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(54) **WATER BOUNCING BALL**

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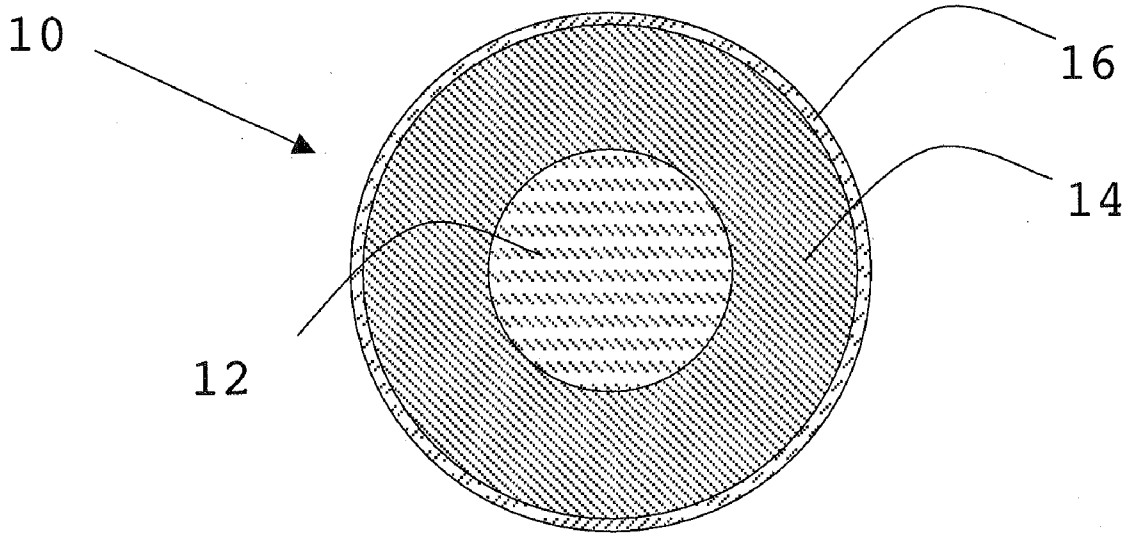
(57) **ABSTRACT**

A water bouncing ball includes a gel core made of plastic material and an elastic porous plastic material adjacent the gel core and covering and centering the gel core in the middle of the ball. The ratio between the diameter of the gel core and the thickness of the elastic porous plastic material is in the range between 0.66 and 2.8. In this way a soft floating ball having good bouncing ability is provided.



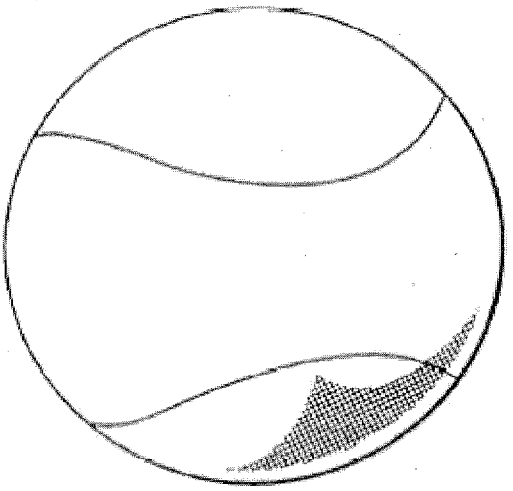


FIG. 1

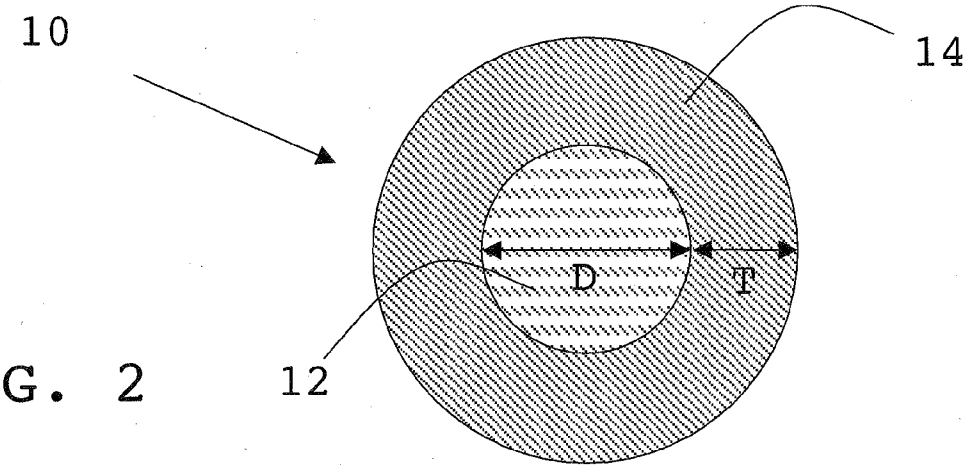


FIG. 2

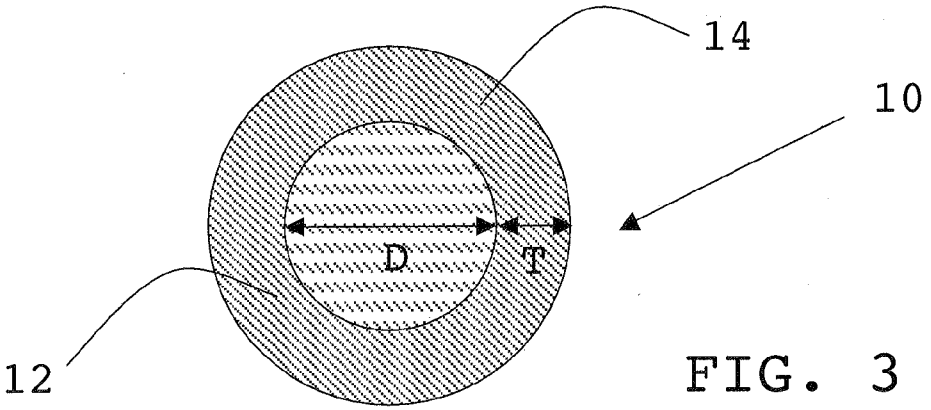


FIG. 3

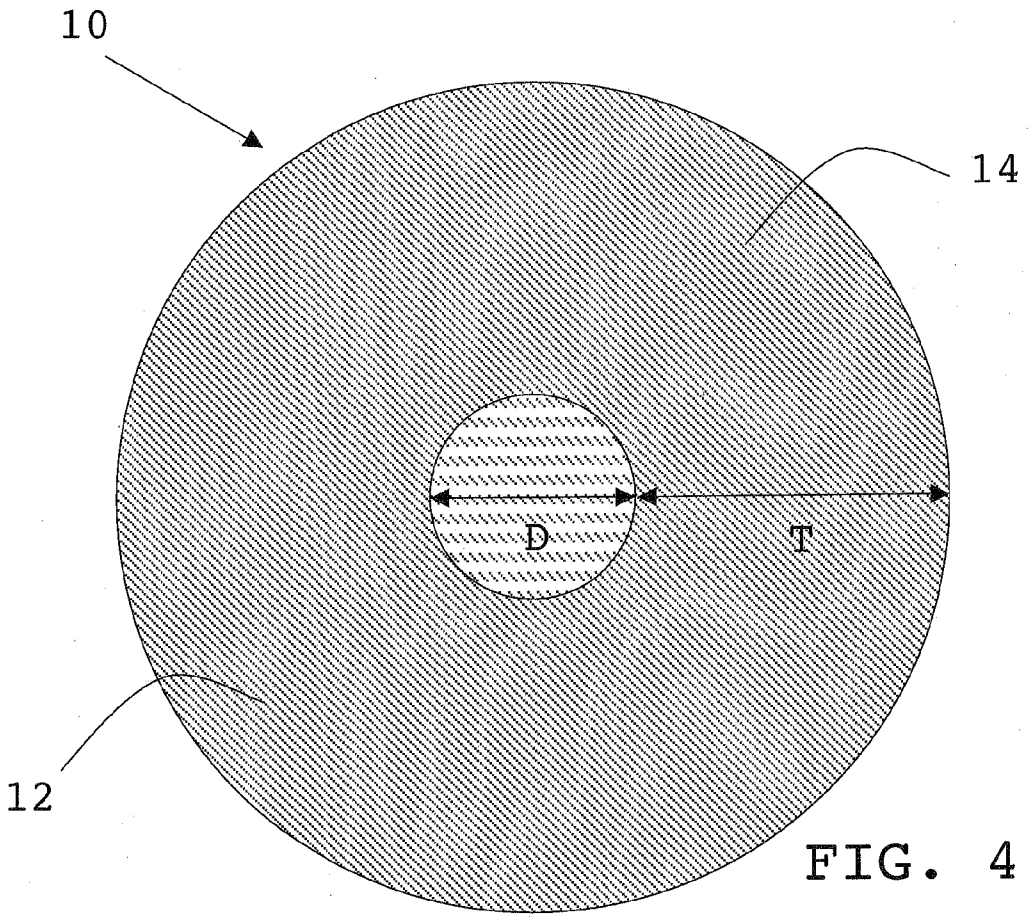


FIG. 4

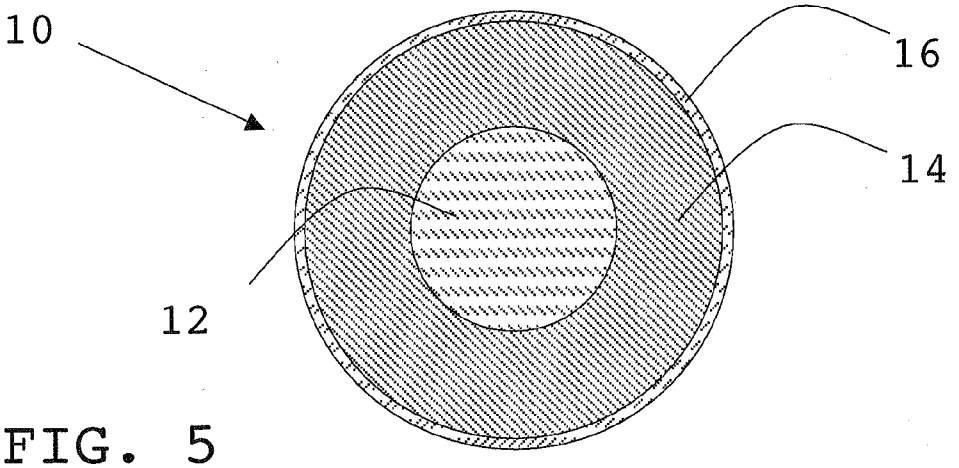


FIG. 5

WATER BOUNCING BALL

TECHNICAL FIELD OF THE INVENTION

[0001] The present invention generally relates to a ball and in particular the present invention relates to a water bouncing ball.

BACKGROUND OF THE INVENTION

[0002] Balls have for many years been provided for entertainment and amusement of both children and adults. Balls are normally used in such a way that they can bounce at an angle off a hard surface. Also water is an element, which is the source of much pleasure for many people.

[0003] In the world of sports, balls have been known to be used for long in relation to water, where water polo is a well-known game.

[0004] Another ball for water games is described in US 2001/0014633, where the interior of the ball is provided with a cavity that is filled with a gas and fluid combination, where the fluid can be a gel and the gas is typically air. This ball is provided for skimming or sliding along the water surface. It does not bounce very well.

[0005] Balls are also known to be used for exercise purposes in order to strengthen muscles. One such ball is a ball described in U.S. Pat. No. 6,224,513. This ball comprises a polyurethane core on top of which is provided an elastic shell layer, which comprises LYCRA®.

[0006] A toy that is provided for being kicked in the air is described in U.S. Pat. No. 5,647,809. The toy can also float in water.

[0007] For some types of water games it is of importance that the ball can bounce off the water surface in a good way, such that the ball when thrown on the water surface can have a trajectory enabling several further bounces in a direction of the throw. This may be important if points are to be scored in the game. It may then also be of importance that the ball at the same time is able to float well.

[0008] WO 2006/121380 describes some balls having such properties. One ball according to this document has a gel core, which is surrounded by a floating enhancement section that is made up of an elastic plastic porous material in the form of a foamed plastics material. This ball in WO 2006/121380 has good bouncing as well as floating ability. However, the thickness of the elastic porous plastic material is fairly thin in relation to the diameter of the gel core. This means that the ball is fairly hard. This also means that if an innocent bystander would by accident be hit by the ball by people engaged in a water game, this innocent bystander may be unpleasantly surprised. If the ball were to be thrown at full strength such an innocent bystander might possibly even get hurt.

[0009] There is therefore a need for providing a ball that has good water bouncing and floating abilities while at the same time being soft and not providing as hard an impact if accidentally hitting a person, like an innocent bystander to a water game.

[0010] For the reasons stated above, and for other reasons stated below which will become apparent to those skilled in the art upon reading and understanding the present specification, there is a need in the art for an improved water bouncing ball.

SUMMARY OF THE INVENTION

[0011] The above-mentioned problems with water bouncing balls and other problems are addressed by the present invention and will be understood by reading and studying the following specification.

[0012] One object of the present invention is therefore to solve the problem of providing a water bouncing ball that has good bouncing and floating abilities while being soft enough for having a limited impact if hitting persons.

[0013] This problem is according to the present invention solved by a water bouncing ball comprising: a gel core made of plastic material; and an elastic porous plastic material adjacent the gel core and covering and centering the gel core in the middle of the ball;
wherein the ratio between the diameter of the gel core and the thickness of the elastic porous plastic material is in the range between 0.66 and 2.8.

[0014] According to one embodiment of the present invention, the ratio between the diameter of the gel core and the thickness of the elastic porous plastic material is approximately 2.

[0015] According to other embodiments of the present invention, the diameter of the gel core is in the range between 10 and 100 mm and then preferably in the range between 25 and 45 mm.

[0016] According to some embodiments of the present invention the density of the gel core is in the range between 80 and 1.10 g/cm^3 and then preferably in the range between 90 and 1.3 g/cm.

[0017] The gel core may be made of polyurethane, thermal plastic rubber or styrene butadiene rubber as may the elastic porous plastic material.

[0018] With the present invention there is therefore provided a ball that is soft and floats well while at the same time retaining good bouncing ability on water. This is important when a soft floating ball is needed that, when thrown on a water surface, can have a trajectory enabling several bounces in the direction in which the ball is thrown.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019] The present invention will now be described in relation to the enclosed drawings, in which

[0020] FIG. **1** shows a perspective view of a ball of the present invention,

[0021] FIG. **2** shows a cross-sectional view of the ball of FIG. **1** according to a first embodiment of the present invention,

[0022] FIG. **3** shows a cross-sectional view of a ball according to a second embodiment of the present invention,

[0023] FIG. **4** shows a cross-sectional view of a ball according to a third embodiment of the present invention, and

[0024] FIG. **5** shows a cross-sectional view of a ball according to a fourth embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0025] In the following detailed description of the preferred embodiments, reference is made to the accompanying drawings that form a part hereof, and in which is shown by way of illustration specific preferred embodiments in which the invention may be practiced. These embodiments are described in sufficient detail to enable those skilled in the art to practice the invention, and it is to be understood that other embodiments may be utilized and that changes may be made without departing from the spirit and scope of the present invention. The following detailed description is, therefore, not to be taken in a limiting sense, and the scope of the present invention is defined only by the claims.

[0026] Referring to FIG. **1**, a perspective view of one ball **10** of the present invention is provided. This figure will be used in the description of four specific embodiments of the present invention to be discussed in more detail in the follow-

ing. This ball **10** is a water bouncing ball and is therefore a ball that is suitable for water games. The ball **10**, in its normal state, is shaped as a round, or spherical ball. In FIG. **1** the ball is designed to appear to have stitching to imitate the look of a baseball. The stitching is thus artwork provided on the ball. This artwork is of course not necessary, but is merely presented as one possible design of the ball. It should also be realized that balls are not limited to round balls, but other shapes are also feasible, like oval shapes.

[0027] FIG. **2** displays a cross sectional view taken through a ball **10** according to a first exemplifying embodiment of the present invention and displays the different sections of the ball **10**. The ball **10** comprises a gel core **12**, around which is provided an elastic or flexible porous plastic material **14**, typically a foamed plastic material. The elastic porous plastic material **14** is provided adjacent, abuts and covers the whole of the gel core **12**. The elastic porous plastic material **14** furthermore centers the gel core **12** in the middle of the ball **10**. There is thus no material provided in-between gel core **12** and elastic porous plastic material **14**. In the first embodiment of the present invention, these are the only materials used in the ball. The elastic porous plastic material **14** has a thickness that is enough for centering the gel core in the middle of the ball. The gel core can therefore be seen as a smaller ball within a larger elastic porous plastic ball. If the ball is provided with artwork as shown in FIG. **1**, then this artwork may be provided as a pattern on the elastic porous plastic material **14**.

[0028] The gel has to have very good bouncing properties when used in water, such that the trajectory of the ball when thrown on a water surface may provide several bounces of the ball in the direction of the throw. The movement of the ball may thus have to have a predictable direction. This allows the provision of a ball that can be used in water games requiring such bouncing characteristics, for instance if it is to be used in a game where points are scored based on the bounce.

[0029] For this reason the gel is made of a plastic material and may be a polyurethane (PU) based gel. The gel can be Diphenylmethane-4,4'-Diisocyanate. This gel is available from BASF Headway Polyurethanes (Taiwan) Co., Ltd., No. 11, Jen Cheng Road, Hsinchu Industrial Park, Huko Heian, Hsinchu, Taiwan as a silicon polyurethane gel material referred to under the trade name 1-126. It will be appreciated by those skilled in the art that other silicon materials can be used without departing from the invention. Also gels based on other materials than silicon may be used. The core may thus also be made of a gel solely consisting of polyurethane, or similar gels like gels based on polyetherpolyol. Other materials in which the gel core may be made are thermal plastic rubber (TPR) and styrene butadiene rubber (SBR).

[0030] The gel core may have a density in the range between 0.8 and 1.10 g/cm^3. This density may furthermore be in the range between 0.9 and 1.3 g/cm^3 and preferably of about 1.05 g/cm^3. The gel core **12** may here have a diameter in the rage between 1 and 100 mm and preferably in the range between 25 and 45 mm. Three diameters providing good bouncing ability are here 25 mm, 35 mm and 45 mm.

[0031] In order to enhance the floating ability and a softer ball, the elastic porous plastic material **14** is provided. Since the material **14** is porous, it is lighter than the gel and therefore enhances the floating ability of the ball. The elasticity of the material furthermore provides the required softness. The elastic porous plastic material **14** may be PU or TPR. It can however be another material like neoprene or similar materials. The material **14** can also be SBR. The material is furthermore with advantage provided in the form of foam, for instance made by PU or TPR gel. These materials have shown to have good floating ability and can provide the required softness.

[0032] On the face of it, it would here seem that in order to obtain a floating water bouncing ball that is soft enough for a given gel diameter it is just a question of merely selecting a thickness of the elastic porous plastic material that provides the desired softness and floating ability. The more elastic porous plastic material you provide in relation to the core, the softer the ball will get.

[0033] However, it is not that simple to obtain a soft floating water bouncing ball because the elastic porous plastic material will also affect the bouncing ability. If for instance starting out with a gel core ball having a diameter described in WO 2006/121380 being covered with a foam having a thickness being described therein and then gradually increasing the thickness of the foam in relation to the diameter of the gel, it has been noted that the bouncing ability after a while is actually degraded to unacceptable levels. A ball having these proportions basically only skims along a water surface when thrown at it. If then the foam thickness is increased then suddenly, for a first relationship between gel and foam, an adequate bouncing ability is obtained. This bouncing ability is then improved if the foam thickness is increased further up till a second relationship between gel and foam is obtained. If the thickness of the foam is then increased further the bouncing ability degrades somewhat, but is still acceptable, up until a third relationship between gel and foam is obtained. If the foam thickness is increased further from this point then again the bouncing ability is degraded to unacceptable levels so that the ball when thrown at the water surface again basically only skims along this surface.

[0034] It is thus clear that in order to provide a softer floating ball that has acceptable bouncing ability, the relationship between the core and the elastic porous plastic material has to be carefully selected.

[0035] The gel core **12** in FIG. **1** has a diameter denoted D, while the elastic porous plastic material **14** has a thickness, here a radial thickness, denoted T. Since the elastic porous plastic material **14** is provided as an outer ball covering an inner ball, it is clear that the outer ball, i.e. the elastic porous plastic material, has an inner diameter and an outer diameter. The thickness of the elastic porous plastic material is here determined as the difference between the outer diameter and the inner diameter divided by two. Mathematically this can be expressed as:

$$T=(D_i-D_u)/2 \quad (1)$$

where D_i is the inner diameter of the elastic porous plastic material and D_u is the outer diameter of the elastic porous plastic material.

[0036] According to the present invention there is a special ratio R between the diameter D of the gel core **12** and the thickness T of the elastic porous plastic material **14**. This ratio can be expressed as:

$$R=D/T \quad (2)$$

[0037] In the first embodiment of the present invention this ratio R is here equal to 2.

[0038] FIG. **3** shows a second embodiment of a ball according to the present invention having the same two materials as the first embodiment. However, here the ratio R is approximately 2.6.

[0039] FIG. **4** shows a third embodiment of a ball according to the present invention having the same two materials as the first and second embodiments. However, here the ratio R is approximately 0.66.

[0040] The ball according to the first embodiment has the best bouncing ability of the three balls and the ratio R is here provided at or close to the second relationship described above. The balls according to the second and third embodiments share fair bouncing abilities. The ball in the second embodiment shown in FIG. **3** here has a ratio provided at or close to the first above-described relationship, while the ball in the third embodiment shown in FIG. **4** has a ratio provided at or close to the third above-described relationship.

[0041] It can therefore be seen that when

$$0.66<R<2.6$$

a soft floating ball having adequate or fair bouncing ability is obtained and if R=2 or approximately 2 then excellent bouncing ability is obtained.

[0042] Since the gel is firmly placed in the center of the ball, the bounce is furthermore reliable and predictable, which may be important if the ball is to be used in a game where points are scored.

[0043] It is possible to express the above relationships between gel core and elastic porous plastic material also in terms of volume.

[0044] The volume of the gel core can then be expressed as

$$V_G=(4/3)*\pi*(D/2)^3=(\pi/6)*D^3 \quad (3)$$

[0045] The volume occupied by the elastic porous plastic material can then be expressed as:

$$V_E=(4/3)*\pi*(T+D/2)^3-(\pi/6)*D^3 \quad (4)$$

which may be simplified as:

$$V_E=(\pi/6)*(2T+D)^3-(\pi/6)*D^3 \quad (5)$$

[0046] The relationship between the volume occupied by the elastic porous plastic material and the volume of the gel core is then given by:

$$V_E/V_G=[(\pi/6)*(2T+D)^3-(\pi/6)*D^3]/[(\pi/6)*D^3] \quad (6)$$

which finally may be simplified as:

$$V_E/V_G=(2T+D)^3/D^3-1 \quad (7)$$

[0047] This volume relationship would provide the same results as described above in a range of

$$4.55<V_E/V_G<63,$$

with an excellent bouncing ability when $V_E/V_G=7$.

[0048] Some examples of relationships that have proven to work are a gel core diameter of 25 mm together with an elastic porous material thickness of 37.5 mm, a gel core diameter of 35 mm together with an elastic porous material thickness of 13.5 mm, a gel core diameter of 35 mm together with an elastic porous material thickness of 37.5 mm. Examples of relationships that have proven to be even better are a gel core diameter of 35 mm together with an elastic porous material thickness of 17.5 mm and a gel core diameter of 45 mm together with an elastic porous material thickness of 22.5 mm.

[0049] It is possible to add a shell section **16** to the ball **10**. This is shown in FIG. **5**, which shows a ball **10** according to a fourth embodiment of the present invention that is variation of the first embodiment. Here a ball **10** having the ratio of two between the diameter of the gel core **12** and the thickness of the elastic porous plastic material **14** is provided. In this embodiment an outer shell section **16** covers the elastic porous plastic material **14**. This can be provided in order to improve the friction of the ball **10** in relation to water as well in relation to weight and volume.

[0050] This shell section **16** may be provided in the form of a thin film of PU, SBR, TPR or any of the other previously mentioned materials being sprayed onto to outer surface of the foam. The film can also be a nano technology based material, i.e. a material that is based on for instance nanotubes.

[0051] As an alternative it is possible that the shell section **16** is made of a stretchable fabric, like LYCRA®. The stretchable fabric may here have a thickness of about 1-2 mm. The shell section may here provide a ball that is easy and comfortable to hold in the hand.

[0052] The shell section can also be provided through a combination of materials, such as through a layer of stretchable fabric, like LYCRA®, beneath which a shell enhancement layer is provided. The shell enhancement layer may be a PU layer. It should be realized that other materials than PU can be used, like for instance SBR, TPR, neoprene or similar materials. The PU layer can act as a water barrier stopping some of the water from entering the ball. However the shell section would normally comprise stitches when the stretchable fabric is being fastened to the shell enhancement layer, which will allow some water to pass through the shell enhancement layer.

[0053] It should here be understood that the shell section of FIG. **5** can just as well be combined with the balls having the ratios shown in FIGS. **3** and **4** too. It should also be realized that the shell section is in no way required in the ball of the present invention.

[0054] With the present invention there is therefore provided a ball that bounces well on water due to the properties of the gel section while at the same time being able to float well and being soft enough for limiting the impact if accidentally hitting people.

[0055] Although specific embodiments have been illustrated and described herein, it will be appreciated by those of ordinary skill in the art that any arrangement that is calculated to achieve the same purpose may be substituted for the specific embodiment shown. This application is intended to cover any adaptations or variations of the present invention. Therefore, it is manifestly intended that this invention be limited only by the claims and the equivalents thereof.

1. A water bouncing ball comprising:

a gel core made of plastic material and having a diameter; and

an elastic porous plastic material adjacent the gel core and covering and centering the gel core in the middle of the ball, the elastic porous plastic material having a thickness;

wherein the ratio between the diameter of the gel core and the thickness of the elastic porous plastic material is in the range between 0.66 and 2.8.

2. A ball according to claim **1**, wherein the ratio between the diameter of the gel core and the thickness of the elastic porous plastic material is approximately **2**.

3. A ball according to claim **1**, wherein the diameter of the gel core is in the range between 10 and 100 mm.

4. A ball according to claim **3**, wherein the diameter of the gel core is in the range between 25 and 45 mm.

5. A ball according to claim **1**, wherein the density of the gel core is in the range between 0.8 and 1.10 g/cm^3.

6. A ball according to claim **5**, wherein the density of the gel core is in the range between 0.9 and 1.3 g/cm^3.

7. A ball according to claim **1**, wherein the gel core is made of polyurethane.

8. A ball according to claim **1**, wherein the gel core is made of thermal plastic rubber.

9. A ball according to claim **1**, wherein the gel core is made of styrene butadiene rubber.

10. A ball according to claim **1**, wherein the elastic porous plastic material is polyurethane.

11. A ball according to claim **1**, wherein the elastic porous plastic material is styrene-butadiene rubber.

12. A ball according to claim **1**, wherein the elastic porous plastic material is thermal plastic rubber.

13. A ball according to claim **1**, further comprising an outer shell section covering the elastic porous plastic material.

14. A ball according to claim **13**, wherein the outer shell section is a plastic film or includes a nano technology based material.

15. A ball according to claim **13**, wherein the outer shell section comprises a stretchable fabric layer.

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