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(54) **INFLATION-INDEPENDENT BALL WITH COVER**

AUFPUMPUNABHÄNGIGER BALL MIT HÜLLE

BALLE INDÉPENDANTE DU GONFLAGE DOTÉE D'UN COUVERCLE

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Description

FIELD OF THE INVENTION

[0001] The invention relates generally to sports balls, such as basketballs, footballs, volleyballs and soccer balls.

BACKGROUND ART

[0002] Sports balls of the type traditionally inflated (e.g., basketballs, footballs, volleyballs and soccer balls) are well known in the art and are sometimes referred to as "inflatables." For example, basketballs are generally manufactured to include an inflatable air bladder surrounded by an outer covering of cover panels. Other inflatable sports balls such as volleyballs, soccer balls and footballs also feature the well-known inflatable air bladder (often comprising rubber, such as 80% butyl rubber and 20% natural rubber) and various other outer coverings. One limitation of current inflatable technology is that the inflatable air bladder may lose pressure after a period of time due to air loss, which may occur by seepage from valves, or by migration of the filled air across the air bladder membrane, or otherwise. When pressure loss occurs, the inflatable must be re-inflated by some mechanism, such as a pump. Any physical damage that pierces the bladder, even small holes or tears may result in loss of pressure and even the inability to be re-pressurized.

[0003] Foam balls, such as NERF® brand balls, are also known in the art, but foam balls to date have exhibited substantially different playing characteristics and feel that traditional sports balls, and do not comport with or approximate the standards set by sports organizations for regulation play, such as size, rebound response, weight or other characteristics. Documents US5865697A and US1531317A disclose balls or cores for balls having a plurality of ribs, a plurality of compartments and wherein a plurality of voids are created between multiple ribs and an outer boundary of the core.

SUMMARY OF THE INVENTION

[0004] The invention is defined in claim 1. Further aspects and preferred embodiments are defined in the dependent claims. Aspects, embodiments and examples of the present disclosure which do not fall under the scope of the appended claims do not form part of the invention and are merely provided for illustrative purposes.

[0005] As such, a sports ball **5** with a core **15** and outer covering **10** that does not include an air bladder and that comports with the standards set by sports organizations for regulation play, such as size, rebound response, weight, or other characteristics is desirable. Such a sports ball **5** is disclosed herein.

[0006] Other aspects and advantages of the invention will be apparent from the following description and the appended claims.

BRIEF DESCRIPTION OF DRAWINGS

[0007] To aid in the appreciation of further advantages and features of the present disclosure, a more particular description will be provided by reference to specific embodiments which are illustrated in the appended drawings. It is appreciated that these drawings are not to be considered limiting in scope. The disclosure herein will be described and explained with additional specificity and detail through the use of the accompanying drawings in which:

Figures 1A-1D show various embodiments of the sports ball **5** as disclosed herein.

Figure 2 shows a cut away view of one example of a core of a sports ball which does not form part of the claimed invention.

Figure 3 shows a cut away view of another example of a core of a sports ball which does not form part of the claimed invention.

Figure 4 shows a cut away view of another example of a core of a sports ball which does not form part of the claimed invention.

Figure 5 shows a cut away view of one embodiment of the core **15** of a sports ball **5** as disclosed herein.

Figure 6 shows an alternate cut away view of the core **15** shown in Figure 5.

DETAILED DESCRIPTION

[0008] This detailed description is provided for amplifying the invention and aiding in understanding of the disclosure, by reference to a possible embodiment(s). The invention shall not be interpreted as limited to any particular embodiment shown, except as set forth in the claims.

[0009] A sports ball **5**, such as for use where inflatables are typically employed, is disclosed herein. FIGS 1A through 1D show various embodiments of the sports ball **5**, in the form of a basketball, a football, a volleyball or a soccer ball. While these particular embodiments are shown for illustrative purposes and each is certainly within the scope of the invention, balls for other sports and general play are also within the scope. In a central aspect of the sports ball **5** is its core **15**.

[0010] The core **15** is made of a polyurethane ("PU") foam. The core **15** could also be made by foamed EVA or other foamed structures, however such cores are not covered by the appended claims. Other materials with resiliency, such as rubbers, may also be used, however such cores are also not covered by the appended claims.

[0011] In one embodiment, the PU foam is open cell PU foam wherein the cell walls comprising the foam are

broken and the air or other gasses may freely enter and exit the broken cells. In an alternate embodiment, the PU foam is closed cell foam wherein the cells comprising the foam are not broken and air or other gases are "trapped" within the intact cells comprising the foam. In an alternate embodiment, the PU foam core may comprise both open and closed cell foam. Other foams such as foamed natural rubber or soy bean based foams are possible, however such cores are not covered by the appended claims.

[0012] In one embodiment, the core **15** may comprise PU foam of a single density. For example, the density of the PU core **15** may be constant, or nearly constant throughout the circumference of the core **15**. In an alternate example, which is not covered by the appended claims, as shown in Figure 2, the density of the PU foam core **15** may change through the diameter of the core **15**. The example shown in Figure 2 shows the density of the PU foam core **15** increasing near the center of the core **15** - i.e., the density of the PU foam near the center of the core **15** is greater than the density of the PU core near the exterior surface of the core **15**. Alternatively, the density of the PU foam near the center of the core **15** could be less than the density of the PU foam near the outer surface of the core **15**.

[0013] In an example, which is not covered by the appended claims, where multiple densities of PU foam are present, the core **15** may comprise a "constant" density gradient (i.e., density increasing at a generally constant rate from the outer surface to the center or vice versa), a "step wise" density gradient (i.e., the density increases (or decreases), in discrete "steps" from the outer surface to the center), a combination of the forgoing, or many other conceivable density gradient (such as a "peak" gradient wherein the density of the PU increases from the outer surface of the core **15** to a point in the interior and then begins to decrease again closer to the center of the core **15**). Any possible density gradient could be possible. For example, as shown in Figures 3 and 4, the core **15** may comprise a plurality of concentric layers **16a**, **16b**, **16c**, **16d**, **16e**, **16f**. The concentric layers **16a**, **16b**, **16c**, **16d**, **16e**, **16f** may comprise single discrete densities of PU foam or they comprise multiple densities of PU foam in either a constant, step wise or peak gradient constructions. In one example, not covered by the appended claims, the densities of the PU foam in the concentric layers **16a**, **16b**, **16c**, **16d**, **16e**, **16f** increases near the center of the core **15**, alternatively the densities of the PU foam in the concentric layers **16a**, **16b**, **16c**, **16d**, **16e**, **16f** may decrease near the center of the core **15**, alternatively, a peak gradient design or other construction may be used. In one example, the concentric layers **16a**, **16b**, **16c**, **16d**, **16e**, **16f** may have the same or approximately the same thickness while in other embodiments the concentric layers **16a**, **16b**, **16c**, **16d**, **16e**, **16f** may be of varying thicknesses.

[0014] In one embodiment, according to the invention, as shown in Figures 5 and 6, the core **15** is not filled with foam entirely throughout its internal volume, but rather

includes space for air. Like a traditional inflatable, the space could be configured as a single air cavity, akin to the common single central bladder of known inflatables. Despite having space for air, sports ball **5** need not be configured to rely on air pressure to provide the desired rebound, firmness, resistance to compression, or other desired characteristics that are typically controlled by the level of inflation of a traditional inflatable. In fact, it is contemplated that sports ball **5** will in many configurations not have an inflation valve at all. While it is possible to configure the sports ball **5** as disclosed in the present disclosure such that the air in the cavity is pressurized, such pressure is not critical for maintaining form and rebound within acceptable levels in every embodiment. If desired, the cavity may be pressurized at the time of production. Alternately, if desired, the sports ball **5** may be constructed with disregard to the air pressure in the cavity, or with the intent or anticipation that the air pressure in the cavity be approximately the ambient air pressure. With the added structural integrity of the sports ball **5** as taught herein compared to traditional inflatables, some embodiments may even exhibit an air pressure in the cavity intentionally lower than that of the ambient atmospheric conditions. Using such a "negative pressure" configuration may permit the sports ball **5** to have a tighter feel normally attributable to the outward pressure of a traditional inflatable.

[0015] Without relying on increased internal air pressure in a cavity for structural integrity, shape, rebound characteristics and the like, these characteristics are imparted to and controlled for sports ball **5** by the material comprising the core **15** and the particular construction of that core **15**. For example, in a single cavity embodiment, the outer boundary **20** will be thicker than would be, for example, the bladder, winding, and covering of a basketball, such an example is however not covered by the appended claims. In some embodiments, this outer boundary **20** will be between one (1) centimeter and one (1) inch (2.54 cm) thick. In other embodiments, the structural integrity of the sports ball **5** may be enhanced by incorporating struts or other structures within the cavity space, such as spines that extend outwardly from the center, or from a center mass (such that if the outer boundary **20** were removed, the struts may look like a starburst, for example). Other, more elaborate internal structures can be employed, such as grid patterns, scaffolding, internal ribbing about the inner circumference of the outer boundary **20** and any other structure that may enhance the ability of the sports ball **5** to maintain its round configuration even in the absence of an internal air pressure higher than ambient air pressure.

[0016] The core **15** comprises a plurality of internal compartments **25** in which the air of one compartment **25** does not flow freely to another compartment **25**. Compartments **25** are separated by walls such as the ribs **30** shown in Figures 5 and 6, and may be oriented and configured in various shapes and spatial relationships. For example, the compartments **25** may be arranged like the

internal lobes of an orange, such that in cross-section the ribs **30** have the appearance of a wheel-and-spokes. Alternatively, if desired the compartments **25** may be configured loosely on a spiral configuration. The shown embodiment at Figures 5 and 6 depicts compartments **25** near the outer surface of the sports ball **5**, separated in circumferential direction by a plurality of walls forming ribs **30**. Toward the center of the core **15**, the sports ball **5** possesses another cavity disposed inwardly of the circumferentially-disposed compartments **25**, denominated in the figures as a central cavity **35**. In the embodiment shown in Figures 5 and 6, the central cavity **35** is a cylindrical body extending from the outer boundary **25** on one side of the sports ball **5** to the outer boundary **25** on the other side. If desired, central cavity **35** might be a perfectly round cavity concentric with the center of the sports ball **5**, or it might be a spheroid, such as a prolate spheroid. In some embodiments it will be desirable for the internal compartments **25** to be configured and placed relative to one another such that in any rotational position of the sports ball **5** a cross section taken through its center will look the same as the cross section taken if the ball is rotated 90 degrees. For example, the core **15** may comprise a plurality of concentric layers of internal compartments **25** arranged around a single central cavity **35**. In other configurations, including the one shown in Figures 5 and 6, the cross section taken at different rotational positions will look markedly different. For example, the core **15** may comprise a plurality of central cavities **35**, which need not be concentric to the center of the sports ball **5**. In the embodiment as shown in Figures 5 and 6, the internal compartments **25** are evenly spaced around the cylindrical body **35**, but the cross section taken at different rotational positions will look different. In combination with the compartments **25**, struts and other structures as discussed above in connection with a single cavity may also be used. It will be recognized that the ribs **30** will provide certain structural support similar to that provided by struts and other structures. It may nevertheless be desirable to incorporate additional structural support, perhaps incorporating struts and the like inside one or more of the compartments **25**.

[0017] In one embodiment, the internal compartments **25** are generally trapezoidal in shape and are formed by the outer boundary **20** of the core **15**, two (2) ribs **30** and the internal cylinder wall **45**. Other shapes for the internal compartments **25**, including square, rectangular and circular internal compartments **25** should be considered within the scope of this disclosure. The internal compartments **25** may be exterior to the cylindrical body **35**. In one embodiment, the core **15** comprises between two (2) and eight (8) internal compartments **25**. The core **15** may comprise between nine (9) and sixteen (16) internal compartments. In another embodiment, the core **15** comprises between seventeen (17) and thirty two (32) internal compartments and finally in yet another embodiment, the core **15** comprises between thirty three (33) and one hun-

dred (100) internal compartments.

[0018] The material comprising the walls of the compartments **25** may be a porous material, such as open-cell foam. If the material is so porous that air would otherwise move freely among the compartments **25**, the compartments **25** may have a material (possibly in the form of a coating or a paint) applied to the interior surface of the internal compartments **25** that reduces or prevents air (or other gases) from migrating across or escaping from the internal compartments **25**. In one embodiment the material may be an additional PU coating or film. In an alternate embodiment, the composition of the PU foam forming the internal compartments **25**, ribs **30** and internal cylinder wall **45** may be adjusted to prevent air (or other gases) from escaping the internal compartments **25**. Certainly, non-porous materials, including closed cell foam, may be used to prevent the free movement of air among compartments **25**. By way of non-limiting example, a closed cell PU foam may be used to form the **25**, ribs **30** and internal cylinder wall **45**. Without being bound by this theory, it is believed that in this embodiment, the internal compartments **25** may create greater rebound via the compression and expansion of the air trapped inside the internal compartments **25** as the sports ball **5** contacts a surface (i.e., as the ball is bounced on the floor).

[0019] With specific reference to the sports ball **5** shown in Figures 5 and 6, the core **15** comprises a cylindrical central cavity **35** defined at least in part by the internal cylinder wall **45**. The cylindrical body **35** may span the entire diameter of the sports ball **5** terminating against the outer boundary **20** of the core **15** or against the outer covering **10**. In an alternate embodiment, the cylindrical body **35** may span only part of the diameter of the core **15**. Without being bound by this theory, it is believed that in an embodiment such as this with a central cavity **35**, the compression and expansion of the air trapped inside the cylindrical body **35** as the sports ball **5** contacts a surface (i.e., as the ball is bounced on the floor) may create a more controlled rebound.

[0020] The sports ball **5** may also comprise an outer covering **10**, whether the core **15** includes a cavity or not, however cores not including a cavity are not covered by the appended claims. Generally, the outer covering **10** is the primary contact surface when a player handles the sports ball **5**. In one embodiment, the outer covering **10** fully encases the core **15**. In an alternate embodiment, the outer covering **10** does not fully encase the core **15**. By way of a non-limiting example, the outer covering **10** may comprise one or more cover panels **11**, with grooves, lines, or other gaps between the cover panels **11**, permitting the core **15** to be seen or touched. In one embodiment, an additional material may be inserted between the cover panels **11**. In one embodiment, the additional material may provide tactile feedback to a player allowing the player to determine the position or orientation of the sports ball **5** in relation to the player's hand.

[0021] The outer covering **10** may be configured to

comprise the features of a football, volleyball, basketball or soccer ball. For example, in an embodiment where the sports ball **5** is a basketball, the outer covering **10** may comprise a plurality of cover panels **11** which are adjacent to channels **12** as shown in Figure 1A. When the sports ball **5** is a football, the outer covering may comprise a plurality of cover panels **11** which are adjacent to channels **12** as well as laces **13** as shown in Figure 1B. Alternatively where the sports ball **5** is a soccer ball, the outer covering **10** may comprise a plurality of pentagonal cover panels **11** as shown in Figure 1C. In yet another embodiment, where the sports ball **5** is a volleyball, the outer covering **10** may comprise a series of covering panels **11** as shown in Figure 1D. The above examples shown in Figures 1A-1D are non-limiting; the physical appearance of the outer covering **10** may be configured to include logos, one or more colors or other aesthetic concerns in other embodiments. Additionally, the outer covering **10** may comprise pebbling or other features to aid the player in gripping and manipulating the sports ball **5**. In one embodiment, the outer covering **10** may be painted or coated to improve its durability. In an alternate embodiment, the outer covering **10** may be painted with a PU paint or a vulcanized rubber material. The vulcanized rubber material may comprise pebbling or other features.

[0022] The outer covering **10** may be affixed to the core **15**. The outer covering **10** may be affixed to the core **15** by any method known to one of ordinary skill in the art. By way of non-limiting example, the outer covering **10** may be glued to the core **15** at least partially by an adhesive such as styrene butadiene, acrylonitrile butadiene or a two (2) part urethane. In an alternate embodiment, the outer covering **10** may not be attached to the core **15** and in this embodiment the core may "float" inside of the outer covering **10** if desirable. The sports ball **5** may also comprise one or more additional layers of material between the outer covering **10** and the core **15**. In one embodiment, an additional layer of windings comprised of a natural or synthetic thread may be present between the outer covering **10** and the core **15**.

[0023] The outer covering **10** may be manufactured from any material that is suitable to one of ordinary skill in the art and may comprise leather, synthetic leather, rubber or other synthetic materials. Additionally, the outer covering **10** may be manufactured from differing materials based upon the sports ball **5** being constructed. For example, the outer covering **10** for a football may comprise differing materials than the outer covering **10** for volleyball. In one embodiment, the outer covering **10** may additionally comprise a tuftane thermoplastic polyurethane film.

[0024] In one embodiment, the outer covering **10** is between 0.1 mm and 2.0 mm in thickness. In an alternate embodiment, the outer covering **10** is between 0.8 and 1.25 mm in thickness.

Method of Manufacture

[0025] The sports ball **5** disclosed herein may be manufactured by any means known to be suitable to those of ordinary skill in the art. The core **15** may be formed in segments and glued together to form the core **15**. In one embodiment, the core **15** may be formed by two (2) halves glued together while in other embodiments four (4) segments may be formed and glued together to form the core **15**.

[0026] The sports ball **5** of the present disclosure substantially meets the requirements set forth by the pertinent governing body to be considered a competition ball.

[0027] The sports ball **5** disclosed herein may meet or exceed the standards set forth by the National Federation of State High School Associations ("NFSHA"). In one embodiment, a football constructed as described herein may weigh between fourteen (14) and fifteen (15) ounces (398.9 - 425.2 grams) as required by the NFSHA as well as meet the size requirements set forth by the NFSHA.

[0028] In an alternate embodiment, a volleyball constructed as described herein may be spherical comprising twelve (12) or more covering panels **11**, measure between twenty five (25) and twenty seven (27) inches (63.5 - 86.8 centimeters) in diameter and weigh between nine (9) and ten (10) ounces (255.2 - 283.5 grams) as required by the NFSHA.

[0029] A soccer ball constructed as described herein may be spherical with a circumference of between twenty seven (27) and twenty eight (28) inches (68.6 - 71.1 centimeters) and weigh between fourteen (14) and sixteen (16) ounces (396.9 - 453.6 grams) as required by the NFSHA. In an alternate embodiment, a soccer ball as described herein may meet the Federation Internationale de Football Association ("FIFA") specifications for rebound and other characteristics. In one embodiment, a size five (5) soccer ball as described herein may exhibit a rebound of between one hundred and thirty five (135) and one hundred and fifty five (155) centimeters (53.1 - 61 inches) at 20 degrees Celsius (68 degrees F) after being dropped from two (2) meters (78.7 inches) onto a steel panel.

[0030] A basketball constructed as described herein may meet the standards set forth by the NFSHA. For a boy's basketball, the basketball may be spherical with a circumference of between twenty nine and one-half (29.5) and thirty (30) inches (74.9 - 76.2 centimeters) and weigh between twenty (20) and twenty two (22) ounces (567.0 - 623.7 grams). For a girl's basketball, the basketball may be spherical with a circumference of between twenty eight and one-half (28.5) and twenty nine (29) inches (72.4 - 73.7 centimeters) and weigh between eighteen (18) and twenty (20) ounces (510.3 - 567.0 grams). Further, a basketball as described herein may rebound to a height of not less than forty nine (49) inches (124.5 centimeters) and not more than fifty four (54) inches (137.2 centimeters) when dropped from seventy two (72) inches (182.9 centimeters) onto a basketball playing

surface (such as a hardwood basketball court).

[0031] The sports ball **5** disclosed herein will also have a similar coefficient of restitution ("CoR") as a regulation inflatable sports ball. In one embodiment the sports ball **5** has a CoR of about 0.60 to 1.00. In another embodiment, the sports ball **5** has a CoR of about 0.70 to 1.00 or about 0.80 to 1.00. In a final example, the sports ball **5** has a CoR of about 0.90 to 1.00.

[0032] The sports ball **5** disclosed herein offers many advantages over the prior art, including without limitation: (i) being inflation independent and puncture resistant through the use of the core **15** described herein rather than a traditional air bladder and (ii) being the first sports ball **5** comprising a foam core **15** that satisfies the standards set by sports organizations for regulation play, such as size, rebound response, weight, or other characteristics.

[0033] While the invention has been described with respect to a limited number of embodiments, those skilled in the art, having benefit of this disclosure, will appreciate that other embodiments can be devised which do not depart from the scope of the invention as disclosed here. Accordingly, the scope of the invention should be limited only by the attached claims.

Claims

1. A sports ball comprising a core, said core comprising:
 - a. a plurality of ribs; and
 - b. a plurality of internal compartments,

wherein the core consists of polyurethane foam and said internal compartments comprise a plurality of voids defined by at least one rib and an outer boundary of the core.

2. The sports ball of claim 1 wherein said internal compartments are non-concentric.
3. The sports ball of claim 1 wherein the polyurethane foam core comprises both open cell and closed cell polyurethane foam.
4. The sports ball of any one of the preceding claims further comprising a synthetic outer cover.
5. The sports ball of claim 4 wherein the synthetic outer cover has a thickness of between 0.2 and 1.8 millimeters.
6. The sports ball of any one of the preceding claims wherein the sports ball is a soccer ball.
7. The sports ball of any one of claims 1 to 5 wherein the sports ball is a basketball.

8. The sports ball of any one of claims 1 to 5 wherein the sports ball is a volleyball.

9. The sports ball of any one of the preceding claims having a CoR in the range of 0.6 and 1.00.

Patentansprüche

1. Sportball, der einen Kern umfasst, wobei der Kern Folgendes umfasst:

- a. eine Vielzahl von Rippen; und
- b. eine Vielzahl von Innenfächern,

wobei der Kern aus Polyurethanschaum besteht und die Innenfächer eine Vielzahl von Hohlräumen umfassen, die durch mindestens eine Rippe und eine äußere Begrenzung des Kerns definiert sind.

2. Sportball nach Anspruch 1, bei dem die Innenfächer nicht-konzentrisch sind.
3. Sportball nach Anspruch 1, wobei der Polyurethanschaumkern sowohl offenzelligen als auch geschlossenzelligen Polyurethanschaum umfasst.
4. Sportball nach einem der vorangehenden Ansprüche, der ferner eine Kunststoffaußenhülle umfasst.
5. Sportball nach Anspruch 4, wobei die Kunststoffaußenhülle eine Dicke zwischen 0,2 und 1,8 Millimetern aufweist.
6. Sportball nach einem der vorangehenden Ansprüche, wobei der Sportball ein Fußball ist.
7. Sportball nach einem der Ansprüche 1 bis 5, wobei der Sportball ein Basketball ist.
8. Sportball nach einem der Ansprüche 1 bis 5, wobei der Sportball ein Volleyball ist.
9. Sportball nach einem der vorangehenden Ansprüche mit einer Stoßzahl im Bereich von 0,6 und 1,00.

Revendications

1. Ballon de sport comprenant un noyau, ledit noyau comprenant :

- a. une pluralité de nervures ; et
- b. une pluralité de compartiments internes,

dans lequel le noyau est constitué de mousse de polyuréthane et lesdits compartiments internes comprennent une pluralité de vides définis par au moins

une nervure et une limite externe du noyau.

2. Ballon de sport selon la revendication 1, dans lequel lesdits compartiments internes sont non concentriques. 5
3. Ballon de sport selon la revendication 1, dans lequel le noyau en mousse de polyuréthane comprend à la fois une mousse de polyuréthane à cellules ouvertes et fermées. 10
4. Ballon de sport selon l'une quelconque des revendications précédentes, comprenant en outre une enveloppe extérieure synthétique. 15
5. Ballon de sport selon la revendication 4 dans lequel l'enveloppe extérieure synthétique a une épaisseur comprise entre 0,2 et 1,8 millimètres.
6. Ballon de sport selon l'une quelconque des revendications précédentes, dans lequel le ballon de sport est un ballon de football. 20
7. Ballon de sport selon l'une quelconque des revendications 1 à 5, dans lequel le ballon de sport est un ballon de basket. 25
8. Ballon de sport selon l'une quelconque des revendications 1 à 5, dans lequel le ballon de sport est un ballon de volley-ball. 30
9. Ballon de sport selon l'une quelconque des revendications précédentes ayant un CoR compris entre 0,6 et 1,00. 35

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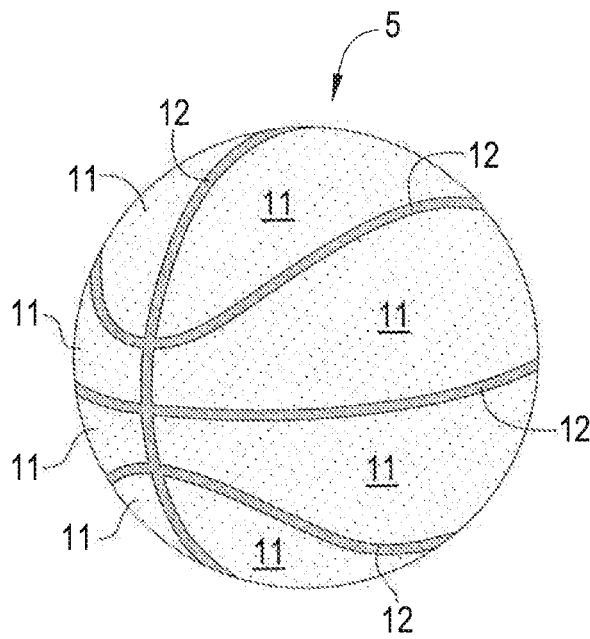


FIG. 1A

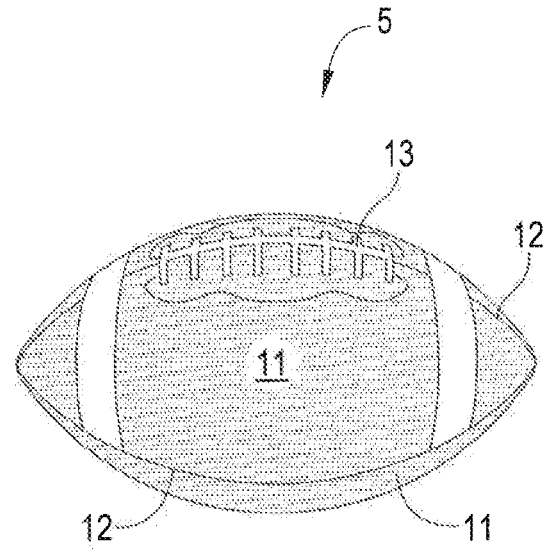


FIG. 1B

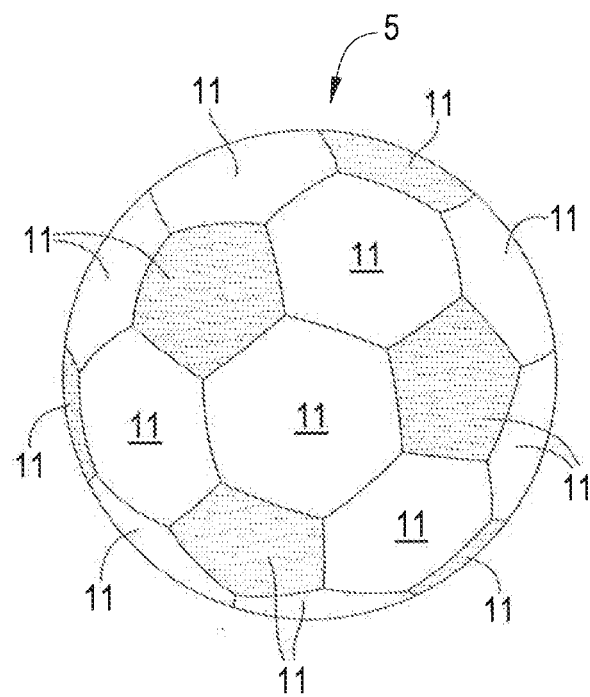


FIG. 1C

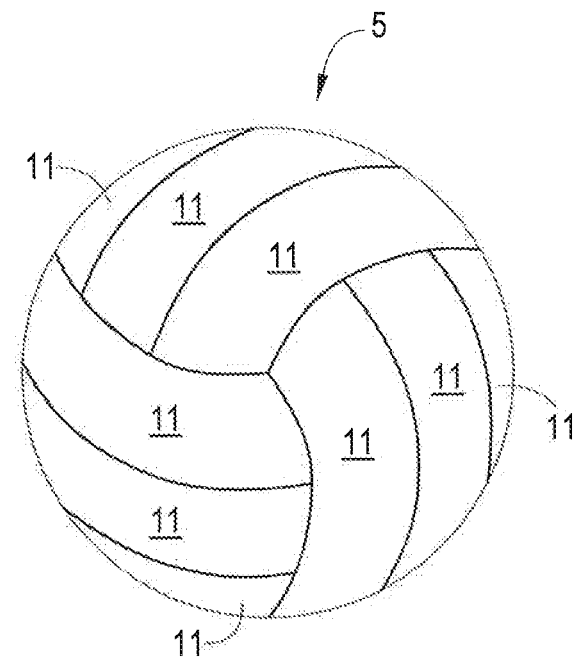


FIG. 1D

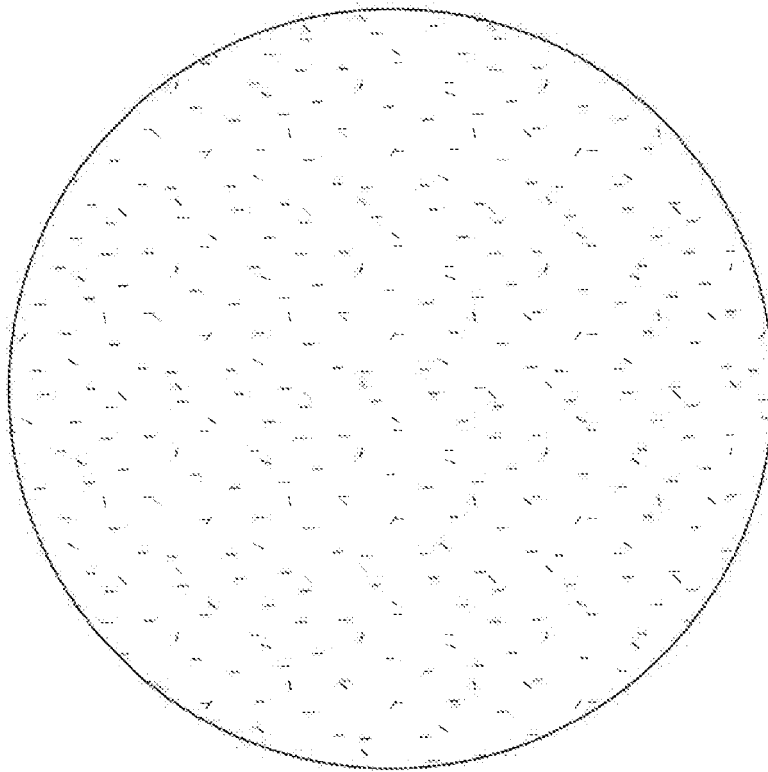


FIG. 2

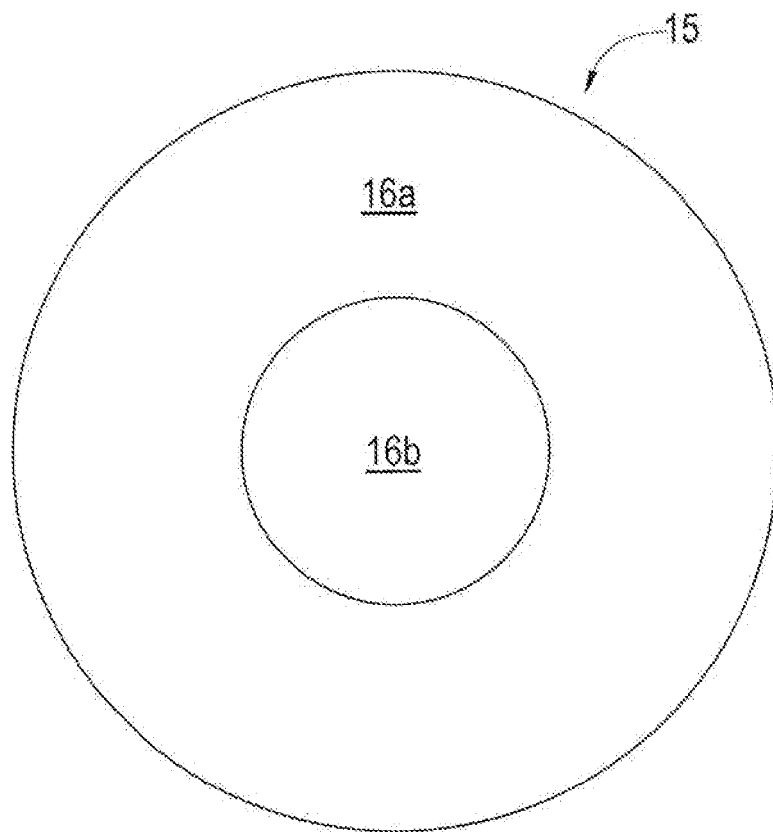


FIG. 3

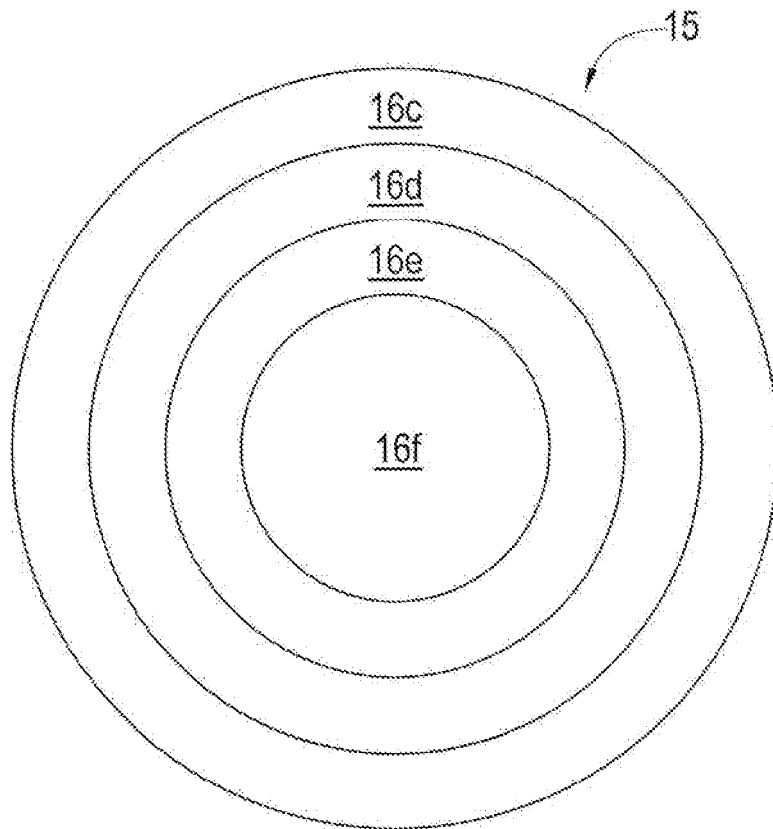


FIG. 4

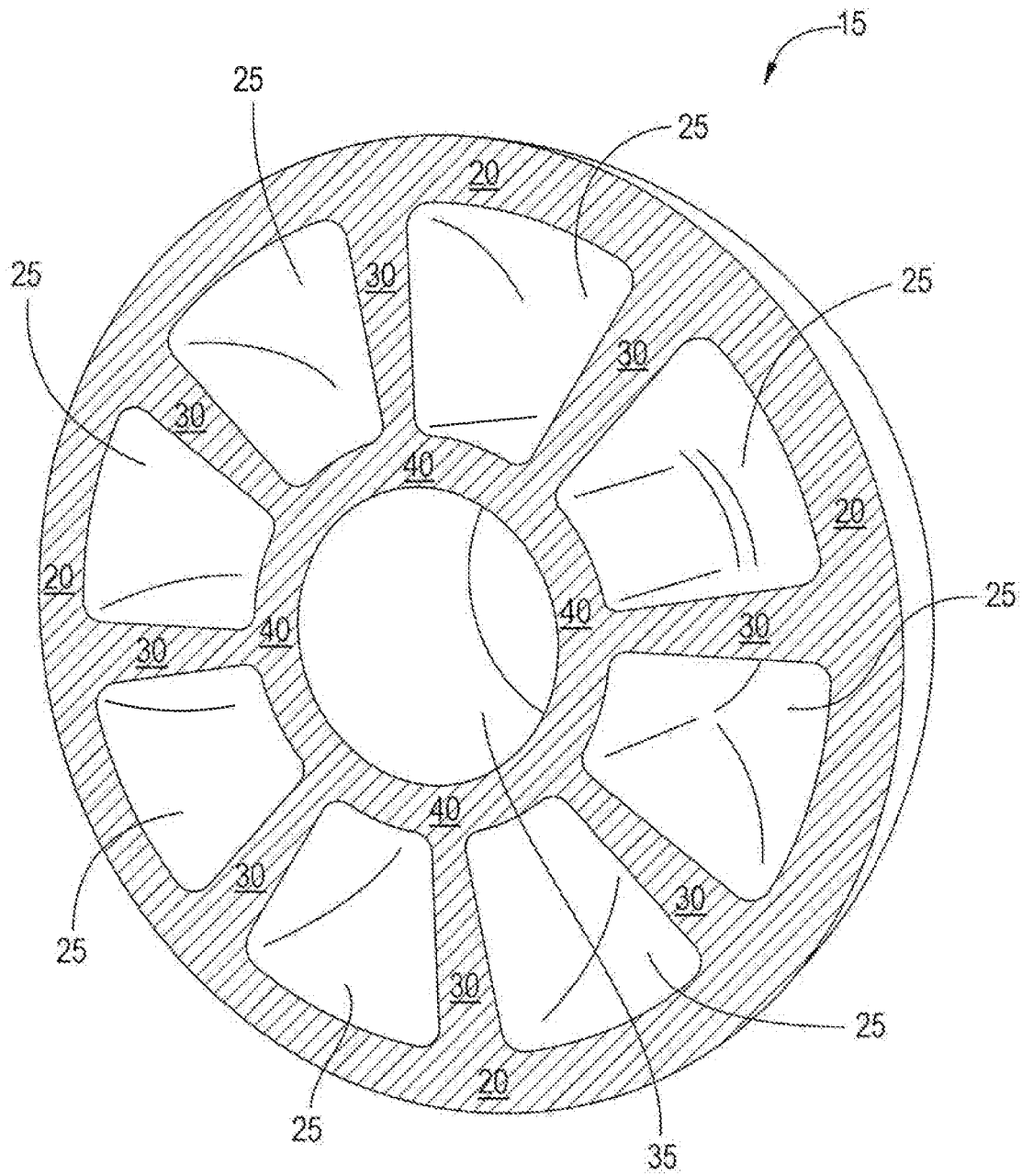


FIG. 5

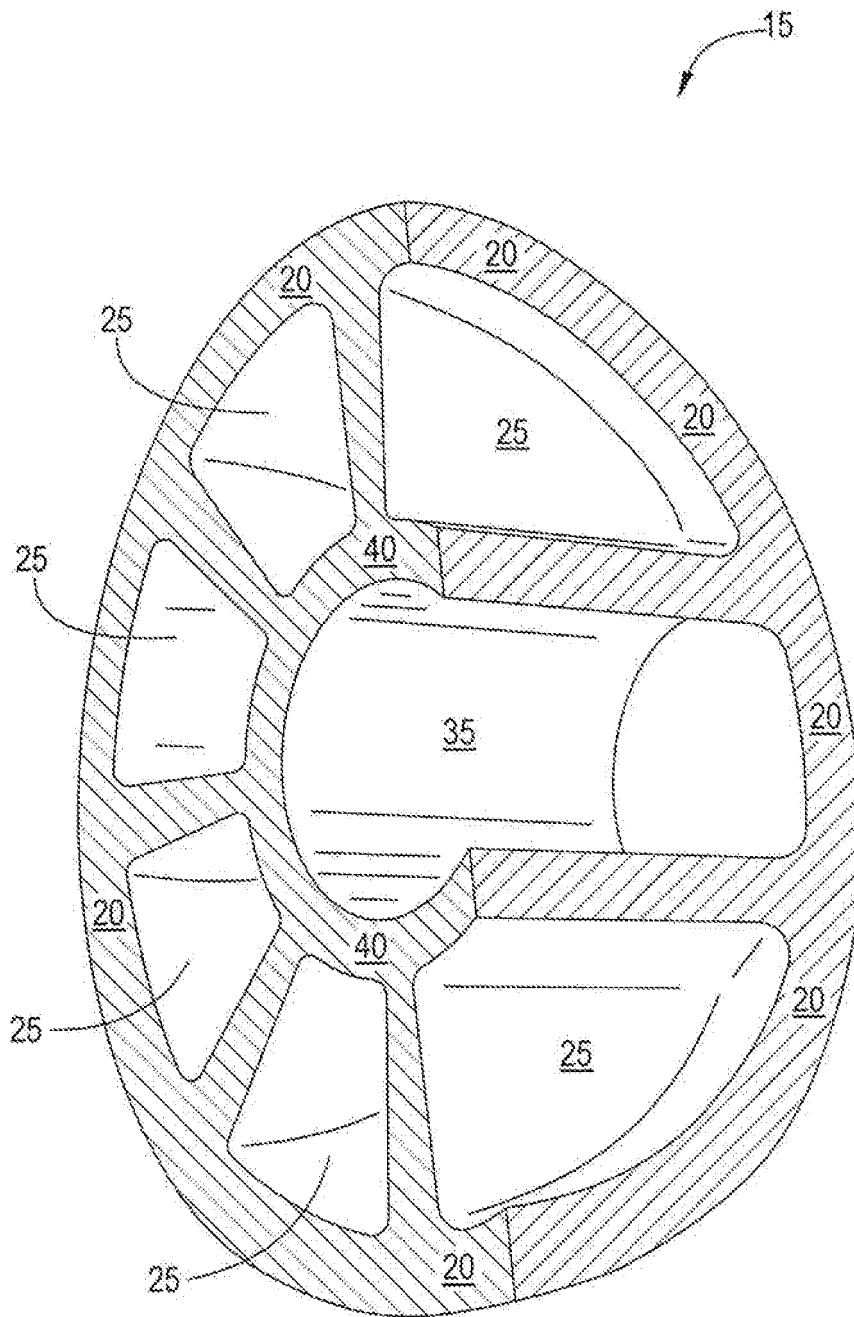


FIG. 6

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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