Nov. 23, 1965 J. W. WAY **3,219,347**

AIR INFLATED BALL WITH REINFORCED SEAMS

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FIG. 1.

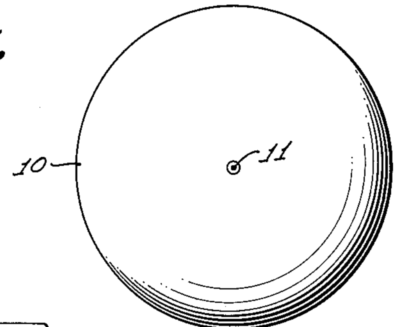


FIG. 2.

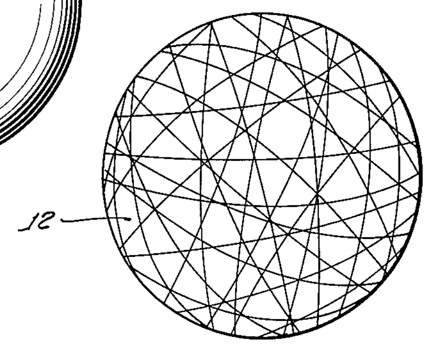


FIG. 3.

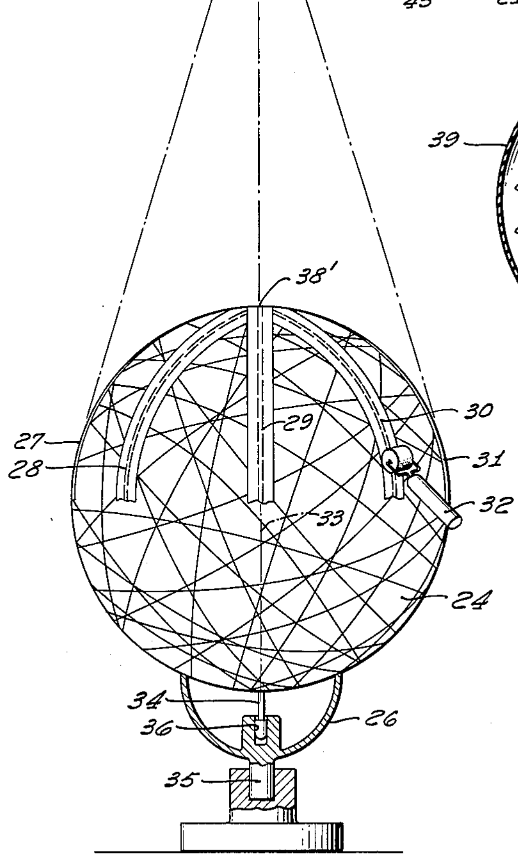
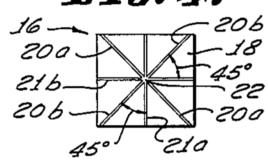


FIG. 4.



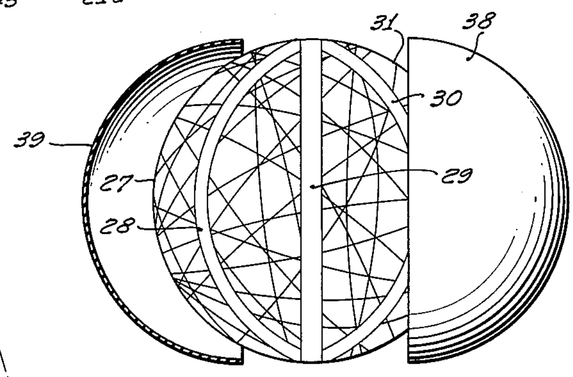


FIG. 5.

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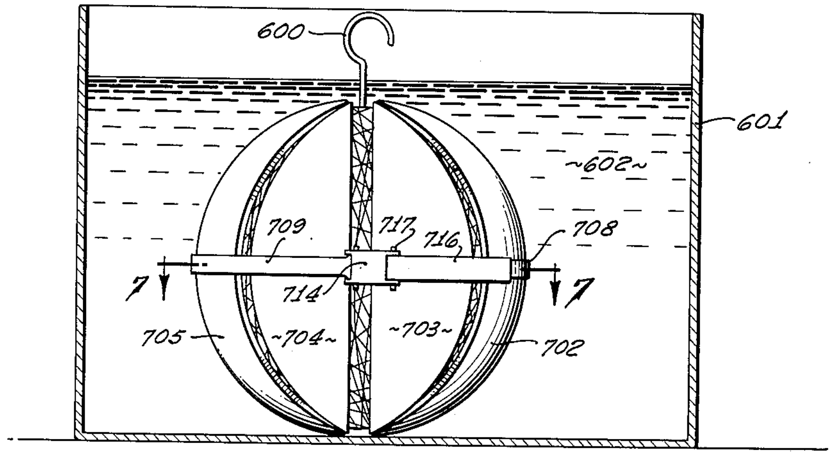
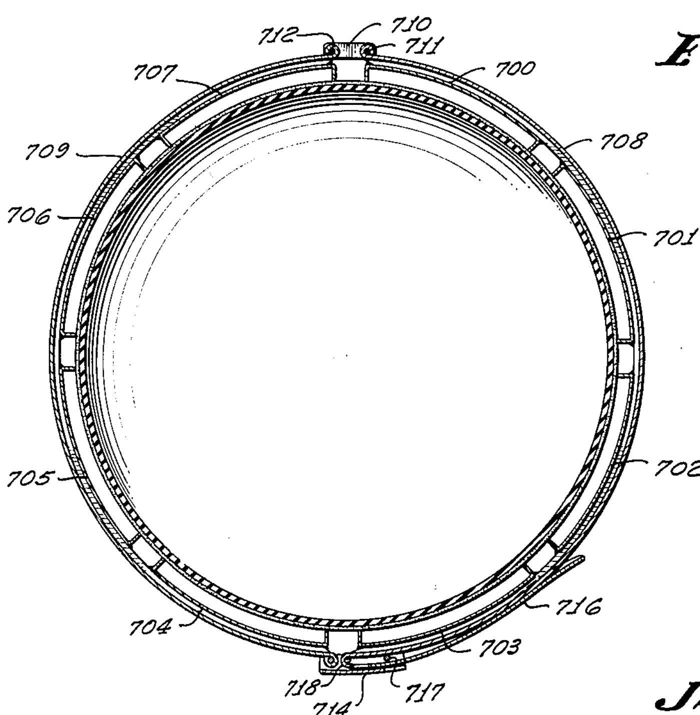


FIG. 6.

FIG. 7.



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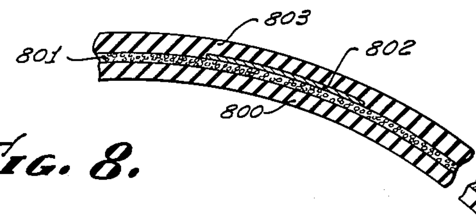


FIG. 8.

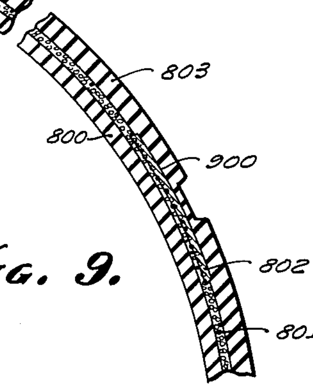
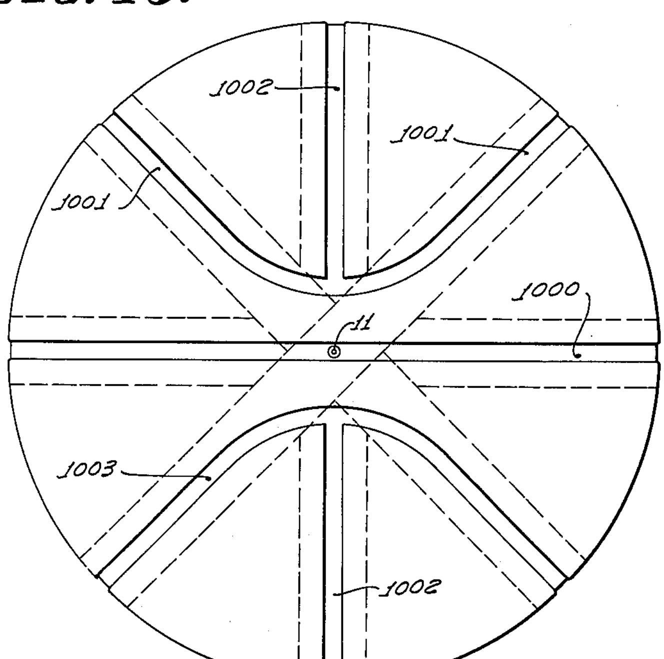


FIG. 9.

FIG. 10.



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AIR INFLATED BALL WITH REINFORCED SEAMS

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3 Claims. (Cl. 273—65)

This invention relates to play balls, and more particularly to play balls of the basketball, volleyball, football and soccerball types, which have either a real seam pattern when the outer cover is made of leather, or a simulated seam pattern impressed on a rubber or resin cover when the cover is a synthetic cover.

Originally, balls of the above type had nothing but leather covers and rubber bladders for inflating the covers. Since leather could not be shaped or molded into a continuous, smooth, single piece, seamless sphere, such leather covers usually consist of a plurality of sections sewn together. These sections usually have predetermined shapes or patterns consisting of the inwardly projecting grooves produced by the inverted seams, with the result that the balls with the leather covers have predetermined, typical inverted seam and inwardly projecting groove patterns produced on their surfaces by the leather seams. These patterns at once identify and typify the nature of the ball. Thus, the basketball has a typical basketball seam pattern, the volleyball has a typical volley ball seam pattern, etc., these patterns being determined by the shape of the leather sectors used for making the outer cover of the leather-covered balls. Seams of the above type in some of the balls also have acquired some functional characteristics. For example, in the basketballs and footballs the seams are used by the players for more readily grasping and orienting the ball, and it is also considered that the seam grooves alter the flight characteristics of the ball and make the trajectories followed by grooved balls more precise than the trajectories of the ball without any grooves. Suffice it to say that the above inwardly grooved patterns have been so well established in the respective types of balls that they now must be followed in the synthetic covers even though it is entirely possible to make covers from the synthetic molded materials with continuous, seamless, smooth surfaces, without any seams or depressions over the entire outer surface of the ball. The matching surfaces of the two hemispherical halves of a mold having a spherical cavity can be made to engage each other along an equatorial joint with such a high degree of precision that the flashing can be reduced to such an extent that the end product, for all practical purposes, is a flashless product. In this manner the covers could be made of uniform thickness and uniform strength and flexibility if it were not for the necessity of impressing into the outer cover the above mentioned patterns which simulate the seams that are used on the leather covered balls.

Accordingly, the synthetic covers are molded so as to simulate the seam pattern by impressing the inwardly projecting grooves. The wall of the ball, however, is weakened at the simulated "seam" because the thickness of the wall and of its outer cover is reduced, at times as much as 30% along the entire length of such seam. For example, in basketballs it is customary to have an outer cover made of either rubber or polyvinyl chloride resin with the thickness of the outer cover being in the order of from .030" to .050". When the basketballs of the above type are put to use, the weakest "link in the chain" is the seam portion because repeated bouncing of such balls produces a sharp, localized flexing of the ball's wall at and along the "seams" with the result that the wall fails prematurely along the simulated "seams" while the remaining portion of the wall is still in a very good condition with only slightly perceptible wear. Thus, the life of the ball is limited by the above "seams."

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I discovered that the above premature destruction of the balls, with the molded synthetic covers, having inwardly projecting molded seam patterns, can be eliminated by preferentially reinforcing through rigidizing the wall structure of the ball directly under and along the seams, with the result that such local reinforcement with the aid of localized rigidizing of the wall along and under the seams makes the flexibility of the entire wall more uniform. With the wall of the ball having such reinforcement and rigidizing of the "seam" portions of the wall structure, it becomes possible to increase the life of the ball by from 400% to 500%. For example, actual tests indicate that the life of a ball, when measured in terms of the number of bounces which the ball can withstand before encountering any flexural failure, can be increased from 4 to 5 times when the cover of the ball, and, therefore, the entire wall, is made of uniform thickness and the seam pattern is eliminated altogether. I have obtained the same gain in the life of the ball with the above type of seam reinforcement, and therefore, the seam reinforced ball, produced in accordance with this invention, has substantially the same life as the ball having a wall of uniform thickness; therefore, the above test data indicates that the premature flexural failure of the walls is eliminated by my invention altogether.

It is, therefore, an object of this invention to produce a ball having an elastomeric cover with the simulated inwardly projecting seam pattern molded into the cover and having such wall reinforced along and under the simulated seams so as to make the flexing characteristic of the wall uniform over its entire surface and thus prevent premature flexural failure of such wall along such seams.

Other objects of this invention will become apparent from more detailed description of the invention in connection with the accompanying drawings in which:

FIGURE 1 is a plan view of a bladder.

FIGURE 2 is a plan view of a bladder with the reinforced winding applied to the bladder.

FIGURE 3 is a side view of one type of apparatus which is suitable for reinforcing simulated seam structure.

FIGURE 4 is a plan view of a projection slide used in connection with the apparatus illustrated in FIGURE 3 with the view taken in the plane 4—4 illustrated in FIGURE 3.

FIGURE 5 is a side view of the ball with reinforced seams and two side covers being applied to the ball.

FIGURE 6 is a side view, partly in sections, of a tank filled with plastisol or latex with the ball being immersed in the tank for reinforcing the wall of the ball along and under the simulated seam structure of the ball.

FIGURE 7 is a sectional view of the ball and of the frame, surrounding the ball, taken in the plane 7—7 illustrated in FIGURE 6.

FIGURE 8 is an enlarged sectional view of the ball prior to molding.

FIGURE 9 is a sectional view of the same ball after the completion of the compression molding.

FIGURE 10 is a side view of a finished ball.

Referring to FIGURE 1, it illustrates a side or plan view of a bladder **10** with an air inflating valve seat **11**, molded into the bladder. The bladder is made of synthetic rubber, or polyvinyl chloride resin or a blend of nitrile rubber and polyvinyl chloride as disclosed in my application, Serial Number 167,399, filed January 19, 1962, and titled "Ball, Ball Bladders and the Method of Making Them."

The bladder then is reinforced by means of a nylon cord **12** in the manner partially illustrated in FIGURE 2, the preferred mode of winding being of the type disclosed in the patent to R. G. Holman, Patent Number 2,995,311, issued August 8, 1961, entitled "Method of Winding a Ball." Upon completion of the application of the winding, the produced carcass is ready for receiving seam reinforcements on its surface. This can be achieved by two methods. The first method is illustrated in FIGURE 3 and the second method is illustrated in FIGURES 6 and 7.

Referring to FIGURE 3, it illustrates a projector **14** having a slide **16** placed in the projector. The plan view of the slide is illustrated in FIGURE 4. It represents a rectangular glass plate **18** with four opaque bands **20***a*, **20***b*, **21***a* and **21***b* superimposed on a plate and having a pattern illustrated in FIGURE 4. The pattern consists of four bands crossing at a center **22**, the first two lines **20***a* and **20***b* forming one right angle cross, and the second two lines **21***a* and **21***b* forming a second right angle cross, with these two crosses (**20***a*, **20***b* and **21***a*, **21***b*) being placed at 45° with respect to each other. When such slide is placed in projector **14** and a ball **24** is placed on a stand **26**, projector **14** produces a corresponding double cross pattern on the surface of the ball, this pattern being illustrated by bands **27**, **28**, **29** and **30** in FIGURE 3. These bands are then used as a guide for applying reinforcing layers of vinyl resin by means of a roller **32** which is dipped into a vinyl plastisol or a latex contained in a suitable tray similar to that used in connection with paint rollers.

The amount of vinyl plastisol applied by means of roller **32** should be sufficient so as to impregnate completely the interstices of the winding along the bands **27** through **31**, and also leave a thin layer of vinyl on top of the winding.

The four semi-circular bands **27** through **31** are then completed extending them all the way around the ball by turning the ball 180° and placing a stem **34** in line with the center line **33** of the stand and of projector **14**.

The ball must be properly oriented on stand **26** so that the valve seat **11** is properly placed in a compression mold which is used later for compression molding the ball.

Such proper orientation of the ball is obtained at the time the upper half of the bands are painted on the ball. The ball is then properly oriented for the second time when the ball is turned 180° and painting of the bands is completed. The first orientation of the ball is achieved quite readily by means of a wooden stem **34** which is placed in the air valve seat **11** of the ball. The stem is then placed in a recess **36** which is provided for this purpose in stand **26**. Automatically, this at once places the ball in proper position with respect to projector **14**, and projector **14** in turn then produces the shadow bands **27** through **30** in proper relationship with respect to the position of the valve seat of the ball, i.e., pole **38′** is 180° away from the valve seat **11**. In order to orient the ball properly for the second time, which is necessary for the completion of the bands, stem **34** is used again. In this case, stem **34** is placed in the center of the pole **38′** produced by the projector which at once places the second pole of the ball in line with the center line **33** of the entire apparatus. The projector again produces the same pattern **27** through **30** on the second half of the ball. Stand **26** is then rotated on stem **35** until complete alignment is obtained between the upper shadow pattern and the already painted 180° bands **27** through **30**, which now appear on the lower half of the ball. The second half of the pattern is then completed by using roller **32**. In this manner, four circular bands are painted on the ball, these 360° bands being also visible in FIGURE 5 as the 360° bands **27** through **30**.

A suitable composition of the plastisol for the seam reinforcement is given below:

Example No. 1.—Seam reinforcing composition

Parts by weight for 100 parts of polyvinyl chloride:

Polyvinyl chloride	100
Di-octyl phthalate	30
Calcium carbonate	50
Barium-cadmium organic stabilizer	2
Lecithin	2

Pigment to suit individual requirements.

The polyvinyl chloride resin is divided into two distinct types, i.e., a high solvating resin such as is commonly used in plastisol compositions, and a low solvating type used more commonly in injecting molding vinyls. By adjusting the two resins, one can increase or decrease the viscosity of this mix to provide an adjustment in the degree of penetration into the cord layer and also to regulate the weight of material applied by the roller **32**.

The dynamic properties of the cured resin used for seam reinforcement can be given in terms of the Shore durometer readings. The Shore durometer reading of the cured composition of the above example is between 85 and 95 on the scale A.

With the seam reinforcement thus completed, the carcass is then dipped into a tank similar to that shown in FIGURE 6 filled with a vinyl plastisol in order to impregnate the winding with the plastisol. This plastisol, upon curing, has a Shore durometer reading of from 55 to 70 on the scale A. A suitable composition for such vinyl plastisol is given below:

Example No. 2.—Composition for impregating the winding

Parts by weight for 100 parts of polyvinyl chloride:

Polyvinyl chloride (plastisol type)	100.00
Di-butoxyethyl adipate	37.00
Epoxy derivative plasticizer	10.00
Butyl cyclo hexyl phthalate	20.00
Organic phosphite	2.50
Metal-organic phosphite chelator-stabilizer	1.00
Calcium carbonate inert filler	5.00

Pigment to suit color requirements.

The ball is then completed by applying an outer cover to the carcass which is also made of vinyl as in the above Example #2, except that the vinyl is of the injection molding type. In this case, the Shore durometer reading of such a cover, upon curing, is in the order of from 55 to 70 on the scale A. Two hemispherical pieces 38 and 39 of the cover are made by using injection molding methods which are then pulled over the carcass as illustrated in FIGURE 5, whereupon the entire ball is ready for compression molding.

The complete ball is illustrated in FIGURE 10 with the simulated seams appearing at **1000**, **1001**, **1002** and **1003**, and the dotted lines indicating the boundaries of the seam-reinforcing and rigidizing layers.

FIGURES 6 and 7 illustrate an alternative method of applying the seam reinforcing to the carcass. Eight metallic, rigid segments, **700** to **707**, are mounted on two hinged together semi-circular rigid metallic bands **708** and **709**. These bands are hinged together by means of a link **710** provided with two hinge pins **711** and **712**. At the opposite end, the two bands are provided with a draw pull catch which sometimes is also called a trunk lock. It includes a hook at the end of band **708**, not visible in either of the two figures, and a pull buckle **714** hinged with its one end to the other end of band **709**. The buckle is then also hinged at **717**, with its other end, to a lever arm **716**. The lever arm **716** is provided with a rounded end **718** which is used for engaging the hook at the end of band **708**. The lever arm **716** is used for pulling bands **708** and **709** together and locking the segments **700** to **707** tightly against the ball. Such tightening of the trunk lock also positions the eight segments **700** to **707** on the surface of the ball in the manner illustrated in FIGURES 6 and 7. The segments are placed on top of the winding in proper relationship with respect to the valve seat by using hook **600** as a means of proper orientation of the ball with respect to the segments.

The ball is then dipped into a tank **601** in the manner illustrated in FIGURE 6. The tank is filled with a suitable plastisol **602**, such as vinyl plastisol, the composition of which has been given previously in Example Number 1. After the dipping process, the seam reinforcements are allowed to set somewhat at room temperature whereupon, after the removal of the mask, the carcass is then dipped again into the second tank filled with the vinyl plastisol for impregnating the remaining portion of the winding. The composition of this plastisol has been given in Example #2. The ball is then heated up to from 300° F. to 350° F. to prefuse the two vinyl compositions prior to the application of the outer cover. Upon such prefusing, the ball is allowed to cool whereupon it is ready for receiving the outer cover.

The cover is then applied in the manner illustrated in FIGURE 5 or any other suitable manner such as those illustrated in my Patent Number 2,945,693 entitled "Reinforced Ball." As stated in that patent, the cover can be also applied by dipping the carcass in a vinyl plastisol in the manner illustrated in FIGURE 6 except that for this third dipping the plastisol has a composition given in Example Number 2. It is also possible to spray the cover using a plastisol composition.

The cross-sectional view of the resulting wall structure prior to curing is illustrated in FIGURE 8. It includes a bladder **800**, an impregnated nylon winding **801**, a seam reinforcement **802**, and a cover **803**. Upon molding, the elements have the appearance illustrated in FIGURE 9. The seam reinforcement and rigidizing vinyl layer **802** now has entered the interstices of the nylon winding and only a relatively thin layer **900** of the reinforcement vinyl still remains on top of the winding. It is to be noted here that all the elements are fused together when vinyl is used for making the bladder, the impregnating layer, the seam reinforcement and the cover. A fused joint is also produced when nitrile-vinyl composition is used for making the bladder and the remaining elements are made of vinyl.

While the invention has been illustrated and described specifically in connection with the vinyl compositions, it will be understood by those skilled in the art that the disclosed method of reinforcing the simulated seams can be also produced by using other elastomers, but having the same durometer readings that have been specified for vinyl compositions.

One suitable method for producing balls by using synthetic or natural rubber is as follows: A conventional rubber bladder is produced in known manner which may be made either of natural or butyl rubber. A layer of low viscosity natural or butyl rubber is then applied over the bladder by vacuum preforming two pieces of such rubber into two hemispherical shells. These shells are then pulled over the bladder in the same manner as illustrated in FIGURE 5 and then the bladder, with the soft undercover layer over it, is placed into a ball winding machine for applying the winding on top of the undercover. The produced carcass is then, preferably, compression molded for approximately 5 minutes at 290° F. to 300° F. During such partial curing, the low viscosity undercover layer penetrates the winding with the result that a partially cured, continuous, smooth rubber surface is produced on the carcass. Such carcass is then reinforced under the seams in the manner described previously by using ribbons of a rubber composition having the Shore durometer reading on scale A of from 85 to 95 and then the carcass cover is applied on the carcass in the same manner as illustrated in FIGURE 5.

The low viscosity undercover layer has a Mooney viscosity of from 30 to 40 ML_4 at 212° F.

In the light of the above description, it follows that the invention encompasses balls produced by using any suitable elastomer having the durometer readings in the range given above. These durometer reading are applicable to thermoplastic and thermosetting elastomers with the thermosetting class including rubbers of vulcanizable type.

While the invention has been described in connection with an air-inflated ball normally having a bladder, a winding, an impregnating material and an outer cover, is also applicable to the air-inflated balls having only a bladder and a cover. When this is the case, then the seam rigidizing bands are applied directly to the bladder.

In order to produce a uniform wall-flexing in basketballs, in which the simulated seams are between ⅙ and ¼ inch wide, the width of the rigidizing band may be made from ⅜ to 1 inch wide. The width of this band is not too critical but it is important that the seam is reasonably well centered over the band.

The previously mentioned durometer readings indicate a suitable range of the difference that may exist between the rigidizing bands and the remaining wall components. When the wall components have much softer or much harder durometer readings, then the difference in the durometer readings for the rigidizing bands should be either decreased or increased in proportion so long as the wall thickness, the shape of the seam, the thickness of the components, etc. remain the same.

What is claimed as new is:

1. An air-inflated ball having a wall including at least a bladder, a winding and an elastomeric cover, said cover having a plurality of simulated seams molded into and projecting inwardly into said cover and subdividing said cover into a plurality of sectors, the improvement comprising

(a) a plurality of seam reinforcing and rigidizing elastomeric bands

(b) forming a fusion joint with the inner portion of said cover,

(c) said bands being located directly under the seams of said ball,

(d) the number of said bands corresponding to the number of said seams,

(e) said elastomeric bands filling the interstices of the winding of said ball along the width and the length of said bands,

(f) said bands, upon curing, having a higher durometer hardness than said cover to compensate for the otherwise increased flexibility of said cover along said seams because of the decreased thickness of said cover along said seams.

2. In an air-inflated ball having

(a) a wall structure including a cover molded from a first elastomer having a first durometer reading and also

(b) having a plurality of simulated seams molded and projecting into said cover,

(c) a corresponding plurality of seam rigidizing bands of an elastomer

(d) compatible with said first elastomer but having a second higher durometer reading than said first reading,

(e) said bands being located directly under and in line with said seams,

(f) the difference between said second and first durometer readings being substantially equal to that so as to compensate for the otherwise increased flexibility of said cover because of the desired thickness of said cover along said seams.

3. The air-inflated ball as defined in claim 2 in which

(g) said first elastomer has the Shore durometer hardness reading on scale A in the

(h) order of from 55 to 70, and

(i) said second elastomer has the Shore durometer reading on scale A in the

(j) order of from 85 to 90.

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