on the outer face of wall 16 by the direct effect of pneumatic pressure acting radially outward. Fig. 8 shows the ball after the application of pressure to it in the mold, and in that figure the inner face of the bladder 11 and wall 16 are shown as smooth, and ridges 35 are shown projecting outwardly into the material of the rubber cover 32. Heat is then applied to the mold 33 to vulcanize the rubber of the bladder, of the cement, of the fabric wall 16, and of the rubber cover 32, which unites into one flexible whole the several elements of the ball, with the elements disposed as shown in Fig. 8. The material of the segments of the rubber cover becomes plastic when heated and forms itself with a smooth exterior surface and an interior surface conforming to the outer surface of the wall 16, and is then hardened in that position. The ridges 35 are fixed in the position they assumed when the ball was subjected to the pressure of inflation, and become permanently embedded in the wall 32 of the rubber cover. After vulcanization is completed the ball is deflated and then removed from the mold 33, completed and ready for use.

The inner surface of the mold 33 may be engraved to imitate the grain and seams of the covering of a regulation leather covered football or basketball and the design will then appear on the exterior surface of the ball. Inflatable rubber balls have been heretofore produced with seams and grain imitative of the exterior surface of a leather covered ball, but the walls of these balls have not been provided with a fabric constituent or any other reinforcing means to prevent the stretching or other deformation of the outermost rubber layer which is formed with these imitative marks. As a result, when the ball has become

stretched or locally deformed, the imitative marks have been correspondingly distorted and given an unreal appearance, which destroys the simulation of a leather covered ball.

The ball as completed presents no ridges or seams on its outer surface. The ridges 35 embedded in the rubber cover 32 act to key together the two walls 16 and 32, and prevent relative circumferential displacement. That feature of our method of making our athletic ball, by which the lapped seams project alternately, first outwardly, then inwardly, and again outwardly in the completed ball, presents several advantages. It makes possible a rapid assembly of wall 16 on the bladder, which would be impossible were it necessary to fit the segments of wall 16 together with butt joints. It affords a better union of the segments of wall 16 into a single continuous sheet for the transmission of stresses in all directions throughout the surface of the wall, than would be the case with butt joints. It affords a smooth surface on the unfinished ball for the rapid application of the segments of the rubber cover.

The wall 16 serves the primary purpose of preventing the walls of the ball from stretching out of shape or to an undesirable size. For that reason they are made of fabric material. In our process this fabric material is twice subjected to a heavy internal pressure of inflation which stretches it in advance of the use of the ball for play purposes, since the mold used in conjunction with each application of internal pressure is larger than the ball structure placed within it. Each time that it is subjected to this stretching action the fibers of the material become tensionally deformed and substantially less capable of further elongation without rupture and the material becomes consequently substantially less capable of further enlargement without rupture when the fibers are subjected to the stresses arising during the use of the ball. Also at the time of each stretching, the rubber constituent of the fabric material is given a degree of vulcanization, which tends to strengthen the fabric material against further elongation.

Figs. 10 and 11 illustrate a modification of our method of making an athletic ball. The bladder 11 is placed in a mold and filled with an alcohol which has a temperature of liquefaction somewhere between normal atmospheric temperatures and the temperature of vulcanization. Cetyl alcohol, ceryl alcohol, and mericyl alcohol has such a melting point. An alcohol of this type is melted and injected into the bladder, while in a mold. The alcohol is then cooled until it solidifies, and the bladder, now filled with a solid substance, is removed from the mold. The solid alcohol gives a relatively unyielding form to the bladder upon which the segments of the wall 16 can be readily applied. Fig. 10 shows the bladder 11 filled with solid alcohol 36, and shows the segments 14 of the wall 16 applied to the bladder ready to be placed in the first vulcanizing mold 26. Fig. 11 shows the unfinished ball in the mold before the application of additional pressure. Heat is now applied sufficient to melt the alcohol, but not sufficient to vulcanize the rubber constituents of the ball. Additional hot liquid alcohol is injected, and the pressure within the bladder raised to approximately ninety pounds. From this point, the process of manufacturing the ball is continued as heretofore described, except that each time deflation or inflation is required, the temperature of the ball and alcohol must be between

the liquefaction point of the alcohol and the vulcanization point of the rubber, and each time wall segments are to be applied, the temperature of the alcohol and ball should be below the liquefaction point of the alcohol.

Where two successive applications of layers or walls are made to the form, the second high pressure inflation applied while the ball is in the second mold can be made by the use of air or other gas, instead of by the injection of additional liquid alcohol, since there is no subsequent step in the process for which a solid form is needed. It is also apparent that two or more outer walls or layers of material can be applied successively to the solid form without any intermediate step of vulcanization, and all the walls vulcanized upon the form at one operation. The high pressure inflation imparted prior to vulcanization can in that case also be effected by the injection of either air or liquid alcohol. Similarly, when the completed ball is to have but one layer of material, this one layer can be applied to the solid form, and the high pressure applied during the molding operation can be attained by the use of alcohol or air. It is even possible, when two or more layers or walls are applied to the form and each layer is separately subjected to the molding and vulcanizing operation, to use air to effect the high pressure required to force the ball material against the inner surface of the mold, during the first of such molding and vulcanizing operations, provided all of the air is later removed from the ball, before the material of the second wall is applied to the form. Otherwise, the presence of air as well as alcohol within the ball will cause the core form to have an imperfect shape, with depressions or other deformations, due to air pockets in the solid alcohol. In the preferred succession of steps which we have described, which comprises two applications of material and two vulcanizing operations, we can vary our method of using the alcohol by removing all the alcohol from the ball after the first vulcanizing operation and relying solely on air pressure, subsequently applied, to give the ball the requisite rigidity for the application of the segments of the outermost wall.

We may omit the use of a central bladder entirely in that modification of our process which involves the use of alcohol to provide a solid form upon which to build up the wall or walls of the ball. In that case, we may form the solid core of alcohol in a suitable mold and rely on the materials in the one or more walls of the ball to retain the alcohol or both alcohol and air injected into the ball during the manufacturing process. While we have referred to alcohol of the physical qualities above recited as one material which may be used in our modified method of manufacture, it is obvious that other materials are also adapted to meet the conditions of our process. We can mention as examples of such other materials, paraffine, wax, and ordinary water ice.

While we have shown and described one particular construction and arrangement of parts in an athletic ball, which embodies our invention, we do not wish to be limited to the particular construction and arrangement of parts herein described, but desire to include in the scope of our invention the features of novelty substantially as set forth in the following claims.

We claim as our invention:

1. In an athletic ball: an inner wall comprising a plurality of segments with lapped meeting edges; spherical means for retaining a gas within

said inner wall; and an outer wall contiguously surrounding said inner wall, the said lapped meeting edges of said inner wall forming thickened seams, said seams lying entirely outside the inner curvilinear surface of said inner wall and portions of said seams lying outside the outer curvilinear surface of the central portion of said segments of said inner wall, said portions being embedded in said outer wall.

2. In an athletic ball, the combination of: an inflatable center; a fiber wall contiguously surrounding said center comprising a plurality of segments with lapped seams said seams lying substantially outside the outer curvilinear surface of said inflatable center and portions of said seams lying outside the outer curvilinear surface of the central portion of said segments; and an outer wall of hardened plastic material contiguously surrounding said fiber wall and in which said seam portions are embedded.

3. In an athletic ball: an inflatable rubber center; a layer of fabric material contiguously surrounding said center comprising a plurality of segments joined in thickened lapped seams, said seams lying substantially outside the outer curvilinear surface of said center and portions of said seams lying outside the outer curvilinear surface of the central portions of said segments; and an integral molded rubber cover contiguously surrounding said layer of fabric material and in which said seam portions are embedded.

4. In an athletic ball: an inflatable rubber center; a layer of rubberized fabric material contiguously surrounding said center comprising a plurality of segments joined each with adjacent segments in thickened lapped seams lying substantially outside the outer curvilinear surface of said center and portions of said seams lying outside the outer curvilinear surface of the central portions of said segments; a layer of rubber cement between said segments and said inflatable center; a layer of cement on the outer surface of said segments; and a molded rubber cover contiguously surrounding said layer of fabric material and in which said seam portions are embedded.

5. In an athletic ball: an inflatable rubber center; a layer of rubberized fabric material contiguously surrounding said center comprising a plurality of segments joined each with adjacent segments in thickened lapped seams lying substantially outside the outer curvilinear surface of said center and portions of said seams lying outside the outer curvilinear surface of the central portions of said segments; a layer of rubber cement between said segments and said inflatable center; a layer of cement on the outer surface of said segments; and a molded rubber cover contiguously surrounding said layer of fabric material and in which said seam portions are embedded, said rubber center, said layers of rubber cement, said layer of rubberized fabric material, and said rubber cover being vulcanizably united into one continuous structure.

6. In a hollow athletic ball: a reinforcing wall adapted to resist circumferential stresses, comprising fibrous material in a state of tensional deformation imbedded in vulcanized rubber, the fibrous strands of said material being substantially less capable of elongation without rupture when subjected to tensional stress than is normally characteristic thereof.

7. In a hollow athletic ball: a reinforcing wall adapted to resist circumferential stresses, comprising woven fabric material in a state of ten-

sional deformation imbedded in vulcanized rubber, the fibrous strands of said material being substantially less capable of elongation without rupture when subjected to tensional stress than is normally characteristic thereof.

8. The combination in a hollow athletic ball adapted to be repeatedly inflated and deflated of: an inner gas retaining rubber wall; an intermediate reinforcing wall adapted to resist circumferential stresses created by inflation of the ball and comprising fibrous material in a state of tensional deformation imbedded in vulcanized rubber, the fibrous strands of said material being substantially less capable of elongation without rupture when subjected to tensional stress than is normally characteristic thereof; an outer protective cover; and an inflating structure mounted in said ball and adapted to afford a valved gas passage through the said cover and walls to the interior of the ball, the said walls and cover being permanently vulcanized in one integral structure, comprising a continuous rubber matrix extending from the inner surface of said inner gas retaining rubber wall to the outer surface of said cover and in which said fibrous material in a state of tensional deformation is embedded.

9. The combination in a hollow athletic ball adapted to be repeatedly inflated and deflated of: an inner gas retaining rubber wall; an intermediate fibrous reinforcing wall adapted to resist circumferential stresses created by inflation of the ball, and comprising vulcanized rubberized fibers in a state of tensional deformation, said fibers being substantially less capable of elongation without rupture when subjected to tensional stress than is normally characteristic thereof; an outer protective cover; and an inflating structure mounted in said ball and adapted to afford a valved gas passage through the said cover and walls to the interior of the ball, the inner wall and intermediate wall being permanently vulcanized in one integral structure, com-

prising a continuous rubber matrix in which said fibers in a state of tensional deformation are embedded.

10. The combination in a hollow athletic ball adapted to be repeatedly inflated and deflated of: an inner gas retaining rubber wall; an intermediate fibrous reinforcing wall adapted to resist circumferential stresses created by inflation of the ball, and comprising vulcanized rubberized fibers in a state of tensional deformation, said fibers being substantially less capable of elongation without rupture when subjected to tensional stress than is normally characteristic thereof; an outer protective cover; and an inflating structure mounted in said ball and adapted to afford a valved gas passage through the said cover and walls to the interior of the ball, the said intermediate wall and cover being permanently vulcanized in one integral structure, comprising a continuous rubber matrix in which said fibers in a state of tensional deformation are embedded.

11. The combination in a hollow athletic ball adapted to be repeatedly inflated and deflated of: an inner gas retaining rubber wall; an intermediate reinforcing wall adapted to resist circumferential stresses created by inflation of the ball, and comprising vulcanized rubberized fibers in a state of tensional deformation, said fibers being substantially less capable of elongation without rupture when subjected to tensional stress than is normally characteristic thereof; an outer protective rubber cover formed with a design simulative of the seams and grain of a leather cover; and an inflating structure mounted in said ball and adapted to afford a gas pasasge through the said cover and walls to the interior of the ball, the said walls and cover being permanently vulcanized in one integral structure, comprising a continuous rubber matrix in which said fibers in a state of tensional deformation are embedded.

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CERTIFICATE OF CORRECTION.

Patent No. 2,221,533.

November 12, 1940.

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It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, second column, line 27, for "ruberized" read --rubberized--; page 3, second column, line 20, for the word "well" read --wall--; line 53, for "and" read --or--; 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 24th day of December, A. D. 1940.

(Seal)

Henry Van Arsdale,
Acting Commissioner of Patents.