METHOD OF MAKING SIMULATED SEAM REINFORCING AND RIGIDIZING FOR AIR-INFLATED BALLS

Original Filed Sept. 7, 1961 3 Sheets-Sheet 1

FIG. 1.

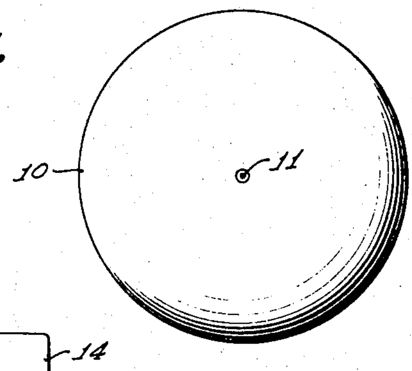


FIG. 2.

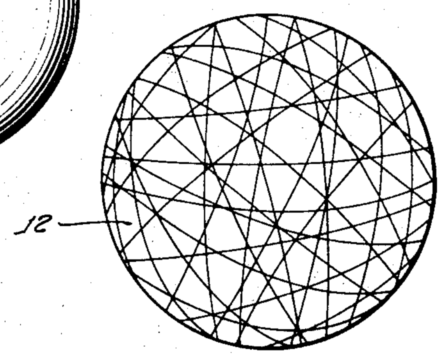


FIG. 3.

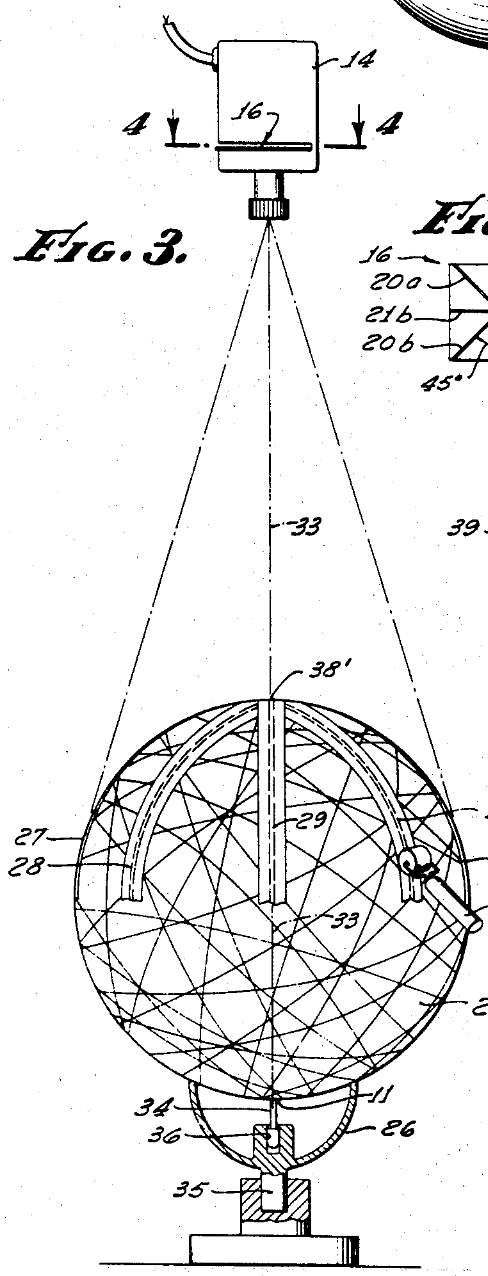
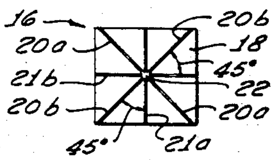


FIG. 4.



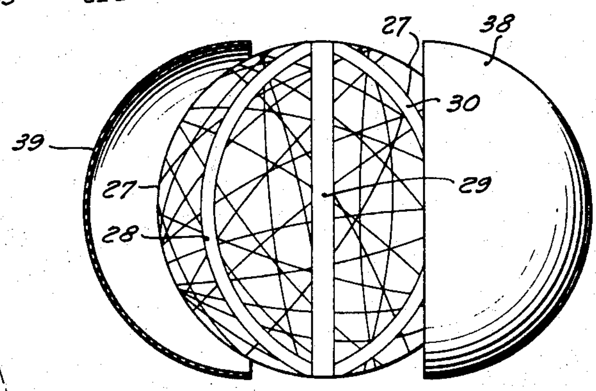


FIG. 5.

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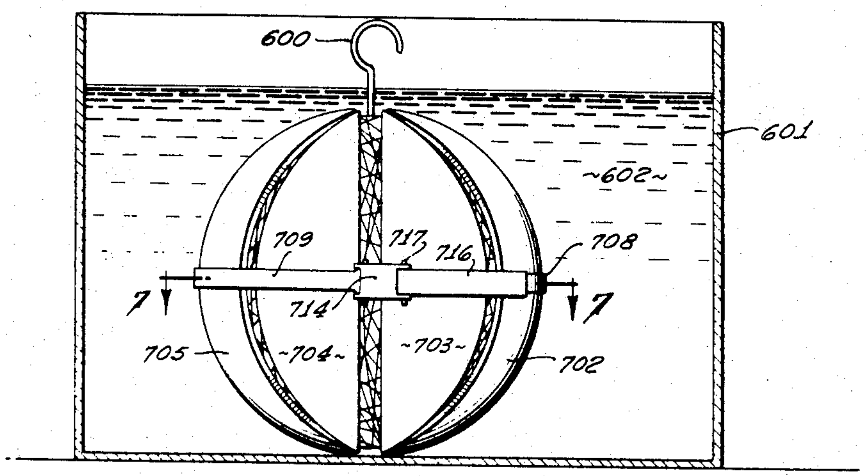

FIG. 6.

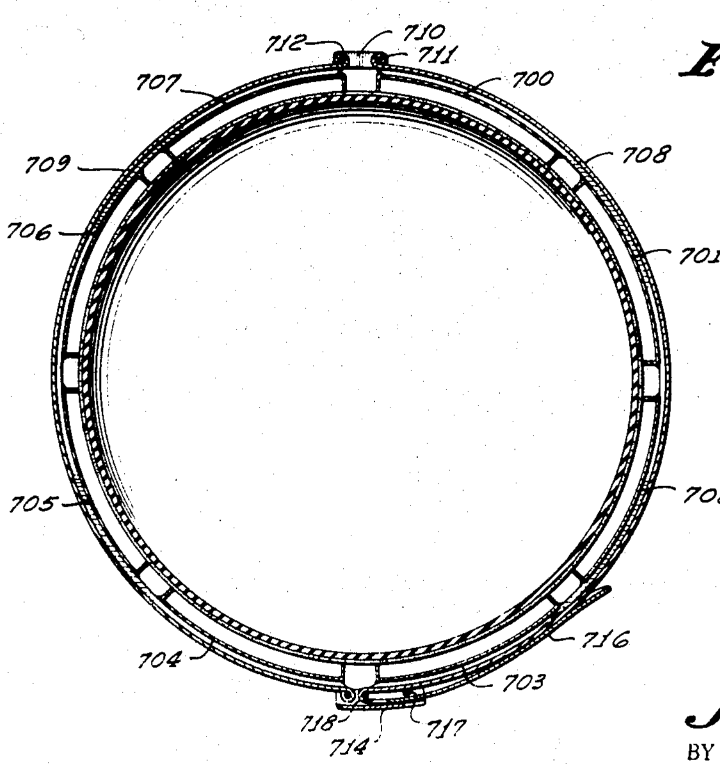

FIG. 7.

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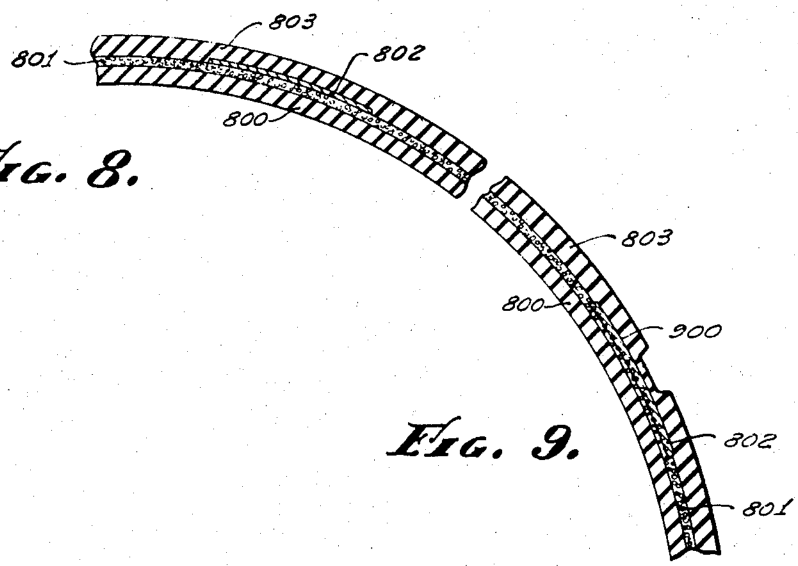
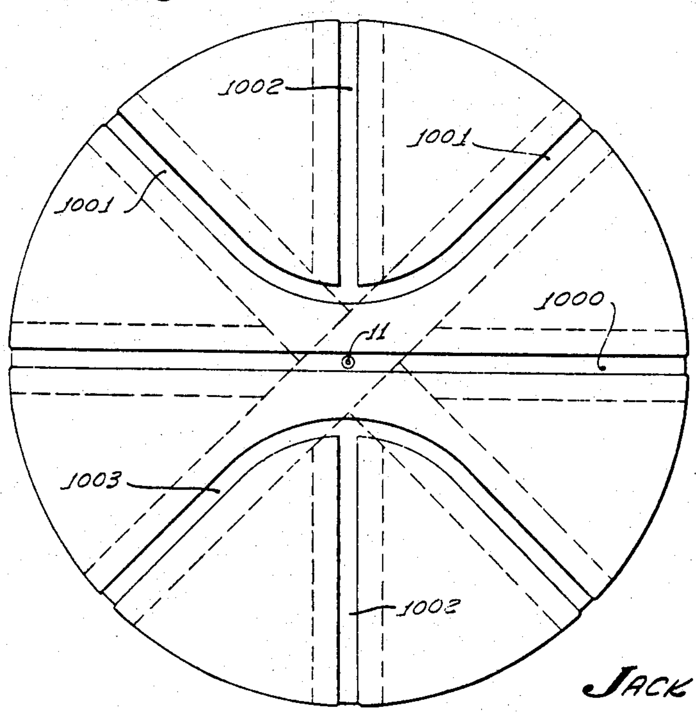


FIG. 8.

FIG. 9.

FIG. 10.



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3,405,018
METHOD OF MAKING SIMULATED SEAM REINFORCING AND RIGIDIZING FOR AIR-INFLATED BALLS

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Original application Sept. 7, 1961, Ser. No. 136,540, now Patent No. 3,219,347, dated Nov. 13, 1965. Divided and this application Aug. 5, 1964, Ser. No. 387,735
4 Claims. (Cl. 156—147)

ABSTRACT OF THE DISCLOSURE

This invention relates to a method of producing a ball having an elastomeric cover with a simulated inwardly projecting seam pattern molding into the cover and having the wall reinforced along and under the simulated seams so as to make the flexing characteristics of the wall uniform over its entire surface and to prevent premature failure of the wall along the seams. The method comprises the steps of providing a plurality of bands on the inner wound bladder having the same locus as the seams but wider than said seams, applying first an elastomer to the band portion of the winding and thereafter covering the entire surface of the ball with a second elastomer. The ball is then compression molded to impart the final configuration.

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.

This application is a division of my earlier application, Ser. No. 136,540, filed Sept. 7, 1961, now Patent No. 3,219,347, issued Nov. 23, 1965.

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 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 seams are formed by a hollow spherical mold having a plurality of inwardly projecting ribs. 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."

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.

It is an additional object of this invention to provide the method of reinforcing a wall structure for inflatable balls having a simulated seam pattern impressed or molded into the wall, and having such seams reinforced so as to produce a substantially uniform flexing of the ball over its entire surface and in this manner make the flexural life of the entire cover equal over the entire surface of the ball.

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, Ser. No. 69,485, filed Nov. 15, 1960, now abandoned, 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 No. 2,995,311, issued Aug. 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 the two crosses 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 semicircular bands **27** thorugh **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 impregnating 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 cyclohexyl phthalate	20.00
Organic phosphite	2.50
Metal-organic phosphite chelator-stabilizer	1.00
Calcium carbonate inert filler	5.00

Pigments, 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 No. 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.

It has been stated above that the durometer hardness of the cover on scale A of the Shore durometer is between 55 and 70 while it is between 85 and 95 for the cured resin produced according to Example No. 1. The hardness of the two polyvinyl chloride resins, therefore, is adjusted so as to produce a reasonably uniform flexing of the ball over its entire surface in spite of the reduced thickness in the cover because of the presence of the simulated seams 1000–1003, which are imbedded in the cover. The above hardness of the two polyvinyl chloride compositions given in Example No. 1 and Example No. 2 is adjusted primarily by either increasing or decreasing the amount of the plasticizer and also by selecting the type of plasticizer. In Example No. 1, 30 parts of plasticizer are used and the selected plasticizer is di-octyl phthlate, while in Example No. 2, there are altogether 67 parts of plasticizer, which is composed of 37 parts of di-butoxyethyl adipate, 20 parts of butyl cyclohexyl phthalate and 10 parts of epoxy derivative plasticizer. As stated in connection with the discussion of Example No. 1, it is also possible to vary the proportions of the low and high solubility, or low and high molecular weight, types of polyvinyl chloride. The variations in the proportions of the two types of polyvinyl chloride primarily determine the viscosity of the plasticizer rather than its hardness, and, therefore, determine the thickness of the deposited seam reinforcing layer or bands **27, 28, 29,** and **30.** The higher the viscosity, the thicker is the band deposited on the winding, which is especially true when these reinforced bands are deposited in the manner illustrated in FIGURE 6. The thickness of the deposited layer also has an effect on the final flexibility of the ball, and, therefore, as stated above, must be taken into consideration in formulating the previously cited Example No. 1.

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 semicircular 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 **702**, 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 poitions 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 a 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 No. 1. After the dipping process, the seam reinforcements are allowed to set somewhat at room temperature whereupon, after the removal of the mask, comprising segments **700** to **707** 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 No. 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 No. 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 No. 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 impragenated 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 a 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 readings are applicable to the 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, it 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 I claim is:

1. The method of making a ball having a bladder, a winding wound over said bladder, and a cover with a plurality of simulated seams imbedded and projecting inwardly into the cover portion of said ball, said method including the steps of projecting on top of said winding a plurality of shadow bands having the same locus as said seams but wider than said seams, applying to that portion of the winding which is shadowed by said bands a first elastomer in a plastisol form, to form a plurality of elastomer bands thereon, thereafter covering the entire surface of said ball, including said elastomer bands, with a second elastomer in a plastisol form capable of forming, upon curing, a fusion bond with the first elastomer and having a lower durometer hardness reading than the durometer reading of the first elastomer, then compression molding said ball in a mold having a spherical cavity and a plurality of inwardly projecting ribs to mold said simulated seams into said second elastomer by locating the center lines of said ribs substantially over the center lines of said elastomer bands, during said compression molding, and said method including making the difference between the first and the second durometer hardness substantially equal to that required to make said ball have a substantially uniform flexibility over the entire surface of said ball and to counteract the otherwise increased flexibility of said cover along said seams due to the reduced thickness of said cover along said seams by adjusting the plasticizer content of said elastomers.

2. A method of making a ball having at least a bladder and an elastomeric cover with a plurality of simulated, imbedded, inwardly projecting seams on said cover, said method including the steps of inflating said bladder, depositing on the outer surface of said bladder a plurality of bands of a first elastomeric plastisol having, upon curing, a first durometer hardness, covering the remaining portion of said outer surface and said bands with a second elastomeric plastisol chemically compatible with the first plastisol and having, upon curing, a second durometer hardness, providing a hollow spherical mold having a plurality of inwardly projecting ribs for compression molding said cover and simultaneously fusing said first and second elastomers to each other, placing said bladder, covered with said first and second elastomers, into said

mold with said bands being centrally aligned with said ribs, compression molding said cover and fusing said first and second elastomers by positioning said covered bladder in said mold and applying heat thereto for producing said ball with said simulated seam portions of said cover being aligned with said bands and impressed into said second elastomer, and said method comprising controlling the plasticizer content of said elastomers to provide a first durometer hardness higher than said second durometer hardness to the extent required to produce a substantially uniform flexing of said ball when said ball is bounced in the course of its regular use, said bands of said first elastomer counteracting the otherwise increased flexibility of said cover along said seams due to the decreased thickness of said cover along said seams.

3. A method of making the wall of a ball to have a substantially uniform flexing when said ball is subjected to repeated bouncing when in use, said wall including a bladder, a winding, an outer cover and a plurality of simulated seams imbedded in and projecting inwardly into said cover, said method including the steps of inflating said bladder, winding a cord on top of said bladder to produce said winding, forming a band pattern on top of said winding, said band pattern corresponding to the subsequent locus of said seams on said ball and said cover, applying only over said band pattern a first elastomeric plastisol to produce a plurality of elastomeric bands having, upon curing, a first durometer hardness, applying a layer of a second elastomeric plastisol, fusible to the first plastisol, over the remaining portion of said winding and all of said bands, said second plastisol, upon curing, fusing with said first plastisol and having a second durometer hardness which is lower than the durometer hardness of said first plastisol, said method including controlling the plasticizer content of said plastisols to provide said hardness, and compression curing said ball in a mold having projecting ribs for simulating said seams in said second elastomer and the resulting cover of said ball by orienting said ball in said mold prior to said compression curing so that said projecting ribs are aligned with the central portions of said bands, whereby said simulated seams, imbedded in said cover, are centrally aligned with said bands, said bands, with their higher durometer hardness than the hardness of said cover producing said uniform flexing of said wall and of said ball to compensate for the decreased thickness of said cover at the imbedded simulated seams in said cover.

4. The method as defined in claim 3 which includes the additional step of selecting the plasticizer content of said first plastisol, to have upon curing, a hardness in the order of from 85 to 90 on scale A of the Shore durometer, and said second plastisol, upon curing, to have a Shore durometer hardness on scale A in the order of from 55 to 70.

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