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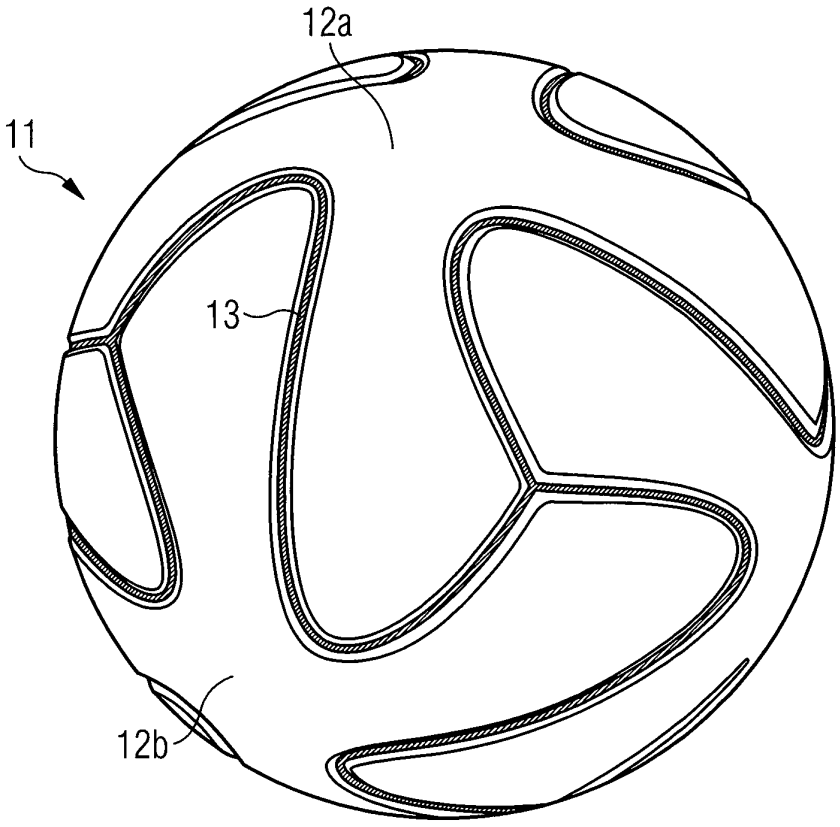
(54) **BALL, IN PARTICULAR A SOCCER BALL, AND METHOD OF MANUFACTURING A BALL**

(57) The present invention relates to a ball (11), in particular a soccer ball, comprising: (a.) a shell (31) with a plurality of panels (12a, 12b, 12c, 12d) on the outside of the shell (31), wherein (b.) the panels (12a, 12b, 12c, 12d) are arranged in such a way that there is at least one gap (21) between at least two adjacent panels (12a, 12b), and wherein (c.) the at least one gap (21) is at least partly filled with a filling material (13).

FIG 1



EP 3 067 100 A1

Description

1. Technical field

[0001] The present invention relates to a ball, in particular a soccer ball, and a method of manufacturing such a ball.

2. Prior art

[0002] Balls, in particular balls for ball sports such as soccer, are usually sewn together from either single pieces of leather or synthetic leather or panels manufactured mostly from plastic are glued on a bladder or on a carcass arranged onto a bladder for reinforcement. Latter kind of balls are also called laminated balls.

[0003] A sewn ball is manufactured from a plurality of pieces of leather or synthetic leather, which edges are folded inwardly and are sewn together by a needle. By corresponding choice of geometry of the pieces of leather or synthetic leather, an approximately spherical shape is provided by the sewing together. For reinforcement, fabric is usually glued on the backside of the pieces of leather or synthetic leather. A bladder of for example rubber providing the necessary airtightness is mostly inserted into the hand-sewn ball. The bladder also comprises a valve for inflating the ball. Between the bladder and the pieces of leather or synthetic leather a carcass made of fabric or of one or more circumferential threads can be arranged for reinforcement and for protection of the bladder.

[0004] For such a sewn together ball, the edges of the pieces of leather or synthetic leather are folded against the inside and thus are sewn with adjacent, i.e. adjoining pieces of leather or synthetic leather. In this way, a seam in the form of a groove is formed on the outside of the ball between adjacent pieces of leather or synthetic leather. Such a seam generally comprises a width at the top (i.e. at the side turning away from the center of the ball) of approximately 2.5 mm and a depth of approximately 2.0 mm.

[0005] It has been proven that the seams of sewn together balls affect positively to the aerodynamic properties by reducing the drag and accordingly allow further flight distances. As a cause therefore, small turbulences on the surface of the flying ball are considered. Moreover, the seams contribute positively to the gripping properties of the ball, i.e. the ball can be gripped and controlled more easily.

[0006] As the ball has a three-dimensional shape it can, however, not be sewn by a machine but has to be sewn by hand. The disadvantage is that such hand-sewn balls are subject to big fluctuations in production, which on the one hand can affect the quality and on the other hand imply variations in weight, size, spherical shape, flight and gripping properties. Another disadvantage of hand-sewn balls is the considerable time according to their manufacturing.

[0007] These disadvantages are partly overcome of laminated balls as the panels have not to be sewn by hand for these balls. The usual fluctuations in production for hand-sewn balls are thus found for balls to a lesser extent. Moreover, a laminated ball may at least partly be manufactured by corresponding machines. As a result and by the elimination of sewing by hand, laminated balls can essentially be manufactured more quickly.

[0008] However, laminated balls have worse flight and gripping properties as the groove between the different panels comprises a lower depth (usually approximately 1 mm). Furthermore, there are no or at best limited possibilities for conventional manufacturing methods of laminated balls to influence the geometry (i.e. e.g. depth, width, cross-sectional profile, etc.) and the surface properties (i.e. e.g. static friction, haptics, roughness, etc.) of this groove.

[0009] US 6,398,894 B1 shows a method of manufacturing a basketball which comprises among other things the following steps of: (a) supplying a sheet of rubber material; (b) folding, compressing and cutting the rubber material to make the rubber material into a bladder; (c) mounting a valve in the bladder; (d) inflating the bladder with air and curing the bladder; wrapping at least one thread on the inflated bladder; (f) gluing the rubber arches on the surface of the lagged layer; (g) making a groove at each junction between adjacent rubber sheets; (h) bonding a thinner and narrower strip than the rubber sheets at each junction of adjacent rubber sheets; (i) heating and curing the relatively large multiple rubber sheets together with the strips in a mold having multiple protruding ribs defined therein to make a basketball, whereby the basketball possesses multiple, relatively concave depressions having two slanting walls defined therein.

[0010] US 3,887,416 relates to a method of manufacturing a soccer ball covered with leather. The soccer ball is made by taking a bladder that has been wound with nylon cord and is covered with a layer of rubber, all of which is conventional, and covering it with several rubber segments, including strips at the seams, built up areas adjacent to the seams and a shaped element at each end.

[0011] US 5,541,662 relates to a sports ball and a corresponding method of manufacturing. An inflatable tube is inserted into a top layer formed by a thin rubber pocket manufactured from a material which does not allow that a solution of a bonding agent penetrates through the top layer and an inorganic lubricant arranged between the tube and the top layer.

[0012] EP 1 080 745 B2 relates to a laminated ball with a bladder arranged thereon a plurality of pieces of leather, wherein the pieces of leather are bonded together at the discontinuities. The pieces of leather are directly bonded together so that there are no gaps between the pieces of leather when the applying of adjacent pieces of leather onto the bladder.

[0013] US 8,574,104 relates to an inflatable sports ball structure and a manufacturing method thereof. The inflatable sports ball structure comprises an inner bladder,

a reinforced carcass, and an exterior material layer. The reinforced carcass covers the surface of the inner bladder, and has a thread wound layer. Part of the thread wound layer is embedded in the reinforced carcass and provides a constricting force towards the inner bladder, and a small remaining part of the thread wound layer may be exposed on the outer surface of the reinforced carcass.

[0014] The primary object of the present invention is therefore to provide a ball, in particular a soccer ball, which on the one hand is manufactured relatively quickly, easily and cost-effectively and on the other hand comprises very good flight and gripping properties approaching those of a hand-sewn ball, but without the usual quality fluctuations for hand-sewn balls. In addition, the flight and gripping properties of the ball should be adjustable individually.

3. Summary of the invention

[0015] According to a first aspect of the present invention, the above mentioned problem is solved by a ball, in particular a soccer ball, comprising (a.) a shell with a plurality of panels on the outside of the shell, wherein (b.) the panels are arranged in such a way that there is at least one gap between at least two adjacent panels, and wherein (c.) the at least one gap is at least partly filled with a filling material.

[0016] According to the invention, the ball thus comprises hence partly at least one gap between two panels. A gap according to the present invention is understood as the panels do not touch in the area of the gap and a free space is formed between the respective panels. If the gap would not be filled with a filling material according to the invention, the shell on which the panels are arranged would be visible through the gap, wherein the panels are arranged onto. However according to the invention, it cannot be excluded that two panels form a gap in one area and touch each other in another area.

[0017] The ball according to the present invention may be manufactured relatively quickly, easily and cost-effectively as the panels are, for instance, glued on an appropriate shell (a bladder or a bladder reinforced with a carcass). This can also be done automatically by means of an appropriate machine. At the same time, a gap is formed between at least two panels which is filled with filling material. Thus, the filled gap imitates a seam of a hand-sewn ball and affects positively the aerodynamic properties of the ball. The filling material is defined as to be insertable into the respective gap. Therefore, certain aerodynamic properties of the manufactured ball are affectable and determinable very specifically. A height and/or width of the respective gap is determinable individually.

[0018] On the one hand, the geometry (i.e. e.g. depth, width, cross-sectional profile, curvatures etc.) and the surface properties (i.e. e.g. static friction, haptics, roughness, etc.) of the filled gap may be selectively influenced by the quantity of the filling material and on the other hand by the quality of the filling material. For example, a particularly non-slip filling material may be used to improve the gripping properties of the ball.

[0019] A depth of the filled gap is preferably at least 1 mm, preferably at least 1.5 mm, more preferably at least 2 mm. The quantity of the filling material is affectable in such a way that the desirable minimum depth of the filled gap is maintained.

[0020] Moreover, the gap of the ball according to the present invention may be filled automatically by means of a machine to reduce the fluctuations in production (and therefore the fluctuations regarding aerodynamics and haptics) between different balls to a minimum. Unlike to hand-sewn balls, the "seam" (i.e. the filled gap) always comprises therefore the same cross section for any ball.

[0021] In contrast to conventional laminated balls, on the one hand the fluctuations in production are further reduced and on the other hand the geometry and surface quality of the "seam" may be set specifically in order to obtain still better flight and gripping properties. For example, a much wider "seam" may be obtained than it is possible for conventional laminated balls where the adjacent panels contact each other.

[0022] The filling material fills the gap in such a way that the outside of the shell is completely covered inside the gap. Thus, the underlying shell may be protected and a penetration of water is prevented. Unlike to a hand-sewn ball, a ball according to the present invention does not soak up with water.

[0023] The filling material may be a cured filling material being liquid before the curing. Liquid filling material may be processed easily and fills the gap very well as it fits to the form of the gap and flows into it so to speak. As a result, the ball is getting especially waterproof.

[0024] The filling material may comprise polyurethane or silicone. These materials are easy to process, comprise advantageous surface properties, in particular a high static friction, and provide a high level of waterproofness. In particular the material properties of polyurethane, for instance the viscosity, are adjustable particularly well. Polyurethane comprises also a high affinity to the surrounding material, in particular to the material of the panels and of the shell. Alternatively, other materials can also be used as filling material, for instance resin systems.

[0025] The filling material may comprise at least one lighting element. The ball is thus clearly visible for low-light conditions (e.g. in the twilight). Furthermore, an individualization of the manufactured ball may be achieved by a certain color selection of the lighting elements. For example, the lighting elements may thus be chosen in certain club colors. As lighting elements, LEDs or Micro-LEDs, respectively, or OLEDs may be for example embedded into the filling material. The filling material may further be a phosphorescent or chemiluminescent material lighting particularly in the dark. A business model may also be that different balls with different embedded light-

ing elements may be for sale. Hence, it is possible for customers to purchase lighting balls in certain colors.

[0026] A display, from which information may be read, may further be embedded into the filling material. For example, such information may be indication regarding measured shooting speeds, impact forces, flying heights or playing times. Sensors for measuring of such indication may be arranged in the inside of the ball. Alternatively, it is conceivable that information can be inputted by a display arranged in the filling material, for instance by a touch-screen.

[0027] The filling material may also generally be formed as a display. Hence, it is possible that the filling material changes its color depending on the measured information. Thus, it is conceivable that the filling material lights in different colors depending on measured shooting speeds or shootings forces. Thus, the filling material may light in a first color for a first shooting force rang, in a second color for a second shooting force range and in a third color for a third shooting force range.

[0028] The filling material may comprise at least one electronic element. For example, the electronic element may be a RFID or NFC tag by which information can be read about the ball.

[0029] The filling material may fill the cross-sectional area of the gap about 50% or more. In this way the gap is well closed and protected against penetrating water. On the other hand, the not filled part of the cross section of the gap is still deep enough in order to achieve good flight and gripping properties.

[0030] It is an advantage, if the gap is filled with filling material in such a way that the filling material extends into an area between chamfered surfaces of the panels. The height of the filling material is preferably higher than the height of lateral edges of the panels and lower than the total height of the panels. Each of the chamfered surfaces extends between the lateral edges of the panels and the outer surfaces of the panels. It is particularly advantageous if the height of the filling material is only slightly higher than the height of the lateral edges of the panels. Instead of chamfered, the surfaces may also comprise a convex or concave shape.

[0031] The height of the filling material is preferably constant along a longitudinal axis of the gap being parallel to the surface of the shell.

[0032] At least one panel of the plurality of panels may comprise a pseudo seam extending over at least a part of an outer surface of the panel. A pseudo seam is a groove on a panel giving the appearance of to be a joint of two panels. Pseudo seams may influence positively the aerodynamics and haptics of the ball by an appropriate choice of their depth.

[0033] The at least one pseudo seam may be filled with the filling material. In this way, there is no identifiable difference from the outside between the gap and the pseudo seam which is advantageously for the look, aerodynamics and haptics of the ball.

[0034] The mentioned minimum depth of at least 1 mm, preferably at least 1.5 mm, more preferably 2 mm applies to both the filled gap and the at least one pseudo seam.

[0035] The shell may be a bladder or a carcass arranged onto a bladder. A bladder provides for the necessary airtightness of the ball and a carcass stabilizes the bladder and protects it against external shocks.

[0036] The present invention also relates to a method of manufacturing a ball, in particular a soccer ball, comprising the steps of (a.) providing a shell; (b.) providing a plurality of panels; (c.) arranging the plurality of panels on the shell so that there is at least one gap between at least two adjacent panels; and (d.) filling at least partly the at least one gap with a filling material.

[0037] According to the invention, at least two panels are arranged in such a way that there is a gap between them. A gap according to the present invention is understood that the panels do not touch in the area of the gap and a free space is formed between the respective panels. If the gap would not be filled with a filling material according to the invention, the shell on which the panels are arranged would be visible through the gap. However according to the invention, it cannot be excluded that two panels form a gap in one area and touch each other in another area.

[0038] The method according to the present invention enables a relatively quick, easy and cost-effective manufacture of the ball where the panels are, for instance, glued on an appropriate shell (a bladder or a bladder reinforced with a carcass). This can also be done automatically by means of an appropriate machine. At the same time, a gap is formed between at least two panels which is filled with filling material. Thus, the filled gap imitates a seam of a hand-sewn ball and influences positively the aerodynamic properties of the ball.

[0039] The geometry (i.e. e.g. depth, width, cross-sectional profile, curvatures etc.) and the surface properties (i.e. e.g. static friction, haptics, roughness, etc.) of the filled gap may be selectively influenced on the one hand by the quantity of the filling material and on the other hand by the quality of the filling material. For example, a particularly non-slip filling material may be used to improve the gripping properties of the ball.

[0040] Moreover, the method according to the present invention enables the automatic filling of the gap by means of a machine to reduce the fluctuations in production (and therefore the fluctuations regarding aerodynamics and haptics) between different balls to a minimum. Unlike to hand-sewn balls, the "seam" always comprises (i.e. the filled gap) therefore the same cross section for any ball. Moreover, the gaps may be created in a defined way. A filling of the gaps with filling material may also be achieved selectively and individually.

[0041] In contrast to conventional manufacturing methods of laminated balls, on the one hand the fluctuations in production are further reduced and on the other hand geometry and surface quality of the "seam" may be set specifically in order to obtain still better flight and gripping properties. For example, a much wider "seam" may be

obtained than it is possible for conventional laminated balls where the adjacent panels contact each other.

[0042] The step of filling may be carried out in such a way that the filling material fills the gap in such a way that the outside of the shell is completely covered inside the gap. Thus, the underlying shell may be protected and a penetration of water is prevented. Unlike to a hand-sewn ball, a ball according to the present invention does not soak up with water.

[0043] The filling material may be liquid and the method may further comprise the step of curing the liquid filling material. A liquid filling material may be processed easily and fills the gap very well as it fits to the form of the gap and flows into it so to speak. As a result, the ball is getting especially waterproof.

[0044] The filling material may be applied from the outside in order to fill the at least one gap. For example, a robot may be here used which enables an especially precise filling of the gap.

[0045] The filling material may be applied by a three-dimensional application technique. A three-dimensional application technique has to be understood as a method wherein an application apparatus moves in space around a workpiece, in this case a ball. Alternatively, it is also possible that the ball is moved around a fixed application apparatus.

[0046] The method may further comprise the step of forming at least one pseudo seam onto at least one panel which extends at least over a part of one outer surface of the panel. A pseudo seam is a groove on a panel gives the appearance to be a joint of two panels. Pseudo seams may influence positively the aerodynamics and haptics of the ball for an appropriate choice of their depth and arrangement.

[0047] The method may further comprise the step of filling the at least one pseudo seam may be filled with the filling material. In this way, there is no identifiable difference from the outside between the gap and the pseudo seam which is advantageous for the look, aerodynamics and haptics of the ball.

[0048] The step of filling the at least one gap with a filling material may be arranged in such a way that the filling material enters from the outside of the shell into the gap. For example, a layer of the filling material may initially applied onto the ball and the panels may be then pressed onto the ball (e.g. in a mold) so that the filling material enters into the gap from below (i.e. from the center of the ball) and fills it.

[0049] The method may further comprise the step of arranging the plurality of panels in a mold. The use of molds allows to exercise a uniform pressure for pressing the panels against the shell and to reduce fluctuations in production.

[0050] The method may further comprise the step of supplying the panels to the shell by means of the mold so that the at least one gap is formed between the at least two adjacent panels and gaps are formed between the panels and the shell. The mold may comprise for this respective recesses to insert the panels. The recesses are distanced in such a way that the panels form the gap when being applied to the shell. In this way the width of the gap may be adjustable very precisely and fluctuations in production may be reduced.

[0051] The method may further comprise the step of injecting the filling material into the gaps or slits between the panels and the shell. The filling material may bond both adjacent panels with each other as well as the panels with the shell. Additional adhesives may be dispensed with.

[0052] The method may further comprise the steps of: arranging the plurality of panels on the shell by a robot arm and arranging the shell with the plurality of panels in a mold. Thereby, the robot arm may position very exactly and precisely the panels onto the shell before they are pressed by the mold to the shell at high pressure.

[0053] The method may further comprise the step of rotating the mold so that the filling material is essentially (i.e. within unavoidable fluctuations in production) uniformly distributed in the at least one gap. In this way, a distribution of the filling material in the gap results as uniformly as possible.

[0054] The filling material may comprise polyurethane or silicone. These materials are easy to process, comprise advantageous surface properties, in particular a high static friction, and provide a high level of waterproofness.

[0055] The shell may be a bladder or a carcass arranged onto a bladder. A bladder provides for the necessary airtightness of the ball and a carcass stabilizes the bladder and protects it against external shocks.

[0056] The step of filling the at least one gap with the filling material may comprise adjusting the filling quantity per time unit to the cross-sectional area of the gap. It is therefore guaranteed that the gap is filled uniformly as possible with the filling material. Possible fluctuations for the width of the gap are compensated.

[0057] The cross-sectional area of the gap may be determined in real time by means of an optical method. The determination of the cross-sectional area, i.e. the width of the gap in the simplest case if the thickness of the panels is assumed as to be constant, by means of optical methods is relatively simple to carry out and enables an immediate adjustment of the filling quantity per time unit.

4. Short description of the figures

[0058] In the following, aspects to the present invention with reference to the enclosed figures are explained in more detail. These figures show:

Fig. 1: shows an embodiment of a ball according to the present invention;

Fig. 2: shows a gap formed between two panels according to the present invention;

Figs. 3a - 3d: show an embodiment of a method according to the present invention for manufacturing a ball;

Fig. 4: shows an exemplary method step, wherein the filling material is applied onto the shell from the outside by means of a robot arm;

Fig. 5: a schematic cross-sectional view for explaining an alternative manufacturing method according to the present invention;

Fig. 6: shows the shell of the ball according to the present invention inserted in a mold together with panels.

5. Detailed description of preferred embodiments

[0059] In the following, embodiments and variations of the present invention are described in more detail.

[0060] Fig. 1 shows an embodiment of a ball 11 according to the present invention. The ball 11 may be in particular a soccer ball. However, the present invention is not limited to a soccer ball and may be also used for balls of other sports such as basketball, volleyball, rugby, football, tennis, etc.

[0061] The ball 11 comprises a shell with a plurality of panels on the outside of the shell. The shell is not shown in Fig. 1 as it is covered with the panels. Two of the plurality of panels from Fig. 1 are referred with the reference numerals 12a and 12b respectively. Overall, the ball 11 shown in Fig. 1 comprises six panels. In principle, a ball according to the present invention may comprise any number of panels, however at least two. In the embodiment of Fig. 1, the ball 11 also comprises more panels which are not designated by a reference numeral. As far as within the present invention the word "plurality" is used, this means "two or more".

[0062] The shell may be a bladder which is usually used for balls in order to prevent an escaping of the air from the ball. For example, a bladder may be manufactured from bowel, latex or rubber. The bladder may be reinforced with a carcass to prevent a damage of the bladder through external shocks. In this case, the bladder forms together with the carcass the shell. The bladder may have a valve (not shown in the figures) to enable an inflating of the ball 11.

[0063] For example, the panels 12a, 12b may be manufactured from leather, synthetic leather or plastic. The panels may be glued on the shell, welded, sewn or bonded with the shell by means of another appropriate bonding method. For example, it is possible that the shell is completely coated with an adhesive or is completely immersed into an adhesive. Afterwards, the panels 12a, 12b may be put on the shell. Alternatively, it is also possible that the panels 12a, 12b are coated with an adhesive on one side and then put on the shell with the adhesive side. For example, the adhesive may be a melt adhesive exposed for instance to infrared radiation for activation. The panels 12a, 12b are arranged in such a way that there is at least one gap between them. In the embodiment of Fig. 1, there is a gap between the panel 12a and the panel 12b. A gap according to the present invention is understood that the panels do not touch in the area of the gap and a free space is formed between the respective panels. If the gap would not be filled with a filling material according to the invention, the shell on which the panels 12a and 12b are arranged would be visible through the gap. However according to the invention, it cannot be excluded that two panels form a gap in one area and touch each other in another area.

[0064] In the embodiment of Fig. 1, it is also shown that the at least one gap is filled with a filling material 13. In the embodiment of Fig. 1, the filling material 13 fills the gap in such a way that the outside of the shell is completely covered inside the gap which is why the shell is not visible in Fig. 1. The filling material 13 may be a cured filling material being liquid before the curing. For example, the filling material 13 may comprise polyurethane or silicone.

[0065] In an embodiment of the invention (not shown in Fig. 1), the filling material 13 may comprise a lighting element. For example, this may be a LED, OLED, Micro-LED or a phosphorescent or chemiluminescent material, in particular a material lighting in the dark. In principle, it is further possible to position a light source in the center of the ball and to arrange fiber optics in the filling material 13 which lead the light from the center of the ball to the outside.

[0066] The filling material 13 may comprise at least one electronic element (not shown in Fig. 1). For example, the electronic element may be a RFID or NFC tag. The RFID or NFC tag may be read out by an appropriate receiver. For example, information about the ball (e.g. model or serial number, a certificate of authenticity or certificate of origin, etc.) may be stored in the RFID or NFC tag.

[0067] In the embodiment of Fig. 1, the filling material 13 fills completely the at least one gap, i.e. the underlying shell of the ball 11 is not visible. However, in another embodiment, the filling material 13 could not completely fill the gap, i.e. the underlying shell is at least visible in a potential area of the gap.

[0068] At least one panel of the plurality of panels may comprise a pseudo seam (not shown in Fig. 1) which extends over at least a part of an outer surface of the panel. A pseudo seam is a groove-shaped recess on the outer surface of a panel 12a, 12b. Unlike to a seam of a hand-sewn ball, a pseudo seam is thus not formed by the sewing of two adjacent panels, but is formed on a panel as a groove in order to imitate the seams of hand-sewn balls. The pseudo seam may be filled with the filling material 13 in the context of the present invention. The filling material 13 may thereby almost completely fill the

pseudo seam.

[0069] Fig. 2 shows a gap 21 formed between two panels 12a and 12b in the context of the present invention and a pseudo seam 22 in cross section. In Fig. 2, it is also shown that the pseudo seam 22 as well as the gap 21 is filled with filling material 13. In the example of Fig. 2, the pseudo seam 22 and the gap 21 are filled with filling material until the same height H_F so that a minimum recess V_M is given. The minimum recess V_M is preferably at least 1.5 mm in order to guaranty the optimum flight properties of the ball.

[0070] Viewed from the outside the difference between the gap 21 and the pseudo seam 22 does advantageously not show. Thus, the ball 11 may be structured in almost arbitrary ways by means of pseudo seams. However, it is also conceivable that the height H_F of the filling material 13 in the gap 21 and the pseudo seam 22 and thus also the minimum recess V_M are different so that the gap 21 and the pseudo seam 22 may be optically distinguished viewed from the outside.

[0071] As can be seen from Fig. 2, the panels 12a, 12b comprise lateral edges of the panels 23a, 23b passing in parallel to each other as well as outer surfaces of the panels 24a, 24b. A chamfered bar 25a, 25b connects each of the lateral edges of the panels 23a, 23b with the outer surfaces 24a, 24b. By this type of forming in the shown embodiment a funnel-shaped or Y-shaped contour of the cross section of the gap 21 is pretended. It is an advantage if the gap as shown in Fig. 2 is filled with filling material 13 in such a way that the filling material 13 extends into an area between the chamfered surfaces 25a, 25b. The height H_F of the filling material 13 is thereby higher than the height H_{PS} of the lateral edges of the panels 23a, 23b and lower that the total height H_{PG} of the panels 12a, 12b. It is particularly advantageous if the height H_F of the filling material 13 is only slightly higher than the height H_{PS} of the lateral edges of the panels 23a, 23b. It is further conceivable that a surface 26 of the filling material 13 comprises a convex or concave shape as indicated in Fig. 2 by dashed lines. By a convex or concave shape the flight properties of the manufactured ball may be influenced selectively. In this way, the haptic or optical properties are further influenceable.

[0072] A surface 26 of the filling material 13 in the pseudo seam 22 may also comprise a convex or concave curvature.

[0073] By the method according to the invention for manufacturing a ball, as described below, the height H_F of the filling material or the minimum recess V_M is adjustable individually depending on the desired flight properties.

[0074] An embodiment of a method according to the invention for manufacturing a ball, in particular a soccer ball, is explained in the following by means of the figure 3a, 3b, 3c and 3d.

[0075] The method comprises as first step providing a shell 31. This may be, as already explained, a bladder or a carcass reinforced with a bladder. In a next step, a plurality of panels 12a, 12b, 12c, 12d are provided. For example, the panels 12a, 12b, 12c, 12d may be punched out from respective leather, synthetic leather or plastic sheeting. It is also conceivable that the panels 12a, 12b, 12c, 12d are manufactured using an injection molding process, deep-drawing process or by means of a 3D-printer.

[0076] In a further step the plurality of panels 12a, 12b, 12c, 12d is arranged on the shell so that there is at least one gap between at least two adjacent panels 12a, 12b, 12c, 12d. In Fig. 3a, two panels 12a and 12b are arranged on the shell 31. In Fig. 3b, a further panel 12c has been arranged on the shell 31 and finally in Fig. 3c a fourth panel 12d has been arranged on the shell 31 so that the shell 31 is almost completely covered except for the intentionally remaining gaps 21 between the panels. The gap is provided in such a way that adjacent panels 12a, 12b, 12c, 12d forming the gap do not touch. As explained above in the context of Fig. 1, the panels may for instance be glued on the shell.

[0077] The method comprises finally the step of filling the at least one gap 21 with a filling material 13 as shown in Fig. 3d. The step of filling may be carried out in such a way that the filling material 13 fills the gap in such a way that the outside of the shell 31 is completely covered inside the gap 21.

[0078] As shown in figs. 3a, 3b, 3c and 3d, the method also comprises the step of forming a pseudo seam 22 on the panels 12a, 12b, 12c and 12d which extends over at least a part of an outer surface of the panels 12a, 12b, 12c and 12d. Instead of all panels, a pseudo seam 22 may also be formed on a subset of panels, e.g. on one panel. The pseudo seam 22 may be cut or milled in the respective panel 12a, 12b, 12c, 12d. Alternatively, the pseudo seam 22 may be formed for instance in the respective panel 12a, 12b, 12c, 12d during the injection molding.

[0079] As shown in Fig. 3d, the pseudo seams 22 are filled with the filling material 13 (e.g. on polyurethane or silicone base) so that viewed from the outside it may not be optically distinguished between the gaps 21 between the respective panels 12a, 12b, 12c and 12d and the pseudo seams 22 on the respective panels 12a, 12b, 12c and 12d.

[0080] If the filling material 13 is a liquid filling material 13, the method can further comprise the step of curing the liquid filling material 13. For example, the filling material 13 may be cured by means of heat or UV light.

[0081] Fig. 4 shows an exemplarily method step, wherein the filling material 13 is applied onto the shell 31 from the outside by means of a robot arm 41 in order to fill the at least one gap 21. To this end, the robot arm 41 comprises a nozzle 42 by which liquid filling material 13 is filled into the gap 21. This method is a three-dimensional application technique. The filling material 13 thus enters from the outside of the shell 31 into the gap 21 with this manufacturing method.

[0082] The robot arm 41 may comprise a sensor (not

shown in Fig. 4) which measures the depth and the width of the gap 21 during the applying of the filling material 13. The quantity of the filling material 13 per time unit to be applied may thereby at least be adjustable to the width of the gap 21 in order to obtain a gap preferably uniformly filled with filling material 13. Alternatively, the sensor may also measure the depth of the gap 21 or measure completely the geometry of the cross section. Fluctuations in the distance of the panels 12a, 12b, 12c and 12d to each other may thus be compensated. The robot arm 41 further comprises preferably a metering device by which an ejection of the filling material 13 may be controlled selectively.

[0083] An alternative manufacturing method according to the present invention is shown in the following by means of the schematic cross-sectional view of Fig. 5 and Fig. 6. In this method, the panels 12a, 12b, 12c and 12d are inserted in a mold 51. The mold 51 is then closed so that the panels 12a, 12b, 12c and 12d are moved in direction of a centrally fixed shell 31 (a bladder or a bladder reinforced with a carcass). Alternatively, the plurality of panels 12a, 12b, 12c and 12d may be arranged on the shell 31 by for example a robot arm and the shell 31 with the panels 12a, 12b, 12c and 12d may then be arranged in the mold. For both alternatives, gaps 21 remain between the panels 12a, 12b, 12c and 12d. At the same time, slits 52 remain between the panels 12a, 12b, 12c and 12d and the shell 31. By the forming of the slits 52, it is for example not necessary that in advance the shell 31 and/or the panels 12a, 12b, 12c and 12d are coated with an adhesive.

[0084] Fig. 6 shows the shell 31 arranged in the mold 51 together with the panels 12a, 12b, 12c and 12d. The shell 31 is thereby pressurized with compressed air over an inlet 61 in order to prevent a collapse of the shell 31. At the same time, the mold 51 exerts pressure to the panels 12a, 12b, 12c and 12d from the outside. By another inlet 62 in the mold 51, liquid filling material 13 (e.g. liquid polyurethane) is filled in the gaps 21 between the panels 12a, 12b, 12c and 12d as well as in the slits between the panels 12a, 12b, 12c and 12d and the shell 31. In this alternative embodiment, both adjacent panels 12a, 12b, 12c and 12d are bonded together and each of the panels 12a, 12b, 12c and 12d are bonded together with the shell 31 by the filling material 13.

[0085] Alternatively, the gaps 21 may also be filled without any forms by foam bead applying and then cure in a heated mold. A filling by means of foam bead applying is just one example for a possible applying variant of the filling material 13 for the case that a foamed material is used as filling material 13. The applied filling material 13 may thereby comprise different bead forms.

[0086] In the alternative embodiment of the method, the panels 12a, 12b, 12c and 12d could only form bowls with a transparent outer shell and a decorative liner which are arranged in respective molds, supplied in their exactly defined position and then back foamed by means of an appropriate polyurethane and simultaneously bonded with the carcass.

[0087] As shown in Fig. 6, the mold 51 may be suspended rotatably around a vertical axis 63 and a horizontal axis 64. The method comprises then the step of rotating the mold 51 so that the filling material 13 distributes essentially uniformly (i.e. within unavoidable fluctuations in production) in the gap 21.

[0088] It is further possible to combine the method according to Fig. 5 and Fig. 6 with the method according to Fig. 4. This makes it possible that the gaps 21 between the panels 12a, 12b, 12c and 12d and/or the slits 52 between the panels 12a, 12b, 12c, 12d and the shell 31 are filled by means of the mold 51 with the filling material 13 in accordance with the method according to Fig. 5 and Fig. 6. Additionally, the injection or applying method from the outside according to Fig. 4 may be used for filling the pseudo seams with the filling material 13.

List of reference numerals

[0089]

11	ball
12a - 12d	panels
13	filling material
21	gap
22	pseudo seam
23a, 23b	lateral edges of the panels
24a, 24b	outer surfaces of the panels
25a, 25b	chamfered surfaces
26	surface of the filled filling material
31	shell
41	robot arm
42	nozzle
51	mold
52	slits
61	air inlet
62	inlet for the filling material
63	vertical axis
64	horizontal axis

[0090] In the following, further embodiments are described to facilitate the understanding of the invention:

1. Ball (11), in particular a soccer ball, comprising:

   a. a shell with a plurality of panels (12a, 12b, 12c, 12d) on the outside of the shell, wherein
   b. the panels (12a, 12b, 12c, 12d) are arranged in such a way that there is at least one gap (21) between at least two adjacent panels (12a, 12b), and wherein
   c. the at least one gap (21) is at least partly filled with a filling material (13).

2. Ball according to the preceding embodiment, wherein the gap is designed in such a way that the at least two adjacent panels do not touch in the area of the gap.

3. Ball according to one of the preceding embodiments, wherein the filling material fills the gap in such a way that the outside of the shell is completely covered inside the gap.

4. Ball according to one of the preceding embodiments, wherein the filling material is a cured filling material being liquid before the curing.

5. Ball according to one of the preceding embodiments, wherein the filling material comprises polyurethane or silicone.

6. Ball according to one of the preceding embodiments, wherein the filling material comprises at least one lighting element.

7. Ball according to one of the preceding embodiments, wherein the filling material comprises at least one electronic element.

8. Ball according to one of the preceding embodiments, wherein the filling material fills the cross-sectional area of the gap about 50% or more.

9. Ball according to one of the preceding embodiments, wherein at least one panel of the plurality of panels comprises a pseudo seam extending over at least a part of an outer surface of the panel.

10. Ball according to the preceding embodiment, wherein the at least one pseudo seam is filled with the filling material.

11. Ball according to one of the preceding embodiments, wherein the shell is a bladder or a carcass arranged onto a bladder.

12. Method of manufacturing a ball (11), in particular a soccer ball, comprising the steps of:

a. providing a shell (31);
b. providing a plurality of panels (12a, 12b, 12c, 12d);
c. arranging the plurality of panels (12a, 12b, 12c, 12d) on the shell (31) so that there is at least one gap (21) between at least two adjacent panels (12a, 12b, 12c, 12d); and
d. filling at least partly the at least one gap (21) with a filling material (13).

13. Method according to the preceding embodiment, wherein the at least two adjacent panels are arranged in such a way that the gap is designed in such a way that the at least two adjacent panels do not touch.

14. Method according the one of embodiments 12 or 13, wherein the step of filling is carried out in such a way that the filling material fills the gap in such a way that the outside of the shell is completely covered inside the gap.

15. Method according to one of embodiments 12 to 14, wherein the filling material is liquid and the method further comprises the step of curing the liquid filling material.

16. Method according to one of embodiments 12 to 15, wherein the filling material is applied from the outside in order to fill the at least one gap.

17. Method according to the preceding embodiment, wherein the filling material is applied by a three-dimensional application technique.

18. Method according to one of embodiments 12 to 17, further comprising the step of forming at least one pseudo seam onto at least one panel which extends at least over a part of one outer surface of the panel.

19. Method according to the preceding embodiment, further comprising the step of filling the at least one pseudo seam with the filling material.

20. Method according to one of embodiments 12 to 19, wherein the step of filling the at least one gap with a filling material is arranged in such a way that the filling material enters from the outside of the shell into the gap.

21. Method according to one of embodiments 12 to 20, further comprising the step of arranging the plurality of panels in a mold.

22. Method according to the preceding embodiment, further comprising the step of supplying the panels to the shell by means of the mold so that the at least one gap is formed between the at least two adjacent panels and gaps are formed between the panels and the shell.

23. Method according to the preceding embodiment, further comprising the step of injecting the filling material into the gaps between the panels and the shell.

24. Method according to one of embodiments 12 to 23, further comprising the steps of:

arranging the plurality of panels on the shell by a robot arm; and
arranging the shell with the plurality of panels in a mold.

25. Method according to one of embodiments 21 to

24, further comprising the step of rotating the mold so that the filling material is essentially uniformly distributed in the at least one gap.

26. Method according to one of embodiments 12 to 25, wherein the filling material comprises polyurethane or silicone.

27. Method according to one of embodiments 12 to 26, wherein the shell is a bladder or a carcass arranged onto a bladder.

28. Method according to one of embodiments 12 to 27, wherein the step of filling the at least one gap with the filling material comprises adjusting the filling quantity per time unit to the cross-sectional area of the gap.

29. Method according to the preceding embodiment, wherein the cross-sectional area of the gap is determined in real time by means of an optical method.

Claims

1. Ball (11), in particular a soccer ball, comprising:

a. a shell with a plurality of panels (12a, 12b, 12c, 12d) on the outside of the shell, wherein
b. the panels (12a, 12b, 12c, 12d) are arranged in such a way that there is at least one gap (21) between at least two adjacent panels (12a, 12b), and wherein
c. the at least one gap (21) is at least partly filled with a filling material (13).

2. Ball according to the preceding claim, wherein the filling material is a cured filling material being liquid before the curing.

3. Ball according to one of the preceding claims, wherein the filling material comprises polyurethane or silicone.

4. Ball according to one of the preceding claims, wherein the filling material comprises at least one lighting element or at least one electronic element.

5. Ball according to one of the preceding claims, wherein at least one panel of the plurality of panels comprises a pseudo seam extending over at least a part of an outer surface of the panel.

6. Ball according to the preceding claim, wherein the at least one pseudo seam is filled with the filling material.

7. Method of manufacturing a ball (11), in particular a soccer ball, comprising the steps of:

a. providing a shell (31);
b. providing a plurality of panels (12a, 12b, 12c, 12d);
c. arranging the plurality of panels (12a, 12b, 12c, 12d) on the shell (31) so that there is at least one gap (21) between at least two adjacent panels (12a, 12b, 12c, 12d); and
d. filling at least partly the at least one gap (21) with a filling material (13).

8. Method according to claim 7, wherein the filling material is applied from the outside in order to fill the at least one gap.

9. Method according to one of claims 7 to 8, further comprising the step of arranging the plurality of panels in a mold.

10. Method according to the preceding claim, further comprising the step of supplying the panels to the shell by means of the mold so that the at least one gap is formed between the at least two adjacent panels and gaps are formed between the panels and the shell.

11. Method according to the preceding claim, further comprising the step of injecting the filling material into the gaps between the panels and the shell.

12. Method according to one of claims 9 to 11, further comprising the step of rotating the mold so that the filling material is essentially uniformly distributed in the at least one gap.

13. Method according to one of claims 7 to 12, wherein the filling material comprises polyurethane or silicone.

14. Method according to one of claims 7 to 13, wherein the step of filling the at least one gap with the filling material comprises adjusting the filling quantity per time unit to the cross-sectional area of the gap.

15. Method according to the preceding claim, wherein the cross-sectional area of the gap is determined in real time by means of an optical method.

FIG 1

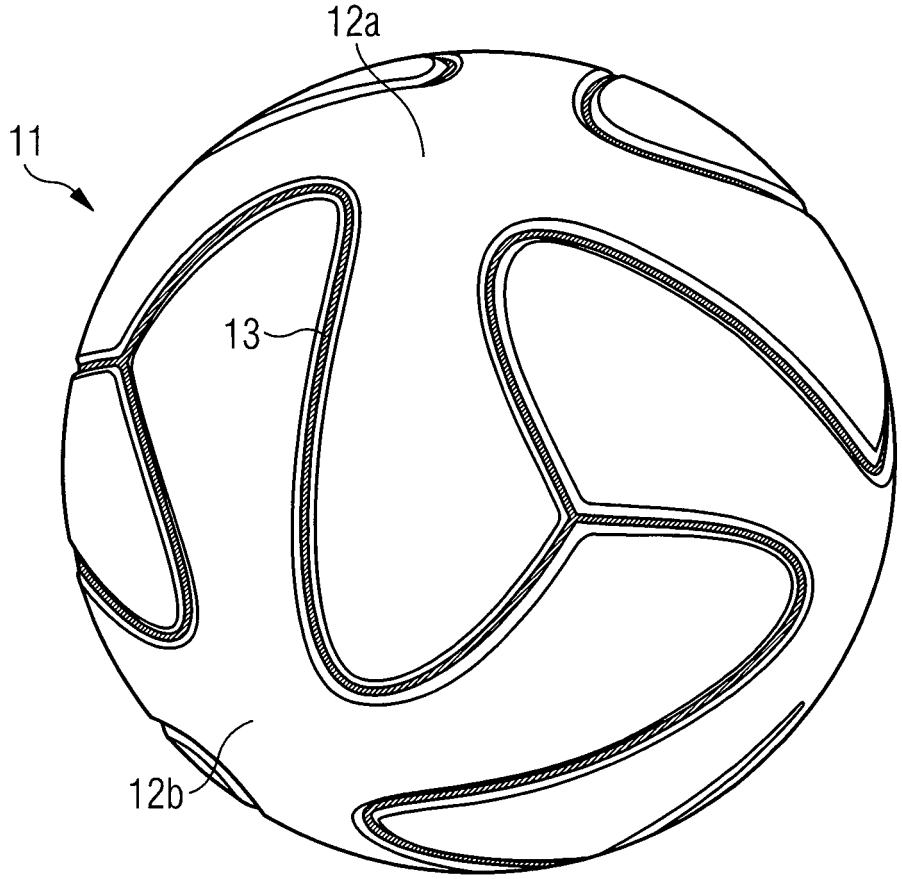

12a
11
13
12b

FIG 2

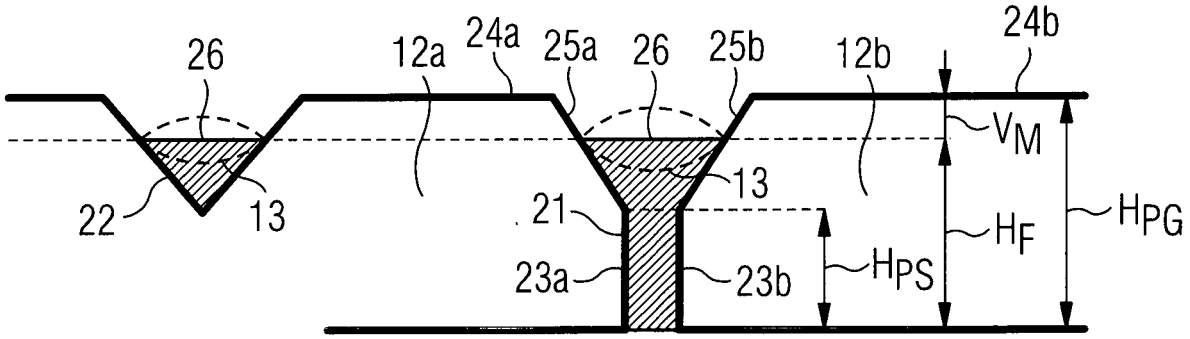

26
12a
24a
25a
26
25b
12b
24b
V_M
22
13
21
13
H_F
H_{PG}
23a
23b
H_{PS}

FIG 3a

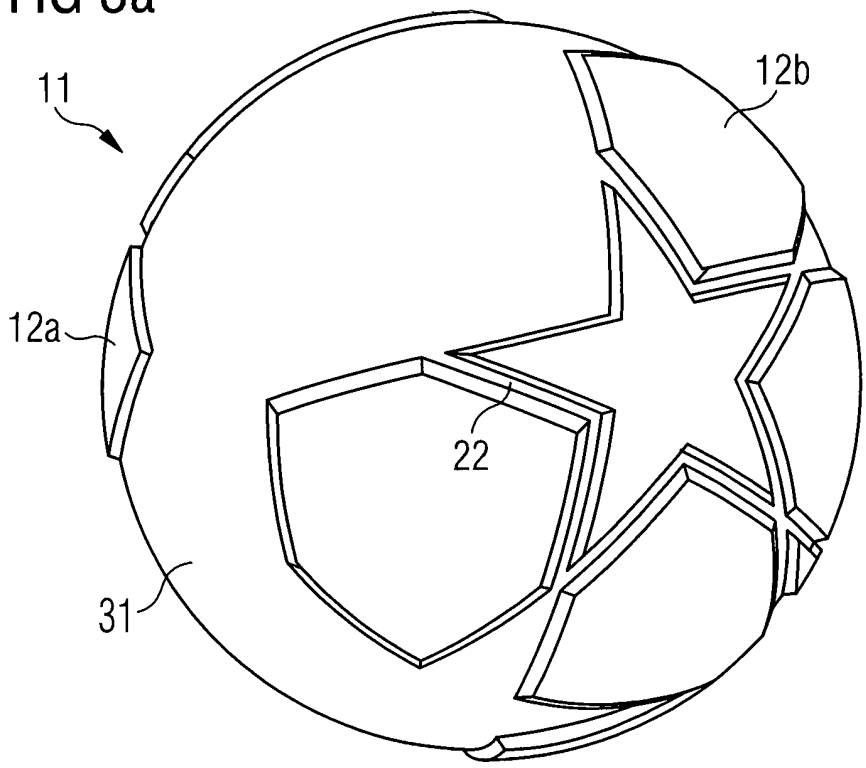


FIG 3b

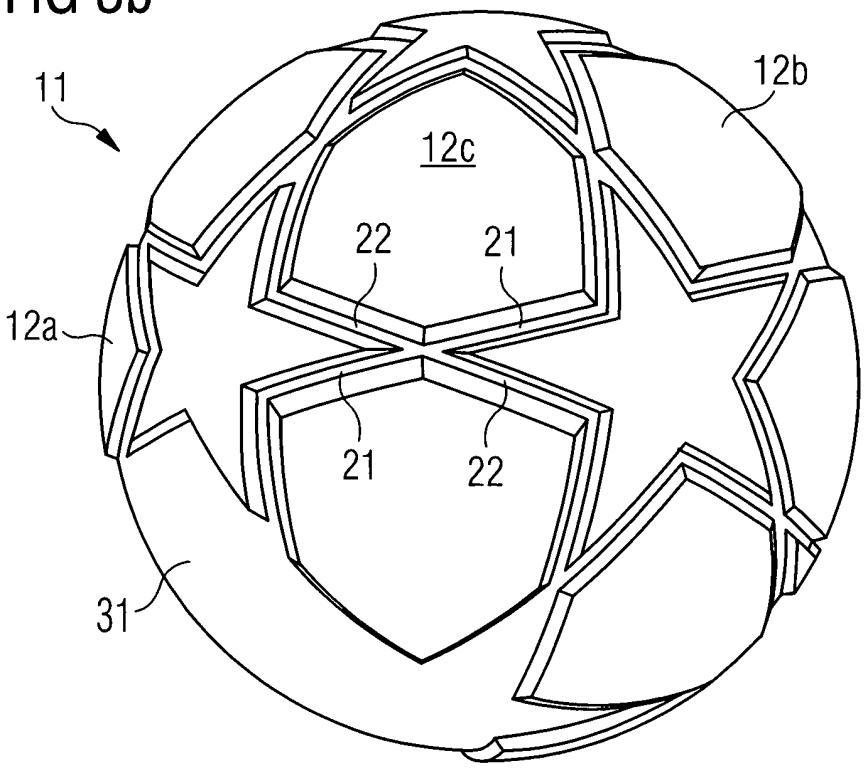


FIG 3c

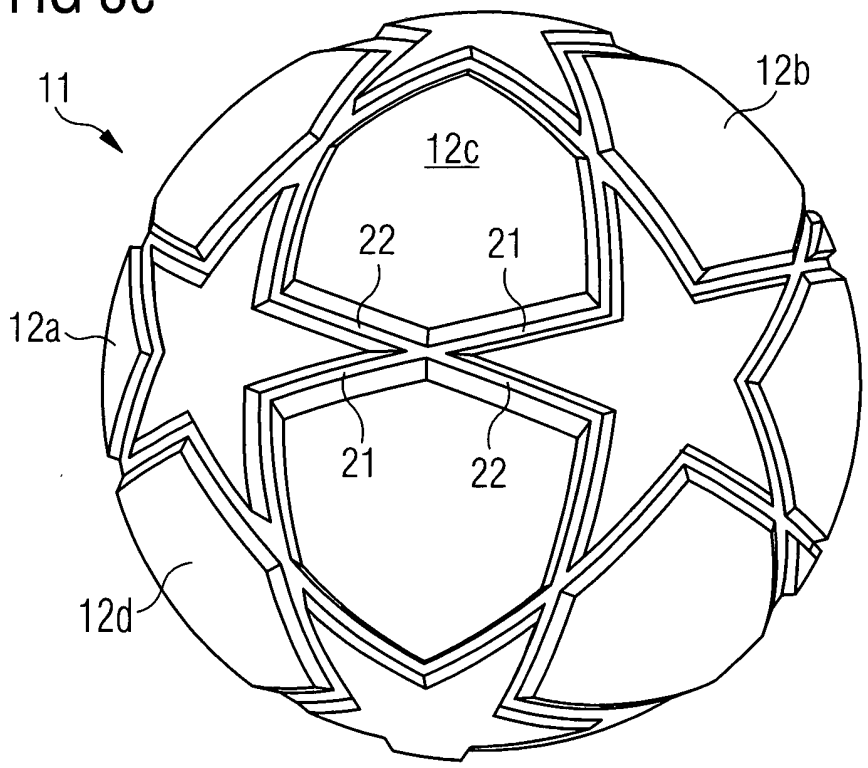


FIG 3d

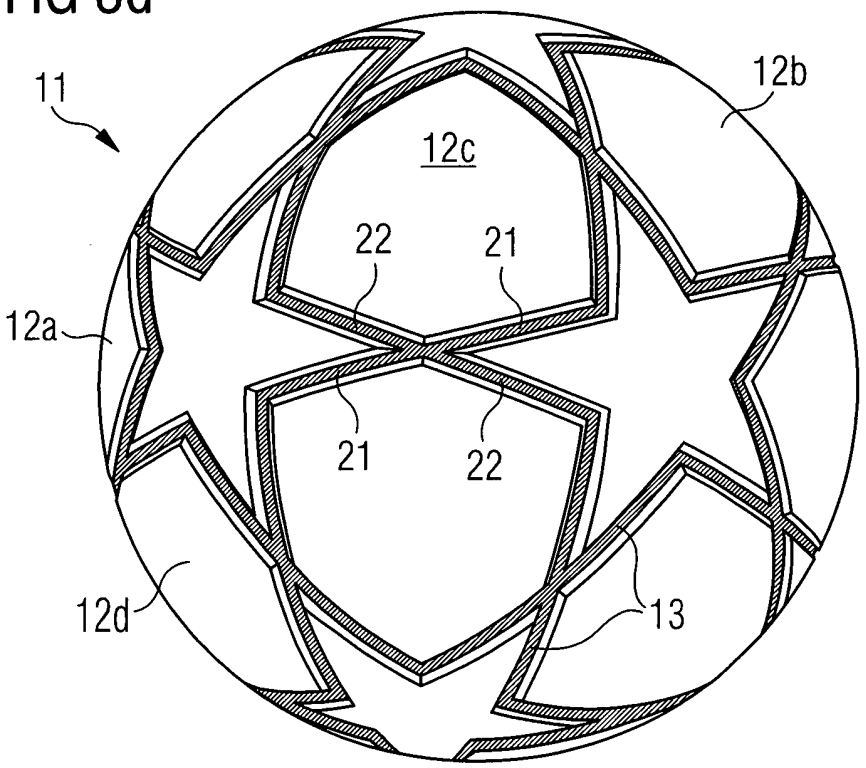


FIG 4

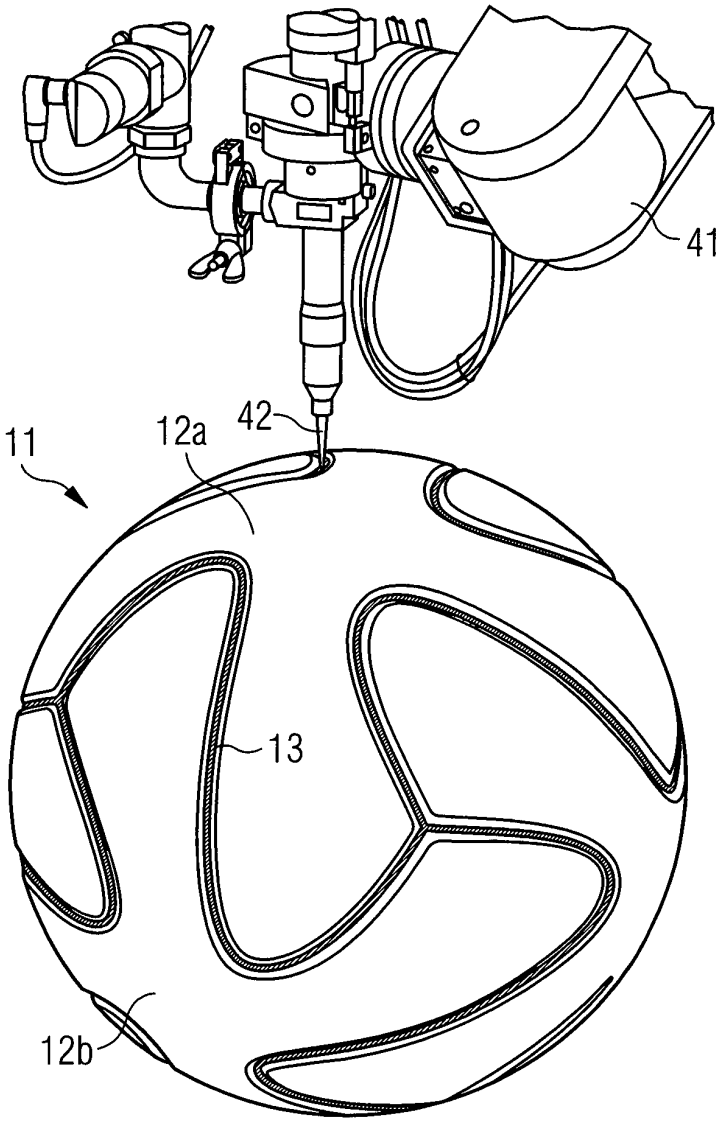


FIG 5

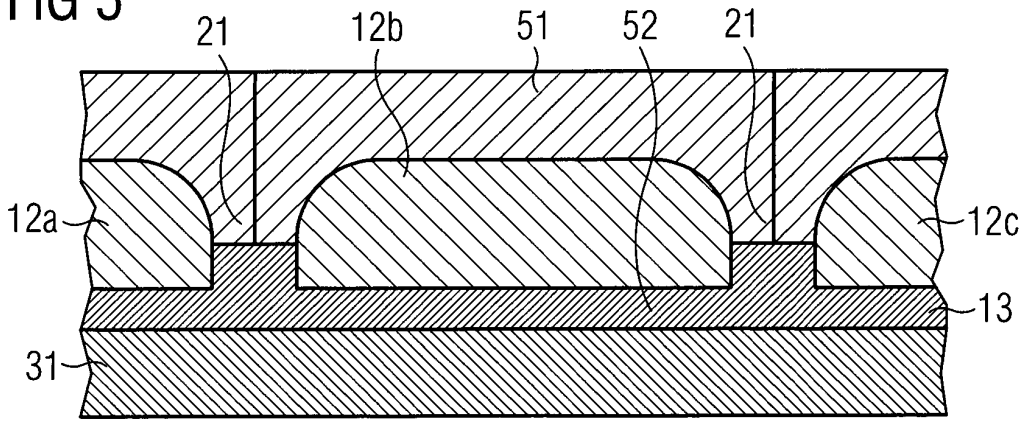
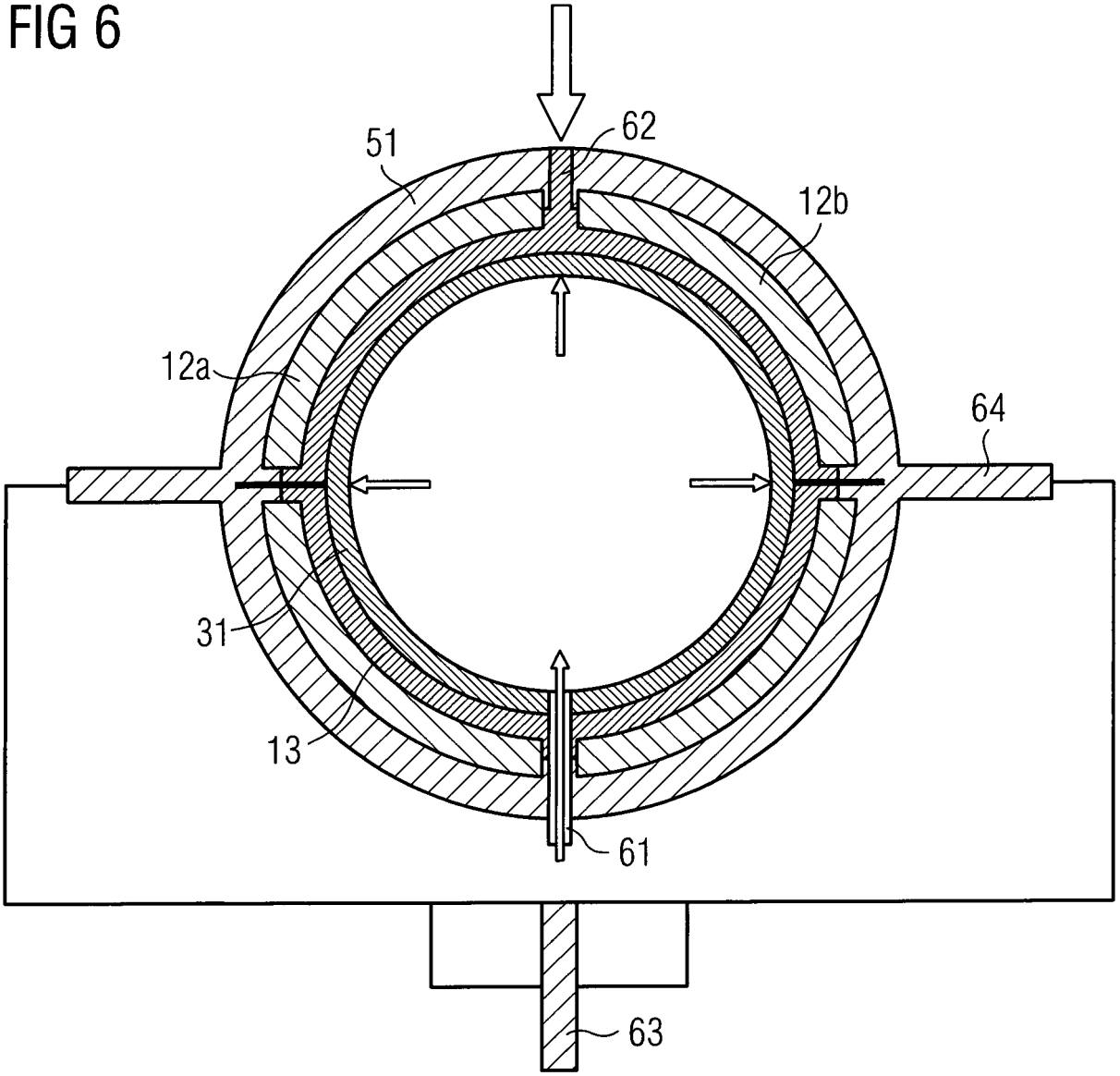


FIG 6



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EUROPEAN SEARCH REPORT

Application Number
EP 16 15 9328

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	14 July 2016	Jekabsons, Armands

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