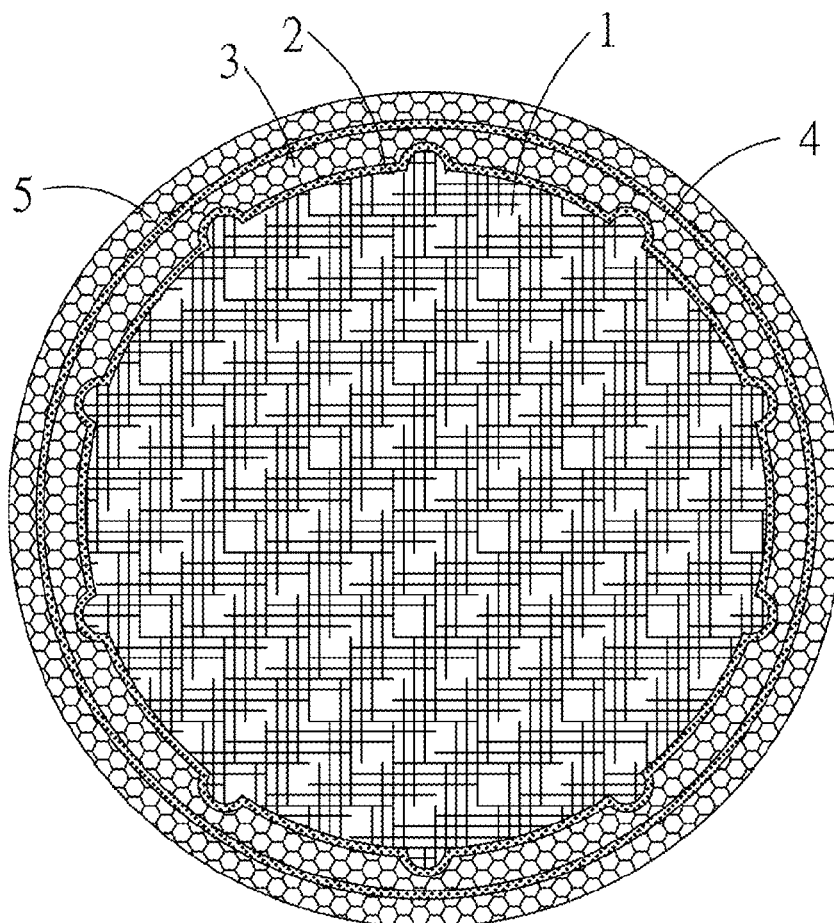




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(19) **United States**(12) **Patent Application Publication**
CHUANG(10) **Pub. No.: US 2017/0326413 A1**(43) **Pub. Date: Nov. 16, 2017**(54) **ELASTIC SOLID BALL STRUCTURE**(71) Applicant: **CHENG-MING CHUANG**, Taoyuan
(TW)(72) Inventor: **CHENG-MING CHUANG**, Taoyuan
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A63B 37/06 (2006.01)(52) **U.S. Cl.**CPC **A63B 37/06** (2013.01); **A63B 2037/065**
(2013.01)(57) **ABSTRACT**

An elastic solid ball structure of the present invention includes at least a thermoplastic polyurethane foam sphere center and a first adhesive layer, a first spherical lamina, a second adhesive layer, and a second spherical lamina sequentially disposed on the external surface of the thermoplastic polyurethane foam sphere center. The overall diameter of the elastic solid ball structure is 8 cm-26 cm. In addition, at least one protruding portion or at least one indentation portion is formed on the external surface of the thermoplastic polyurethane foam sphere center, thereby forming an irregular circular surface thereon. The described structural design provides the elastic solid ball structure of the present invention with advantages including good elasticity, a long serviceable life, permanently dispensing with the need to inflate, and eliminating having to re-inflate the ball structure.

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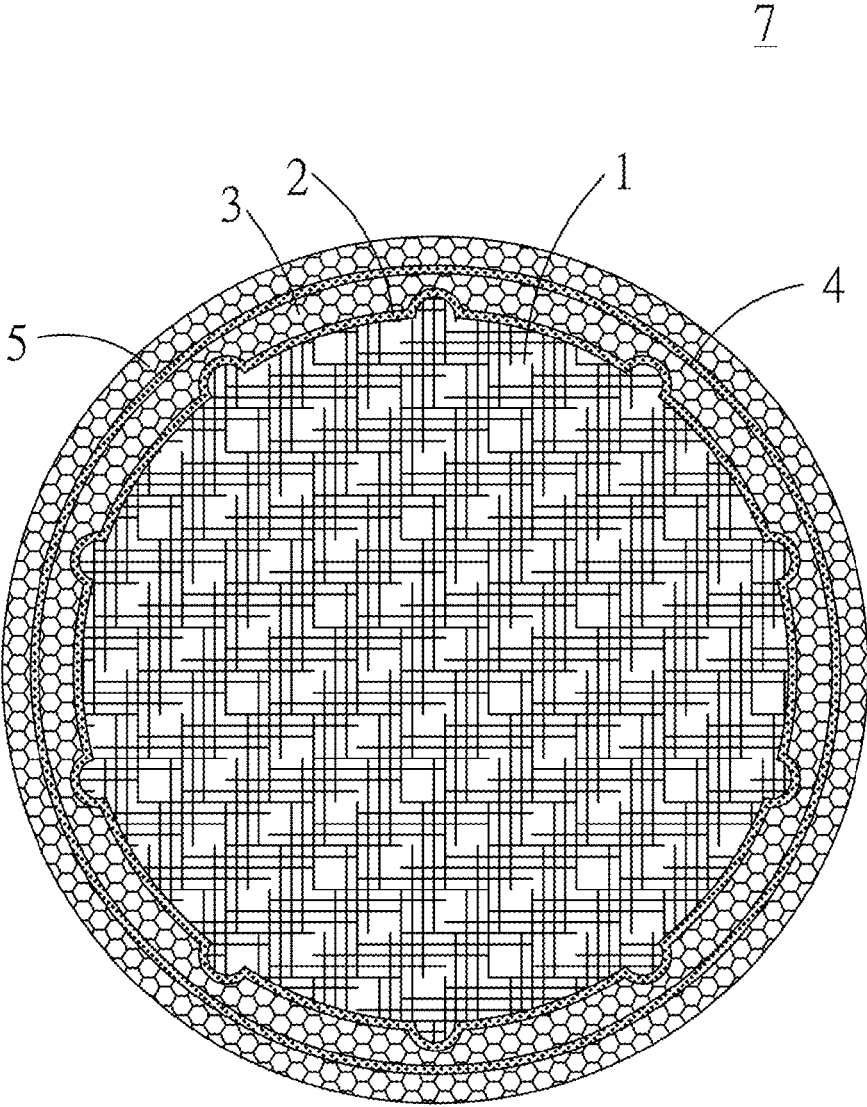


FIG.1

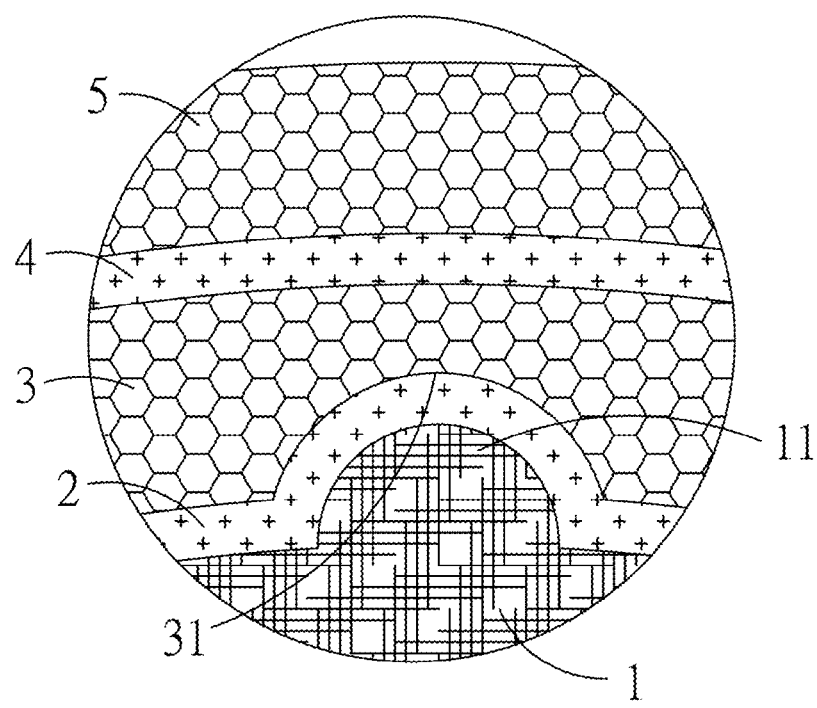


FIG.2

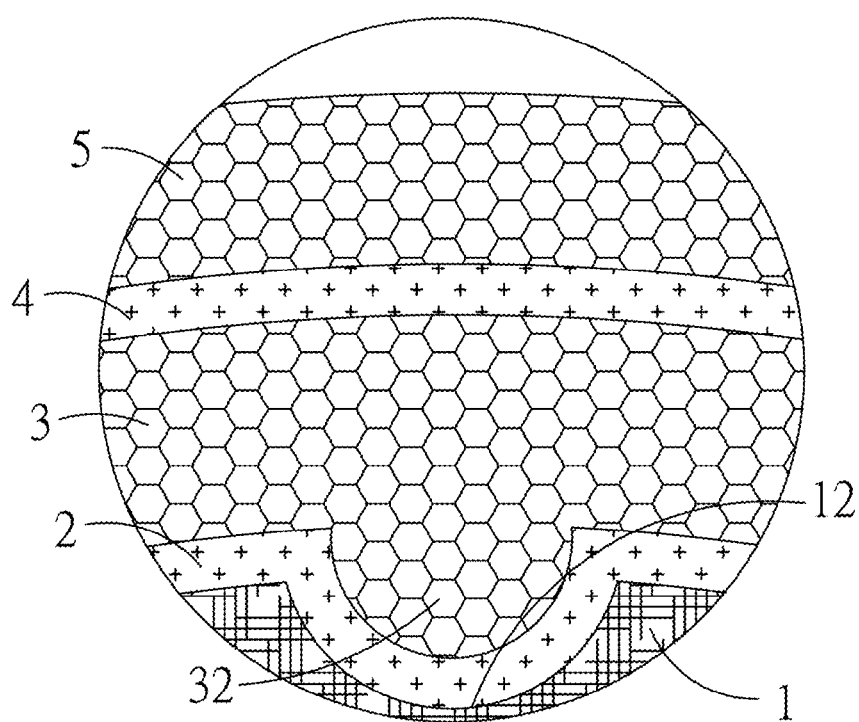


FIG.3

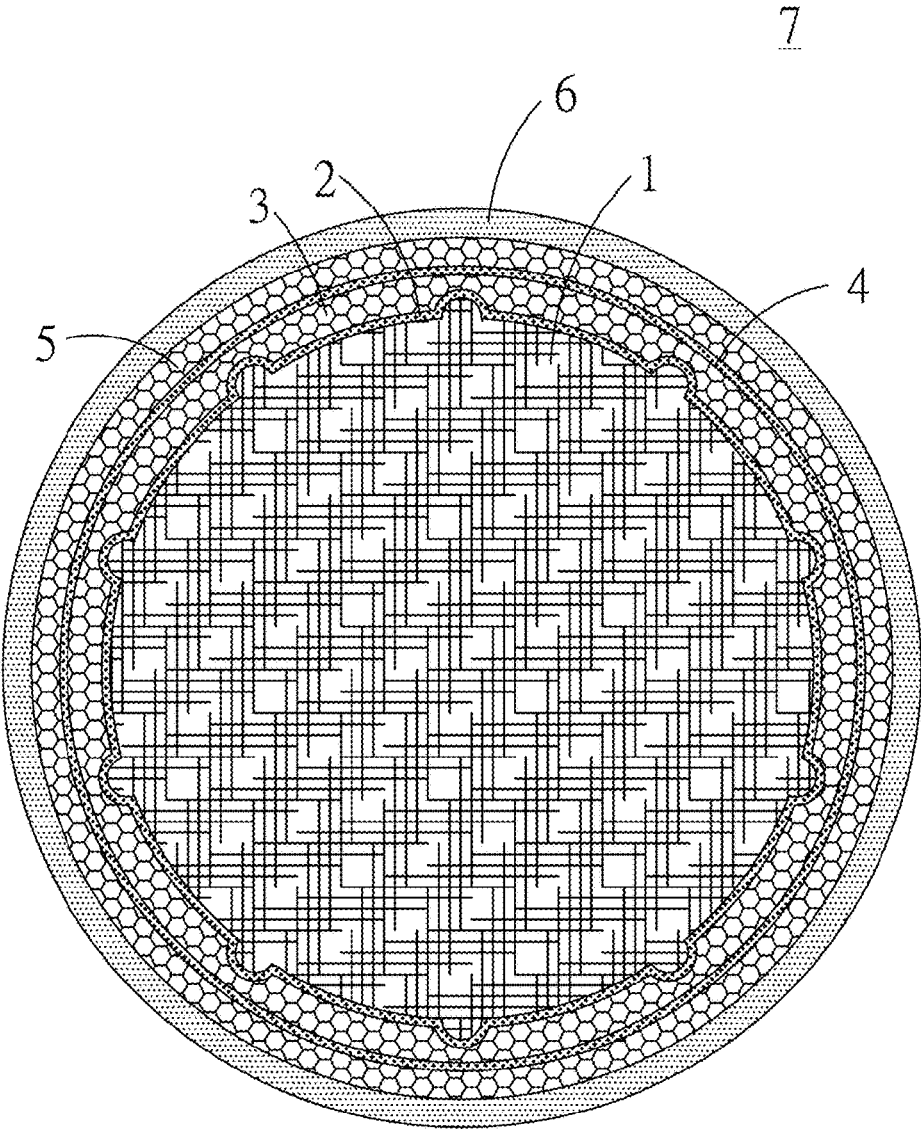


FIG.4

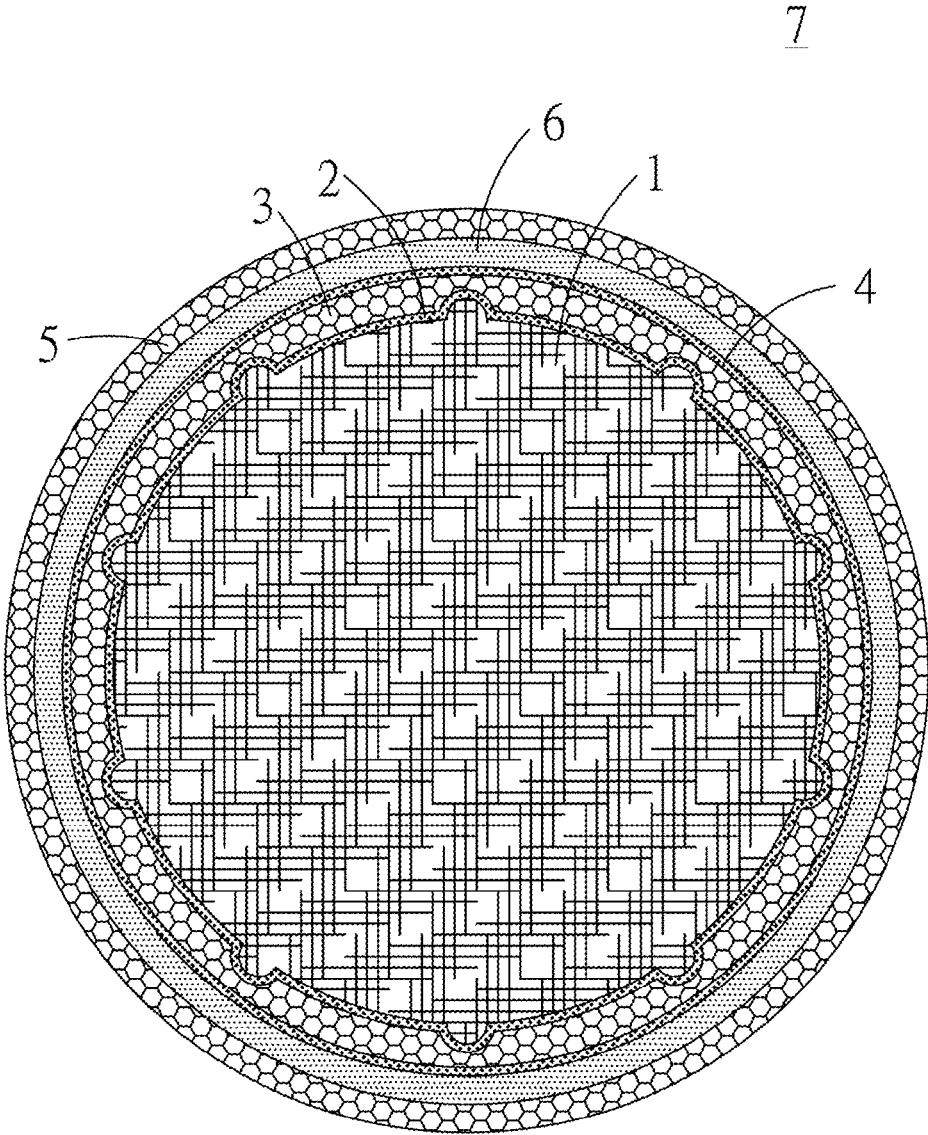


FIG.5

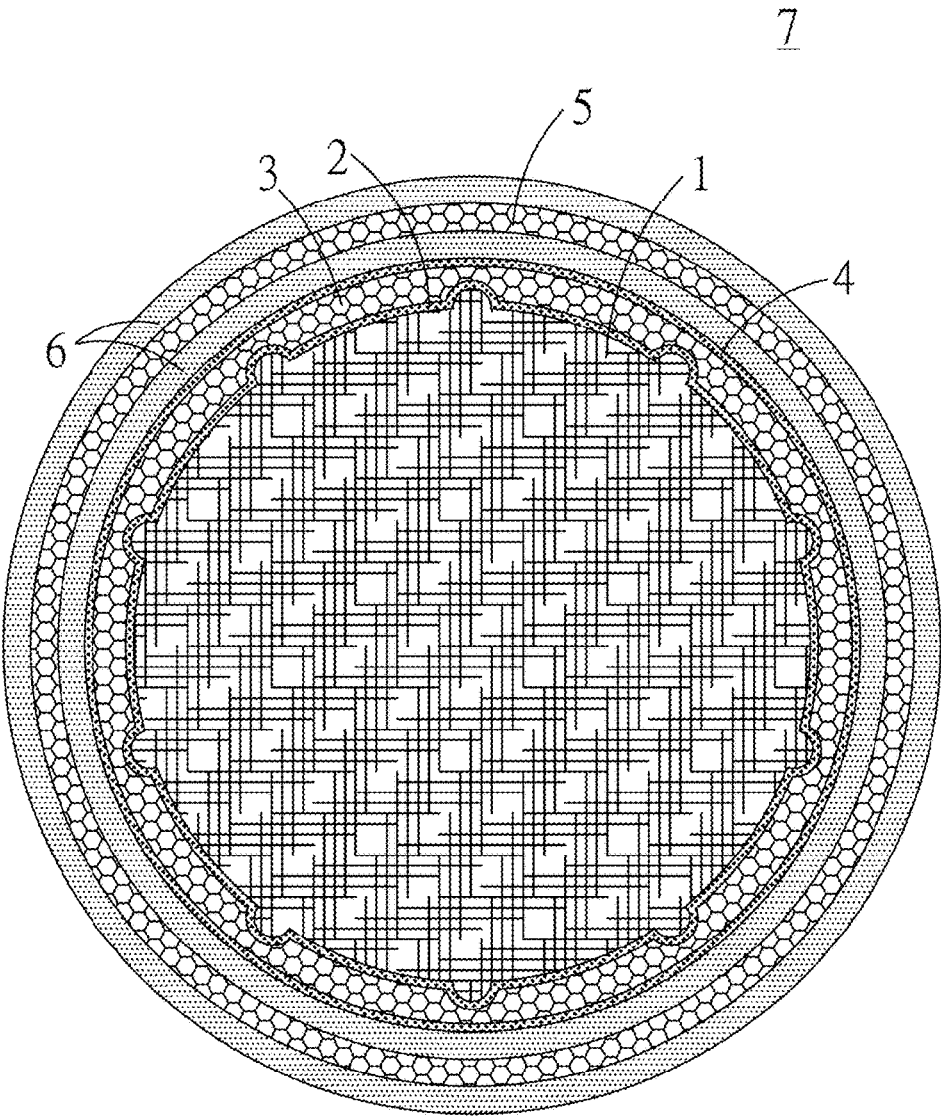


FIG.6

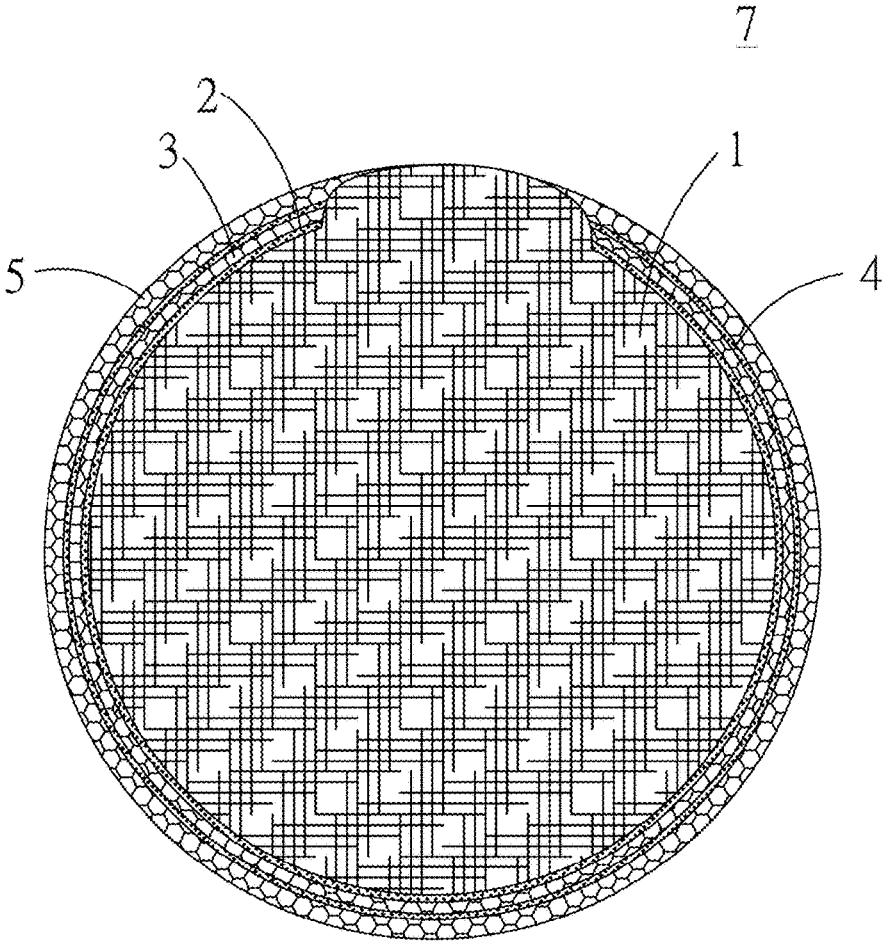


FIG.7

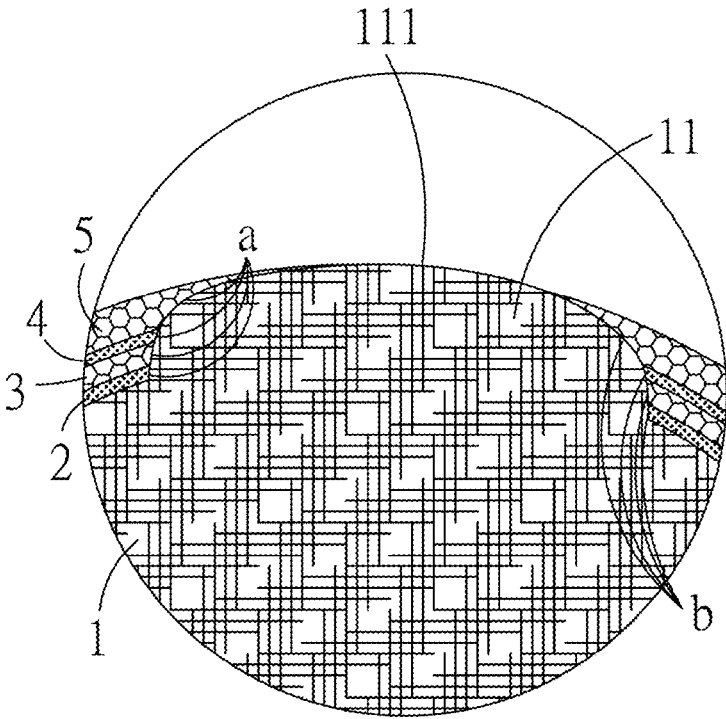


FIG.8

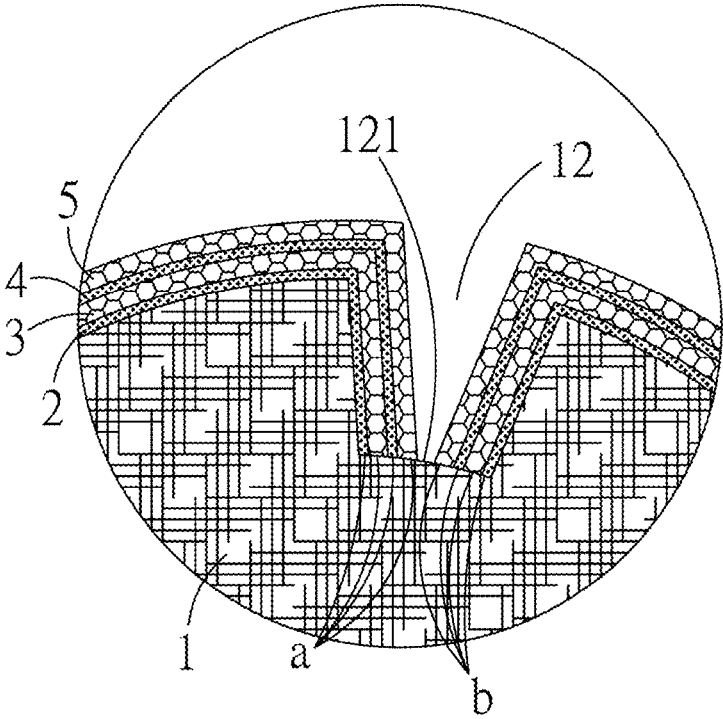


FIG.9

ELASTIC SOLID BALL STRUCTURE

BACKGROUND OF THE INVENTION

(a) Field of the Invention

[0001] The structure of the present invention relates to an elastic solid ball structure, and more particularly relates to an elastic solid ball structure having advantages including good elasticity, a long serviceable life, permanently dispensing with the need to inflate, and eliminating having to re-inflate the ball structure.

(b) Description of the Prior Art

[0002] The various types of inflatable spherical bodies, such as volleyballs, footballs, and basketballs, usually comprise a laminated structure that combines a body case, a limiting structure, and a bladder. The body case forms the outer layer of the spherical body, and is generally formed from durable, wear resistant material. The limiting structure forms the middle layer of the spherical body, and is fixedly positioned between a bladder and the body case to limit expansion of the bladder. In general, the bladder has an inflatable spherical body that is positioned inside the limiting structure to provide an inner layer of the spherical body. In order to facilitate inflation (i.e., inflating with air), the bladder usually includes a one-way inflation valve that extends through the limiting structure and the body case, thereby enabling inflation of the bladder from the exterior of the spherical body.

[0003] The aforementioned characteristics of inflatable hollow spherical bodies are formed at the same time during production of the entire spherical body. The inflation nozzle is a relatively complex one-way inflation valve structure, which causes the entire cost of the inflatable spherical body to be relatively high. Moreover, because such inflatable spherical bodies are hollow, they have high resilience when struck, as well as being resistant to wear. However, after being used for a period of time, the air inside will naturally leak out, resulting in the spherical body losing its elasticity, and thus requiring the need for an inflating tool to regularly repeat inflation of the spherical body. Accordingly, inflatable spherical bodies of the prior art are inconvenient in use.

SUMMARY OF THE INVENTION

[0004] The technical problems resolved by the structure of the present invention enable providing an elastic solid ball structure having advantages including good elasticity, a long serviceable life, permanently dispensing with the need to inflate, and eliminating having to re-inflate the ball structure.

[0005] The technological means adopted in the present invention are as described below.

[0006] According to the object of the structure of the present invention, an elastic solid ball structure is provided that comprises at least: a thermoplastic polyurethane foam sphere center formed from thermoplastic polyurethane foam material; and a first adhesive layer, a first spherical lamina, a second adhesive layer, and a second spherical lamina sequentially disposed on the external surface of the thermoplastic polyurethane foam sphere center. Wherein the diameter of the thermoplastic polyurethane foam sphere center is 11 cm~25 cm; the thickness of the first spherical lamina is 1 mm~5 mm; the thickness of the second spherical lamina is 0.1 mm~0.25 mm; and the overall diameter of the elastic

solid ball structure is 8 cm~26 cm. In addition, at least one protruding portion or at least one indentation portion is formed on the external surface of the thermoplastic polyurethane foam sphere center, thereby forming an irregular circular surface thereon.

[0007] The described elastic solid ball of the present invention has an innovative structural design that provides advantages including good elasticity, a long serviceable life, permanently dispenses with the need to inflate, as well as eliminating having to re-inflate the ball structure, and also saves on having to purchase an inflation equipment. Moreover, contact between irregular circular surfaces is used to increase bonding between the sphere center and the spherical lamina, which further increases the serviceable life of the elastic solid ball.

[0008] To enable a further understanding of said objectives and the technological methods of the invention herein, a brief description of the drawings is provided below followed by a detailed description of the preferred embodiments.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] FIG. 1 is a first structural schematic view of an elastic solid ball of the present invention.

[0010] FIG. 2 is a second structural schematic view of an elastic solid ball of the present invention.

[0011] FIG. 3 is a third structural schematic view of an elastic solid ball of the present invention.

[0012] FIG. 4 is a fourth structural schematic view of an elastic solid ball of the present invention.

[0013] FIG. 5 is a fifth structural schematic view of an elastic solid ball of the present invention.

[0014] FIG. 6 is a sixth structural schematic view of an elastic solid ball of the present invention.

[0015] FIG. 7 is a seventh structural schematic view of an elastic solid ball of the present invention.

[0016] FIG. 8 is an eighth structural schematic view of an elastic solid ball of the present invention.

[0017] FIG. 9 is a ninth structural schematic view of an elastic solid ball of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0018] Referring to FIG. 1, which is a structural schematic view of an elastic solid ball of the present invention, and an elastic solid ball structure 7 of the present invention comprises at least a thermoplastic polyurethane foam sphere center 1 formed from thermoplastic polyurethane foam material; and a first adhesive layer 2, a first spherical lamina 3, a second adhesive layer 4, and a second spherical lamina 5 sequentially disposed on the external surface of the thermoplastic polyurethane foam sphere center 1.

[0019] Wherein the diameter of the aforementioned thermoplastic polyurethane foam sphere center 1 is 11 cm~25 cm.

[0020] The first spherical lamina 3 covers the external surface of the thermoplastic polyurethane foam sphere center 1, and the thickness of the first spherical lamina 3 is 1 mm~5 mm. The first spherical lamina 3 can be an EVA (ethylene vinyl acetate) foamed spherical lamina, a TPE (thermoplastic elastomer) foamed spherical lamina, SBR (styrene butadiene rubber) foamed spherical lamina, NBR (nitrile butadiene rubber) foamed spherical lamina, an

EPDM (ethylene propylene diene M-class rubber) foamed spherical lamina, a SBL (styrene butadiene latex) foamed spherical lamina, POE (polyolefin elastomer) foamed spherical lamina, PE (polyethylene) foamed spherical lamina, or a TPR (thermoplastic rubber) foamed spherical lamina. The external surface of the thermoplastic polyurethane foam sphere center 1 mutually corresponds to the internal surface of the first spherical lamina 3, and the mutually corresponding surfaces are both irregular circular surfaces. Referring together with the embodiment depicted in FIG. 2, at least one protruding portion 11 is formed on the external surface of the thermoplastic polyurethane foam sphere center 1, thereby forming the irregular circular surface thereon. And at least one indentation portion 31 is formed on the internal surface of the first spherical lamina 3, thereby forming the irregular circular surface thereon. Accordingly, using the protruding portions 11 and the indentation portions 31 increases bondability between the thermoplastic polyurethane foam sphere center 1 and the first spherical lamina 3.

[0021] The first adhesive layer 2 is disposed between the external surface of the thermoplastic polyurethane foam sphere center 1 and the internal surface of the first spherical lamina 3, thereby enabling the first spherical lamina 3 to bond to the exterior surface of the thermoplastic polyurethane foam sphere center 1 by means of the first adhesive layer 2.

[0022] The second spherical lamina 5 covers the external surface of the first spherical lamina 3, and the thickness of the second spherical lamina 5 is 0.1 mm~0.25 mm. The second spherical lamina 5 can be a transparent TPU (thermoplastic polyurethane) thin film, transparent PVC (polyvinyl chloride) thin film, transparent PC (polycarbonate) thin film, transparent TPE (thermoplastic elastomer) thin film, transparent TPR (thermoplastic rubber) thin film, transparent PET (Polyethylene terephthalate) thin film, or a transparent EVA (ethylene vinyl acetate) thin film.

[0023] The second adhesive layer 4 is disposed between the first spherical lamina 3 and the second spherical lamina 5, thereby enabling the first spherical lamina 3 to bond to the external surface of the first spherical lamina 3 By means of the second adhesive layer 4.

[0024] The aforementioned multi-layer laminated structure forms the elastic solid ball structure 7, and the overall diameter of the elastic solid ball structure 7 is 8 cm~26 cm. Using the first spherical lamina 3 and the second spherical lamina 5 to cover the periphery of the thermoplastic polyurethane foam sphere center 1 provides effective protection of the thermoplastic polyurethane foam sphere center 1 to extend the serviceable life of the elastic solid ball structure 7 of the present invention.

[0025] In addition, the aforementioned structural design not only provides the elastic solid ball structure 7 of the present invention with good elasticity and a long serviceable life, but also provides advantages including permanently dispensing with the need to inflate and eliminating having to re-inflate the ball structure, as well as saving on the cost of having to purchase an inflation equipment. Moreover, contact between the irregular circular surfaces is used to increase bondability between the sphere center and the spherical lamina, which further increases the serviceable life of the solid ball.

[0026] Furthermore, in the embodiment depicted in FIG. 3, at least one indentation portion 12 can also be formed on

the external surface of the thermoplastic polyurethane foam sphere center 1, thereby forming an irregular circular surface thereon. And at least one protruding portion 32 is formed on the internal surface of the first spherical lamina 3, thereby forming an irregular circular surface thereon. Accordingly, the indentation portions 12 and the protruding portions 32 are similarly used to increase bondability between the thermoplastic polyurethane foam sphere center 1 and the first spherical lamina 3.

[0027] In addition, referring to FIG. 4, the elastic solid ball structure 7 can be further provided with a printed layer 6, which is disposed on the external surface of the second spherical lamina 5. The printed layer 6 is used to print different patterns or trademarks on the surface of the second spherical lamina 5 according to needs; or the printed layer 6 can be disposed on the internal surface of the second spherical lamina 5, as shown in FIG. 5, and then the second adhesive layer 4 is used to fixedly bond the second spherical lamina 5 printed with the printed layer 6 to the external surface of the first spherical lamina 3; or, as shown in FIG. 6, the elastic solid ball structure 7 is provided with two of the printed layers 6, which are disposed on the internal surface of the second spherical lamina 5 and the external surface of the second spherical lamina 5, respectively, and the second adhesive layer 4 is similarly used to fixedly bond the second spherical lamina 5 printed with the printed layers 6 to the external surface of the first spherical lamina 3, thereby completing the elastic solid ball structure 7.

[0028] Referring to FIG. 7 and FIG. 8, in the aforementioned embodiment at least one indentation portion 31 is formed on the internal surface of the first spherical lamina 3, thereby forming an irregular circular surface thereon, and the external surface of the thermoplastic polyurethane foam sphere center 1 coincides with the surface of the second spherical lamina 5, wherein the first adhesive layer 2, the first spherical lamina 3, the second adhesive layer 4, and two ends of the second spherical lamina 5 are respectively provided with a first end surface a and a second end surface b. Accordingly, a separation distance is formed between the first end surfaces a and the second end surfaces b, with the separation distance enabling exposure to the outside of at least one surface 111 of the at least one protruding portion 11. The irregular circular surface of the first spherical lamina 3 is similarly used to increase the contact area with the first adhesive layer 2 on the surface of the first spherical lamina 3, thereby increasing bondability between the sphere center and the spherical lamina, which further increases the serviceable life of the solid ball.

[0029] In addition, referring to FIG. 9, which shows the at least one indentation portion 12 similarly formed on the external surface of the thermoplastic polyurethane foam sphere center 1, thereby forming an irregular circular surface thereon, wherein the first adhesive layer 2, the first spherical lamina 3, the second adhesive layer 4, and two ends of the second spherical lamina 5 are respectively provided with the first end surface a and the second end surface b. Accordingly, a separation distance is formed between the first end surfaces a and the second end surfaces b, with the separation distance enabling exposure to the outside at least one surface 121 of the at least one indentation portion 12. The irregular circular surface of the first spherical lamina 3 is similarly used to increase the contact area with the first adhesive layer 2 on the surface of the first spherical lamina 3, thereby

increasing bondability between the sphere center and the spherical lamina, which further increases the serviceable life of the solid ball.

[0030] It is of course to be understood that the embodiments described herein are merely illustrative of the principles of the invention and that a wide variety of modifications thereto may be effected by persons skilled in the art without departing from the spirit and scope of the invention as set forth in the following claims.

What is claimed is:

1. An elastic solid ball structure, characterized in that the structure comprises at least:

- a thermoplastic polyurethane foam sphere center formed from thermoplastic polyurethane foam material, the diameter of the thermoplastic polyurethane foam sphere center is 11 cm~25 cm, and at least one protruding portion is formed on the external surface of the thermoplastic polyurethane foam sphere center, thereby forming an irregular circular surface thereon;
 - a first spherical lamina, the first spherical lamina covers the external surface of the thermoplastic polyurethane foam sphere center, the thickness of the first spherical lamina is 1 mm~5 mm;
 - a first adhesive layer, the first adhesive layer is disposed between the external surface of the thermoplastic polyurethane foam sphere center and the internal surface of the first spherical lamina;
 - a second spherical lamina, the second spherical lamina covers the external surface of the first spherical lamina, the thickness of the second spherical lamina is 0.1 mm~0.25 mm; and
 - a second adhesive layer, the second adhesive layer is disposed between the first spherical lamina and the second spherical lamina;
- wherein the overall diameter of the elastic solid ball structure is 8 cm~26 cm.

2. The elastic solid ball structure according to claim 1, characterized in that: at least one indentation portion is formed on the internal surface of the first spherical lamina, thereby forming an irregular circular surface thereon, and at least one indentation portion mutually corresponds to the at least one protruding portion on the external surface of the thermoplastic polyurethane foam sphere center.

3. The elastic solid ball structure according to claim 1, characterized in that: the surface of the second spherical lamina coincides with the surface of the at least one protruding portion formed on the external surface of the thermoplastic polyurethane foam sphere center.

4. The elastic solid ball structure according to claim 1, characterized in that: the first adhesive layer, the first spherical lamina, the second adhesive layer, and two ends of the second spherical lamina are respectively provided with a first end surface and a second end surface; a separation distance is formed between the first end surfaces and the second end surfaces, wherein the separation distance enables exposure to the outside of at least one surface of the at least one protruding portion.

5. The elastic solid ball structure according to claim 1, characterized in that: the elastic solid ball structure is provided with a printed layer, and the printed layer is disposed on the external surface of the second spherical lamina.

6. The elastic solid ball structure according to claim 1, characterized in that: the elastic solid ball structure is

provided with two of the printed layers, the two printed layers are disposed on the internal surface of the second spherical lamina and the external surface of the second spherical lamina, respectively.

7. The elastic solid ball structure according to claim 1, characterized in that: the first spherical lamina is an EVA (ethylene vinyl acetate) foamed spherical lamina, a TPE (thermoplastic elastomer) foamed spherical lamina, SBR (styrene butadiene rubber) foamed spherical lamina, a NBR (nitrile butadiene rubber) foamed spherical lamina, an EPDM (ethylene propylene diene M-class rubber) foamed spherical lamina, a SBL (styrene butadiene latex) foamed spherical lamina, POE (polyolefin elastomer) foamed spherical lamina, PE (polyethylene) foamed spherical lamina, or a TPR (thermoplastic rubber) foamed spherical lamina.

8. The elastic solid ball structure according to claim 1, characterized in that: the second spherical lamina is a transparent TPU (thermoplastic polyurethane) thin film, transparent PVC (polyvinyl chloride) thin film, transparent PC (polycarbonate) thin film, transparent TPE (thermoplastic elastomer) thin film, transparent TPR (thermoplastic rubber) thin film, transparent PET (Polyethylene terephthalate) thin film, or a transparent EVA (Ethylene vinyl acetate) thin film.

9. An elastic solid ball structure, characterized in that, the structure comprises at least:

- a thermoplastic polyurethane foam sphere center formed from thermoplastic polyurethane foam material, the diameter of the thermoplastic polyurethane foam sphere center is 11 cm~25 cm, and at least one indentation portion is formed on the external surface of the thermoplastic polyurethane foam sphere center, thereby forming an irregular circular surface thereon;
 - a first spherical lamina, the first spherical lamina covers the external surface of the thermoplastic polyurethane foam sphere center, the thickness of the first spherical lamina is 1 mm~5 mm;
 - a first adhesive layer, the first adhesive layer is disposed between the external surface of the thermoplastic polyurethane foam sphere center and the internal surface of the first spherical lamina;
 - a second spherical lamina, the second spherical lamina covers the external surface of the first spherical lamina, the thickness of the second spherical lamina is 0.1 mm~0.25 mm;
 - a second adhesive layer, the second adhesive layer is disposed between the first spherical lamina and the second spherical lamina;
- wherein the overall diameter of the elastic solid ball structure is 8 cm~26 cm.

10. The elastic solid ball structure according to claim 9, characterized in that: at least one protruding portion is formed on the internal surface of the first spherical lamina, thereby forming an irregular circular surface thereon, and the at least one protruding portion mutually corresponds to the at least indentation portion on the external surface of the thermoplastic polyurethane foam sphere center.

11. The elastic solid ball structure according to claim 10, characterized in that: the first adhesive layer, the first spherical lamina, the second adhesive layer, and two ends of the second spherical lamina are respectively provided with a first end surface and a second end surface; a separation distance is formed between the first end surface and the

second end surface, wherein the separation distance enables exposure to the outside of at least one surface of the at least one indentation portion.

12. The elastic solid ball structure according to claim **9**, characterized in that: the elastic solid ball structure is provided with a printed layer, and the printed layer is disposed on the internal surface of the second spherical lamina.

13. The elastic solid ball structure according to claim **9**, characterized in that: the elastic solid ball structure is provided with a printed layer, the printed layer is disposed on the external surface of the second spherical lamina.

14. The elastic solid ball structure according to claim **9**, characterized in that: the elastic solid ball structure is provided with two of the printed layers, the two printed layers are disposed on the internal surface of the second spherical lamina and the external surface of the second spherical lamina, respectively.

15. The elastic solid ball structure according to claim **9**, characterized in that: the first spherical lamina is an EVA (ethylene vinyl acetate) foamed spherical lamina, a TPE

(thermoplastic elastomer) foamed spherical lamina, SBR (styrene butadiene rubber) foamed spherical lamina, a NBR (nitrile butadiene rubber) foamed spherical lamina, an EPDM (ethylene propylene diene M-class rubber) foamed spherical lamina, a SBL (styrene butadiene latex) foamed spherical lamina, POE (polyolefin elastomer) foamed spherical lamina, PE (polyethylene) foamed spherical lamina, or a TPR (thermoplastic rubber) foamed spherical lamina.

16. The elastic solid ball structure according to claim **9**, characterized in that: the second spherical lamina is a transparent TPU (thermoplastic polyurethane) thin film, transparent PVC (polyvinyl chloride) thin film, transparent PC (polycarbonate) thin film, transparent TPE (thermoplastic elastomer) thin film, transparent TPR (thermoplastic rubber) thin film, transparent PET (Polyethylene terephthalate) thin film, or a transparent EVA (Ethylene vinyl acetate) thin film.

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