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(54) **BALL**

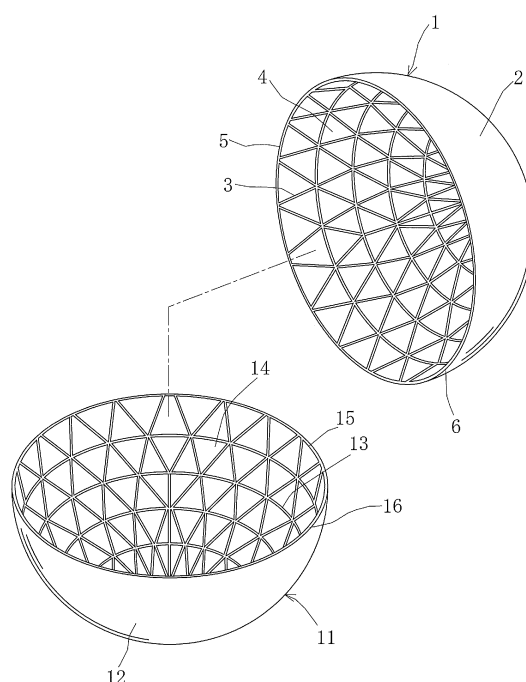
(57) [Problem]

A ball is provided which bounces even if compressed air above atmospheric pressure is not blown into the inside of the ball.

[Solution]

On inner wall surfaces of a plurality of divisional bodies 1 and 11 configured of a soft material made of resin or rubber, many recessed parts 4 and 14 are formed as being surrounded by many linear protruding parts 3 and 13 to form triangles or shapes in a geometric pattern other than triangles. With this, the protruding parts exert a function equivalent to that as a bobbin to make a ball have uniform hardness as a whole, allowing user as a ball irrespectively of attaching a skin body formed separately from the plurality of divisional bodies 1 and 11 to an outer wall surface of the ball. On the other hand, divisional end parts of the divisional bodies 1 and 11 forming circular openings or flange parts 5 and 15 provided to the divisional end parts are welded or bonded together, and do not protrude outside from the outer wall surface of the ball, thereby allowing use at ease as a ball irrespectively of attaching a skin body.

Fig.1



Description

Technical Field

[0001] The present invention relates to a hollow ball formed of a plurality of divisional bodies configured of a soft material made of resin or rubber.

Background Art

[0002] Fig. 19 and Fig. 20 depict a bladder as an air cell of a ball disclosed in PTL 1. As depicted in Fig. 19, the bladder is formed as one ball by coupling a flange part 102 of a first divisional body 101 and a flange part 104 of a second divisional part 103 together. The first divisional body 101 is provided with a valve part 105 depicted in Fig. 20. Therefore, a needle such as an injection needle is inserted into the valve part 105 from outside the bladder, a tip of an air pump is connected to that needle, and the air pump allows air to be blown into the inside of the bladder and to be removed from the inside of the bladder.

[0003] As depicted in Fig. 19, the first divisional body 101 is made of thermoplastic resin, and has a form including a dome-shaped space inside from a circular opening. On an inner wall surface of the first divisional body 101, linearly-shaped protruding parts 106 extend longitudinally and laterally, and protrude to a space side from the inner wall surface of the first divisional body 101. With the protruding parts 106 crossing each other longitudinally and laterally, many recessed parts 107 each having a rectangular plane of orthogonal projection are formed on the inner wall surface of the first divisional body 101 as being surrounded by the protruding parts 106. The flange part 102 of the first divisional body 101 protrudes from the opening of the first divisional body 101 to outside in a diameter direction of the first divisional body 101, and has an annular shape which circles the opening of the first divisional body 101 once. The flange part 102 is provided with a positioning part 108.

[0004] The second divisional body 103 is made of thermoplastic resin, and has a form including a dome-shaped space inside from a circular opening. On an inner wall surface of the second divisional body 103, linearly-shaped protruding parts 109 extend longitudinally and laterally, and protrude to a space side from the inner wall surface of the first divisional body 101. With the protruding parts 109 crossing each other longitudinally and laterally, many recessed parts 110 each having a rectangular plane of orthogonal projection are formed on the inner wall surface of the first divisional body 101 as being surrounded by the protruding parts 109. The flange part 104 of the second divisional body 103 protrudes from the opening of the second divisional body 103 to outside in a diameter direction of the second divisional body 103, and has an annular shape which circles the opening of the second divisional body 103 once. The flange part 104 is provided with a positioning part 111.

[0005] And, with the opening of the first divisional body 101 and the opening of the second divisional body 103 facing each other, the positioning parts 108 and 111 fitting together, and the flange parts 102 and 104 combined together to be welded by heat, the first divisional body 101 and the second divisional body 103 are made as one sphere to configure the bladder depicted in Fig. 20.

[0006] However, as depicted in Fig. 19, in the bladder formed of the first and second divisional bodies 101 and 103, since the flange parts 102 and 104 have a structure protruding from the outer wall surface of the bladder to outside, the bladder cannot be used as a ball unless a skin body not depicted is attached to the bladder. Moreover, when a skin body is attached to the bladder, it is required to evade the flange parts 102 and 104 or provide the skin body with a foam layer for absorbing steps of flange parts 102 and 104.

Citation List

Patent Literature

[0007] PTL 1: United States Patent Publication No. 2013/0053193

Summary of Invention

Technical Problem

[0008] The present invention has been made in view of the background art described above, and has an object of making a ball have uniform hardness as a whole and allowing use as a ball irrespectively of attaching a skin body formed separately from a first divisional body and a second divisional body to an outer wall surface of the ball.

Solution to Problem

[0009] The present invention is directed to a hollow ball formed of a plurality of divisional bodies configured of a soft material made of resin or rubber, wherein each divisional body has an inner wall surface provided with protruding parts or recessed parts and divisional end parts of the respective divisional bodies are configured not to protrude outside from an outer wall surface of the ball when welded or bonded together so as to configure the hollow ball.

Advantageous Effects of Invention

[0010] Since the present invention has the structure in which the protruding parts or the recessed parts are provided on the inner wall surface of the hollow ball formed of the plurality of divisional bodies, the protruding parts exert a function as a bobbin to make the ball have uniform hardness as a whole, allowing use as a ball irrespectively of attaching a skin body formed separately from the plu-

rality of divisional bodies to the outer wall surface of the ball. That is, with the protruding parts or the recessed parts provided to the inner wall surface of the hollow ball, it was possible to develop a ball which bounces even if compressed air above atmospheric pressure is not blown into the inside of the ball. Also, since the divisional end parts of the respective divisional bodies are configured not to protrude outside from the outer wall surface of the ball when welded or bonded together so as to configure a hollow ball, when a skin body formed separately from the plurality of divisional bodies is affixed to the outer wall surface of the ball, the skin body can be affixed, without a special process, across a coupling line where the divisional end parts of the respective divisional bodies are welded or bonded together. In the present invention, if the divisional end part of the divisional body is provided with a flange part as protruding from the divisional end part of the divisional body to a center part side and the flange parts are configured not to protrude outside the outer wall surface of the ball when welded or bonded together so as to configure the hollow ball, the coupling strength of the divisional bodies can be maintained even if the thickness of the dome-shaped wall body parts of the divisional bodies is made thinner. Also, in the present invention, if the ball is used as a bladder and a skin body is provided on an outer wall surface of the bladder, the skin body can be changed to share the bladder for use.

Brief Description of Drawings

[0011]

Fig. 1 is a perspective view depicting first and second divisional bodies as being exploded, according to a first embodiment.

Fig. 2 is a perspective view depicting an outer appearance of a truncated icosahedron for describing how to provide protruding parts according to the first embodiment.

Fig. 3 is an end face view depicting the first and second divisional bodies according to the first embodiment.

Fig. 4 is a perspective view depicting an outer appearance of a ball according to the first embodiment.

Fig. 5 is an end face view depicting first and second divisional bodies according to a second embodiment.

Fig. 6 is a developed view depicting the inside of a part of a divisional body according to a third embodiment.

Fig. 7 is a sectional view as being cut abeam at a center part of Fig. 6.

Fig. 8 is a sectional view of a divisional body according to a fourth embodiment corresponding to Fig. 7

Fig. 9 is a developed view depicting the inside of a part of a divisional body according to a fifth embodiment.

Fig. 10 is a perspective view depicting the inside of

a part of a divisional body according to a sixth embodiment.

Fig. 11 is a perspective view depicting the inside of a part of a divisional body according to a seventh embodiment.

Fig. 12 is a perspective view depicting first and second divisional bodies as being exploded, according to an eighth embodiment

Fig. 13 is a perspective view depicting first and second divisional bodies as being exploded, according to a ninth embodiment.

Fig. 14 is a perspective view depicting first to third divisional bodies as being exploded, according to a tenth embodiment

Fig. 15 is a developed view depicting first to fourth divisional bodies configuring a hollow ball according to an eleventh embodiment.

Fig. 16 is a perspective view depicting a ball as being exploded, according to a twelfth embodiment.

Fig. 17 is a sectional view depicting a structure with a skin body affixed to a bladder according to a thirteenth embodiment.

Fig. 18 is a sectional view depicting a part of a bladder and a skin body coupled together according to a fourteenth embodiment.

Fig. 19 is a perspective view depicting the inside of conventional first and second divisional bodies.

Fig. 20 is a perspective view depicting an outer appearance of a bladder formed of conventional first and second divisional bodies.

Description of Embodiments

[0012] With reference to Fig. 1, the structure inside first and second divisional bodies 1 and 11 illustrated as a plurality of divisional bodies according to a first embodiment is described. By being combined together, the plurality of divisional bodies configure one hollow ball. Therefore, by being combined together, the first and second divisional bodies 1 and 11 configure one hollow ball. When the first and second divisional bodies 1 and 11 are configured of thermoplastic resin, the first and second divisional bodies 1 and 11 can be welded or coupled with a bonding agent. On the other hand, when the first and second divisional bodies 1 and 11 are configured of thermosetting resin or rubber, the first and second divisional bodies 1 and 11 can be coupled with a bonding agent.

[0013] The first divisional body 1 is configured in a sagittal shape including a space recessed inside from a circular opening. By molding using a mold such as injection molding, punching, or vacuum forming of a material made of resin or rubber, the first divisional body 1 has an integral structure including a wall body part 2, recessed parts 3, protruding parts 4, and a flange part 5. The wall body part 2 surrounding the space of the first divisional body 1 has the same thickness as a whole. The wall body part 2 is in a dome shape protruding from a back side to a front side. The dome shape refers to a solid figure ob-

tained by cutting a hollow ball along one plane. Therefore, the wall body part 2 configures a three-dimensional curved surface along an outer wall surface of a ball defined in advance. On an inner wall surface positioned on a space side in the wall body part 2, many protruding parts 3 are linearly provided. Each protruding part 3 protrudes from an inner wall surface of the wall body part 2 to the inner space of the first divisional body 1. On the inner wall surface of the wall body part 2, many recessed parts 4 each having a triangular surface of projection are formed as being surrounded by the respective protruding parts 3.

[0014] A divisional end part formed in a circular opening of the first divisional body 1 is provided with the flange part 5. The flange part 5 protrudes from the divisional end part of the first divisional body 1 to a center part side of the opening of the first divisional body 1, and has an annular shape which circles the opening of the first divisional body 1 once. That is, the flange part 5 is configured to be in an annular shape protruding from the outer wall surface of the first divisional body 1 to an inner space side, without protruding to an outer wall surface side of the first divisional body 1.

[0015] The second divisional body 11 is configured in a sagittal shape including a space recessed inside from a circular opening. By molding using a mold such injection molding, punching, or vacuum forming of a material made of resin or rubber, the second divisional body 11 has an integral structure including a wall body part 12, recessed parts 13, protruding parts 14, and a flange part 15. The wall body part 12 surrounding the space of the second divisional body 11 has the same thickness as a whole. The wall body part 12 is in a dome shape protruding from a back side to a front side. Therefore, the wall body part 12 configures a three-dimensional curved surface along an outer wall surface of a ball defined in advance. On an inner wall surface positioned on a space side in the wall body part 12, many protruding parts 13 are linearly provided. Each protruding part 13 protrudes from the inner wall surface of the wall body part 12 to the inner space of the second divisional body 11. On the inner wall surface of the second divisional body 11, many recessed parts 14 each having a triangular surface of projection are formed as being surrounded by the respective protruding parts 13.

[0016] A divisional end part formed in a circular opening of the second divisional body 11 is provided with the flange part 15. The flange part 15 protrudes from the opening of the second divisional body 11 to a center part side of the opening of the second divisional body 11, and has an annular shape which circles the opening of the second divisional body 11 once. That is, the flange part 15 is configured to be in an annular shape protruding from an outer wall surface of the second divisional body 11 to an inner space side, without protruding to an outer wall surface side of the second divisional body 11.

[0017] The structure of the first divisional body 1 provided with the wall body part 2, the protruding parts 3,

the recessed parts 4, and the flange part 5 and the structure of the second divisional body 11 provided with the wall body part 12, the protruding parts 13, the recessed parts 14, and the flange part 15 have the same shape, and the first divisional body 1 and the second divisional body 11 have the same weight. Therefore, when the structure of the hollow ball does not allow air to be blown therein or removed therefrom, two divisional bodies having the same shape are formed by molding using a mold, and one of the two can be applied as the first divisional body 1 and the other of the two can be applied as the second divisional body 11.

[0018] Also, the first and second divisional bodies 1 and 11 can be assembled so as to configure one hollow sphere by an assembling machine not depicted. A case is described in which the first and second divisional bodies 1 and 11 are assembled so as to configure one hollow sphere by the assembling machine not depicted. Two holding parts in the assembling machine not depicted are open in a state of facing each other and being separated from each other. One of the holding parts is caused to hold the first divisional body 1 and the other of the holding parts is caused to hold the second divisional body 11.

[0019] Then, the flange part 5 of the first divisional body 1 held by one holding part and the flange part 15 of the second divisional body 11 held by the other holding part are in a state of facing each other, for example, as depicted in Fig. 3. Then, after an end face 6 of the flange part 5 positioned on a second divisional body 11 side and an end face 16 of the flange part 15 positioned on a first divisional body 1 side are melted together by heat, the two holding parts rectilinearly move in a direction in which they approach each other to press the end faces 6 and 16 to each other, thereby causing the first and second divisional bodies 1 and 11 to be strongly welded together to configure one hollow ball.

[0020] As described above, with the protruding parts 3 and 13 provided to the inner wall surfaces of the first and second divisional bodies 1 and 11 so as to surround many recessed parts 4 and 14, the protruding parts 3 and 13 exert a function as a bobbin to make the ball formed of the first and second divisional bodies 1 and 11 have uniform hardness as a whole, and it is possible to exert an appropriate rebound performance as a ball.

[0021] With reference to Fig. 2, how to provide the protruding parts 3 and 13 of Fig. 1 is described, with a truncated icosahedron 61 being taken as an example. In Fig. 2, each regular pentagon face part 62 in the truncated icosahedron 61 is provided with five triangular regions. Each regular hexagon face part 63 in the truncated icosahedron 61 is provided with six triangular regions. The triangular regions in the regular pentagon face part 62 and the triangular regions in the regular hexagon face part 63 have different sizes. In this structure, the protruding parts 3 and 13 of Fig. 1 are provided in a state of being projected from the center of the first divisional body 1 and the second divisional body 11 to the inner wall surfaces so as to be arranged on section lines (lines

formed of dotted lines and solid lines) of the triangular regions in each of the regular pentagon face parts 62 and the regular hexagon face parts 63. Regarding how to provide the protruding parts 3 and 13, similar effects can also be expected by using a regular polyhedron other than the truncated icosahedron 61. Also, a shape of, for example, a geometric pattern other than triangles can also be applied, as long as the structure allows a balance as a ball as a whole.

[0022] With reference to Fig. 3, the first and second divisional bodies 1 and 11 are described. When it is assumed that the outer wall surface centering at a center part 7 positioned at the opening of the first divisional body 1 has a radius 8, the inner wall surface centering at the center part 7 positioned at the opening of the first divisional body 1 has a radius 9, the outer wall surface centering at a center part 17 positioned at the opening of the second divisional body 11 has a radius 18, and the inner wall surface centering at the center part 17 positioned at the opening of the second divisional body 11 has a radius 19, the radiuses 8 and 18 have the same dimension, and the radiuses 9 and 19 have the same dimension.

[0023] In Fig. 3, when the ball is configured of the first and second divisional bodies 1 and 11, the end faces 6 and 16 positioned at the openings of the first and second divisional bodies 1 and 11, respectively, are coupled together. With this, from the first and second divisional bodies 1 and 11, one ball is formed in a shape depicted in Fig. 4. When the above first and second divisional bodies 1 and 11 are coupled, they are maintained so that the shapes of the wall body parts 2 and 12 are not deformed.

[0024] With reference to Fig. 4, the outer appearance of the ball formed of the first and second divisional bodies 1 and 11 is described. In the ball, a coupling line 21 is present where the flange parts 5 and 15 of the first and second divisional bodies 1 and 11 are coupled together. On the coupling line 21, the flange parts 5 and 15 do not protrude outside from the outer wall surfaces of the first and second divisional bodies 1 and 11. That is, the outer wall surface of the ball configures a smooth spherical surface where the outer wall surfaces of the first and second divisional bodies 1 and 11 continue to each other.

[0025] In one case, the ball is configured so that compressed air with pressure above atmospheric pressure cannot be injected inside from outside. In another case, the ball is configured so that compressed air with pressure higher than atmospheric pressure can be injected inside from outside. When the ball is configured so that the compressed air cannot be injected inside from outside, also, in place of a valve installation hole part 22 indicated by a virtual line in Fig. 4, a through hole part which communicates with the inside and outside of the ball is provided to that portion. With this, the structure is such that the inside of the ball has the same pressure as atmospheric pressure and is not influenced by outside pressure and outside temperature.

[0026] When the ball is configured so that the compressed air can be injected inside from outside, the valve

installation hole part 22 indicated by the virtual line in Fig. 4 is provided to one or both of the first and second divisional bodies 1 and 11. To the valve installation hole part 22, a valve part not depicted is attached. Then, a needle such as an injection needle is inserted into the valve from outside the ball, a tip of an air pump is connected to that needle, and the air pump allows air to be blown into the inside of the ball and to be removed from the inside of the ball. That is, with the inside of the ball formed of the first and second divisional bodies 1 and 11 becoming at pressure higher than atmospheric pressure, the structure allows the use of characteristics of an air spring.

[0027] Furthermore, it is similarly applicable to integrally provide the outer wall surface of the ball formed of the first and second divisional bodies 1 and 11 depicted in Fig. 4 with a pattern imitating a skin body not depicted, without attaching a skin body not depicted formed separately from the first and second divisional bodies 1 and 11.

[0028] With reference to Fig. 5, first and second divisional bodies 1 and 11 according to a second embodiment are described. The first and second divisional bodies 1 and 11 depicted in Fig. 5 are different from the first and second divisional bodies 1 and 11 depicted in Fig. 3 in that the structure is not provided with the flange parts 5 and 15 depicted in Fig. 3. The thickness of the wall body parts 2 and 12 depicted in Fig. 5 is configured to be thicker than the thickness of the wall body parts 2 and 12 depicted in Fig. 3, and the end faces 6 and 16 of the divisional end parts are welded. With this, a coupling line identical to the coupling line 21 depicted in Fig. 3 is present where the divisional end parts of the first and second divisional bodies 1 and 11 are coupled together. On this same coupling line as the coupling line 21, the divisional end parts do not protrude outside from the outer wall surfaces of the first and second divisional bodies 1 and 11. That is, the outer wall surface of the ball configures a smooth spherical surface where the outer wall surfaces of the first and second divisional bodies 1 and 11 continue to each other.

[0029] With reference to Fig. 6 and Fig. 7, a structure according to a third embodiment is described in which protruding parts 33 and 34 have a difference of elevation. Note in Fig. 6 and Fig. 7 that a divisional body 31 is a generic name for the first and second divisional bodies 1 and 11 of Fig. 1, a wall body part 32 is a generic name for the wall body parts 2 and 12 of Fig. 1, the protruding parts 33 and 34 are generic names for the protruding parts 3 and 13 of Fig. 1, and recessed parts 35 and 36 are generic names for the recessed parts 4 and 14 of Fig. 1.

[0030] As depicted in Fig. 6, when the protruding part 33 surrounds one recessed part 35 and the protruding parts 34 surround a plurality of recessed parts 36 in the recessed part 35, the protruding part 33 is higher than the recessed parts 34.

[0031] Specifically, as depicted in Fig. 7, a height H1 of the protruding part 33 is higher than a height H2 of the

protruding part 34 ($H1 > H2$). The heights $H1$ and $H2$ are dimensions protruding from the wall body part 32 to an inner side of the divisional body 31.

[0032] In Fig. 8, a structure according to a fourth embodiment is described in which protruding parts 33 and 34 have a difference of elevation. As depicted in Fig. 8, a structure can also be applied in which a height $H2$ of the protruding part 34 is decreased as heading from both end parts positioned on a protruding part 33 side toward a center part side of the recessed part 35. Note in Fig. 8 that a divisional body 31 is a generic name for the first and second divisional bodies 1 and 11 of Fig. 1, a wall body part 32 is a generic name for the wall body parts 2 and 12 of Fig. 1, the protruding parts 33 and 34 are generic names for the protruding parts 3 and 13 of Fig. 1, and recessed parts 35 and 36 are generic names for the recessed parts 4 and 14 of Fig. 1.

[0033] As described above, with the protruding parts 33 and 34 provided with a difference of elevation, a rebound, strength, and touch feeling of the ball can be adjusted.

[0034] Also, as depicted in Fig. 7 and Fig. 8, asperities such as wrinkles, dimples, or knurls are provided on an outer wall surface of a wall body part 32, for example, a protruding pattern part 56 and a recessed pattern part 57 are formed on the outer wall surface of the wall body part 32, and it is thereby also possible to make the surface hard to slip. When asperities are provided on the outer wall surface of the wall body part 32, they are provided by molding the divisional body 31 in one case, and a skin body formed separately from the divisional body 31 is attached to the outer wall surface of the wall body part 32 in another case.

[0035] With reference to Fig. 9, a structure according to a fifth embodiment is described in which protruding parts 37 and 38 are discontinuous. The structure is such that a plurality of protruding parts 37 are present in gaps between a plurality of protruding parts 38, the plurality of protruding parts 38 are present in gaps between the plurality of protruding parts 37, the plurality of protruding parts 37 and the plurality of protruding parts 38 are arranged in a lattice shape, and paired protruding parts 37 and paired protruding parts 38 surround one recessed part 39. Note in Fig. 9 that a divisional body 31 is a generic name for first and second divisional bodies 1 and 11 of Fig. 1, a wall body part 32 is a generic name for the wall body parts 2 and 12 of Fig. 1, the protruding parts 37 and 38 are generic names for the protruding parts 3 and 13 of Fig. 1, and recessed parts 39 are generic names for the recessed parts 4 and 14 of Fig. 1. As the shape of the recessed part 39 surrounded by the protruding parts 37 and 38, a triangle, tetragon, pentagon, or polygon larger than those mentioned above, a circle, an oval, or the like can be applied.

[0036] With reference to Fig. 10, the structure of a protruding part 46 according to a sixth embodiment is described. On an inner surface of a wall body part 32 of a divisional body 31, the protruding part 46 is provided in

a spiral shape. The number of protruding part 46 may be one, two, or more. The protruding part 46 may have a discontinuous structure with a gap present in midstream. Note in Fig. 10 that the divisional body 31 is a generic name for the first and second divisional bodies 1 and 11 of Fig. 1, the wall body part 32 is a generic name for the wall body parts 2 and 12 of Fig. 1, the protruding part 46 is a generic name for the protruding parts 3 and 13 of Fig. 1, and the protruding part 46 configured as a recessed part can also be applied.

[0037] With reference to Fig. 11, the structure of protruding parts 47 and 48 according to a seventh embodiment is described. On an inner surface of a wall body part 32 of a divisional body 31, the protruding parts 47 are radially provided. On a portion partitioned by adjacent protruding parts 47, a protruding part 48 is provided in a zigzag manner. The number of protruding parts 47 and 48 may be one, two, or more. The protruding parts 47 and 48 may have a discontinuous structure with a gap present in midstream. Note in Fig. 11 that the divisional body 31 is a generic name for the first and second divisional bodies 1 and 11 of Fig. 1, the wall body part 32 is a generic name for the wall body parts 2 and 12 of Fig. 1, the protruding part 46 is a generic name for the protruding parts 3 and 13 of Fig. 1, and the protruding parts 47 and 48 configured as recessed parts can also be applied.

[0038] With reference to Fig. 12, first and second divisional bodies 1 and 11 according to an eighth embodiment are described. The first divisional body 1 has a divided shape smaller than the second divisional body 11. On inner wall surfaces of the first and second divisional bodies 11 and 11, protruding parts 3 and 13 are provided so as to surround many recessed parts 4 and 14 in a geometric pattern shape. Then, with an opening of the first divisional body 1 and an opening of the second divisional body 11 caused to face each other and an end face 6 of the first divisional body 1 and an end face 6 of the second divisional body 11 coupled together, the first and second divisional bodies 1 and 11 form one ball.

[0039] Note in Fig. 12 that it is similarly applicable to divide the second divisional body 11 into two by a dividing line 23 indicated by a virtual line.

[0040] With reference to Fig. 13, first and second divisional bodies 1 and 11 according to a ninth embodiment are described. The first and second divisional bodies 1 and 11 each have a shape obtained by division into a gourd shape, as a divisional body configuring a baseball or tennis ball. On inner wall surfaces of the respective first and second divisional bodies 1 and 11, protruding parts 3 and 13 are provided so as to surround many recessed parts 4 and 14 in a geometric pattern shape. Then, with openings of the first and second divisional bodies 1 and 11 caused to face each other and end faces 6 and 16 of the first and second divisional bodies 1 and 11 respectively coupled together, the first and second divisional bodies 1 and 11 form one ball. A virtual line depicted in Fig. 13 is a line indicating the outer shape of

one ball configured of the first and second divisional bodies 1 and 11. Note that a divisional structure can be applied in which the first and second divisional bodies 1 and 11 are coupled together at one point so as not to come apart.

[0041] With reference to Fig. 14, first to third divisional bodies 1, 11, and 41 illustrated as a plurality of divisional bodies according to a tenth embodiment are described. The first to third divisional bodies 1, 11, and 41 form a shape divided into three in a circumferential direction over paired poles in one hollow ball. On inner wall surfaces of the first to third divisional bodies 1, 11, and 41, protruding parts 3, 13, and 43 and flange parts 5, 15, and 44 are provided so as to surround many recesses parts 4, 14, and 42 in a geometric pattern shape. And, with end faces 6, 16: 45 positioned at openings at the flange parts 5, 15, and 44 of the first to third divisional bodies 1, 11, and 41 coupled together, the first to third divisional bodies 1, 11, and 41 form one ball. Note that a divisional structure can be applied in which the first and second divisional bodies 1 and 11 are coupled together at one point so as not to come apart.

[0042] Note in Fig. 14 that it is similarly applicable to divide the plurality of divisional bodies into four over paired poles in one hollow ball.

[0043] With reference to Fig. 15, first to fourth divisional bodies 1, 11, 41, and 51 illustrated as a plurality of divisional bodies according to an eleventh embodiment are described. The first to fourth divisional bodies 1, 11, 41, and 51 have a shape of being linked together at one pole in one hollow ball and being divided into four in a circumferential direction. On inner wall surfaces of the first to fourth divisional bodies 1, 11, 41, and 51, protruding parts 3, 13, 43, and 52, recessed parts 4, 14, 42, and 53, and flange parts 5, 15, 44, and 54 are provided. The structure is such that the protruding parts 3, 13, 43, and 52 individually surround the recessed parts 4, 14, 42, and 53. The recessed parts 4, 14, 42, and 53 are many in a shape of a geometric pattern. And, with end faces 6, 16:45, and 55 of the respective first to fourth divisional bodies 1, 11, 41, and 51 coupled together, the first to fourth divisional bodies 1, 11, 41, and 51 form one ball.

[0044] With reference to Fig. 16, the structure of a ball according to a twelfth embodiment is described. A bladder 70 is configured of a ball having the protruding parts 3 and the recessed parts 4 depicted in Fig. 1 inside. A skin body 71 even in a shape other than a hexagon can be applied. Also, the number of types of the shape of the skin body 71 affixed to one bladder 70 is not necessarily one, and the skin bodies 71 of many types can be applied. The skin body 71 is configured of a soft material made of resin or rubber, and includes a main body part 72, a circumferential wall part 73, and a beveled part 74. The main body part 72 has a dome shape protruding from a back side to a front side, and configures a three-dimensional curved surface along an outer wall surface of the bladder 70 defined in advance.

[0045] The circumferential wall part 73 protrudes from

each peripheral edge part of the main body part 72 to a back side as a bladder 70 side, and has an annular shape which surrounds the peripheral edge parts of the main body part 72 once. The beveled part 74 is configured by removal so that a dihedral angle between the main body part 72 and the circumferential wall part 73 forms a flat surface or curved surface on the front side as a side of the skin body 71 to be touched by a person. That is, the beveled part 74 configured by removal so that the dihedral angle between the main body part 72 and the circumferential wall part 73 forms a flat surface or curved surface is provided on the front side of the skin body 71.

[0046] As described above, by molding using a mold such as injection molding, press molding, vacuum forming, or blow molding of a soft material made of resin or rubber, the skin body 71 has a simple structure integrally configured, including the main body part 72, the circumferential wall part 73, and the beveled part 74.

[0047] With reference to Fig. 17, a structure according to a thirteenth embodiment is described in which a skin body 71 is affixed to a bladder 70 configured of a ball having the protruding parts 3 and the recessed parts 4 depicted in Fig. 1 inside. In a state where circumferential wall parts 73 of adjacent skin bodies 71 bonded together with a bonding agent, a main body part 72 is arranged away from an outer wall surface of the bladder 70, and surfaces of the adjacent circumferential wall parts 73 on a bladder 70 side are bonded to the outer wall surface of the bladder 70 with a bonding agent.

[0048] With this, a cavity part 75 is formed between the skin body 71 and the bladder 70 as a space surrounded by the bladder 70, the main body part 72, and the circumferential wall parts 73, and a plurality of skin bodies 71 cover an entire outer wall surface of the bladder 70. When a person grabs the ball, the main body part 72 is easily recessed, thereby allowing the ball to be easily grabbed. Also, a valley part based on the beveled part 74 is formed on a boundary between adjacent skin bodies 71, thereby allowing the ball to be easily grabbed. Furthermore, the outer appearance of the ball becomes in a hand-stitch style.

[0049] With reference to Fig. 18, the structure of a ball according to a fourteenth embodiment is described. As depicted in Fig. 18, the ball has a structure in which adjacent skin bodies 71 are fixed to an outer wall surface of a bladder 70 so that a gap is formed between adjacent circumferential wall parts 73 and a spacer 76 is arranged in that gap. It is applicable to integrally provide the spacer 76 to the bladder 70, or to provide the spacer 76 separately from the bladder 70. When the spacer 76 is separate from the bladder 70, the spacer 76 is fixed to one or both of the bladder 40 and the adjacent skin body 71.

[0050] Although omitted in the drawings, it is also applicable that protruding parts 3, 13, 33, 34, 37, 38, 43, and 52 are recessed parts, the above recessed parts 4, 14, 35, 36, 39, 42, and 53 are protruding parts, and the recessed parts in place of the protruding parts 3, 13, 33, 34, 37, 38, 43, and 52 are provided to inner surfaces of

the first divisional body 1, the second divisional body 11, the divisional body 31, the third divisional body 41, the fourth divisional body 51, and so forth so as to surround the protruding parts in place of the recessed parts 4, 14, 35, 36, 39, 42, and 53.

[0051] Also, although omitted in the drawings, it is also applicable that the protruding parts 3, 13, 33, 34, 37, 38, 43, and 52 or the protruding parts in place of the recessed parts 4, 14, 35, 36, 39, 42, and 53 have a discontinuous shape of circles, ovals, polygons or the like other than linear shapes as long as the ball has uniform hardness as a whole and an appropriate rebound performance as a ball can be exerted.

Reference Signs List

[0052]

1	first divisional body
2	wall body part
3	protruding part
4	recessed part
5	flange part
6	end face
7	center part
8	radius
9	radius
11	second divisional body
12	wall body part
13	protruding part
14	recessed part
15	flange part
16	end face
17	center part
18	radius
19	radius
21	coupling line
22	valve installation hole part
23	dividing line
31	divisional body
32	wall body part
33	protruding part
34	protruding part
35	recessed part
36	recessed part
37	protruding part
38	protruding part
39	recessed part
41	third divisional body
42	recessed part
43	protruding part
44	flange part
45	end face
46	protruding part
47	protruding part
48	protruding part
51	fourth divisional body
52	protruding part

53	recessed part
54	flange part
55	end face
56	protruding pattern part
57	recessed pattern part
61	truncated icosahedron
62	regular pentagon face part
63	regular hexagon face part
70	bladder
71	skin body
72	main body part
73	circumferential wall part
74	beveled part
75	cavity part
76	spacer
77	section position
101	first divisional body
102	flange part
103	second divisional body
104	flange part
105	valve part
106	protruding part
107	recessed part
108	positioning part
109	protruding part
110	recessed part
111	positioning part

30 **Claims**

1. A ball which is a hollow ball formed of a plurality of divisional bodies configured of a soft material made of resin or rubber, wherein each divisional body has an inner wall surface provided with protruding parts or recessed parts and divisional end parts of the respective divisional bodies are configured not to protrude outside from an outer wall surface of the ball when welded or bonded together so as to configure the hollow ball.
2. The ball according to claim 1, wherein the divisional end part of the divisional body is provided with a flange part as protruding from the divisional end part of the divisional body to a center part side, and the respective flange parts are configured not to protrude outside from the outer wall surface of the ball when welded or bonded together so as to configure the hollow ball.
3. A ball in which the ball of claim 1 is used as a bladder and a skin body is provided on an outer wall surface of the bladder.

Fig.1

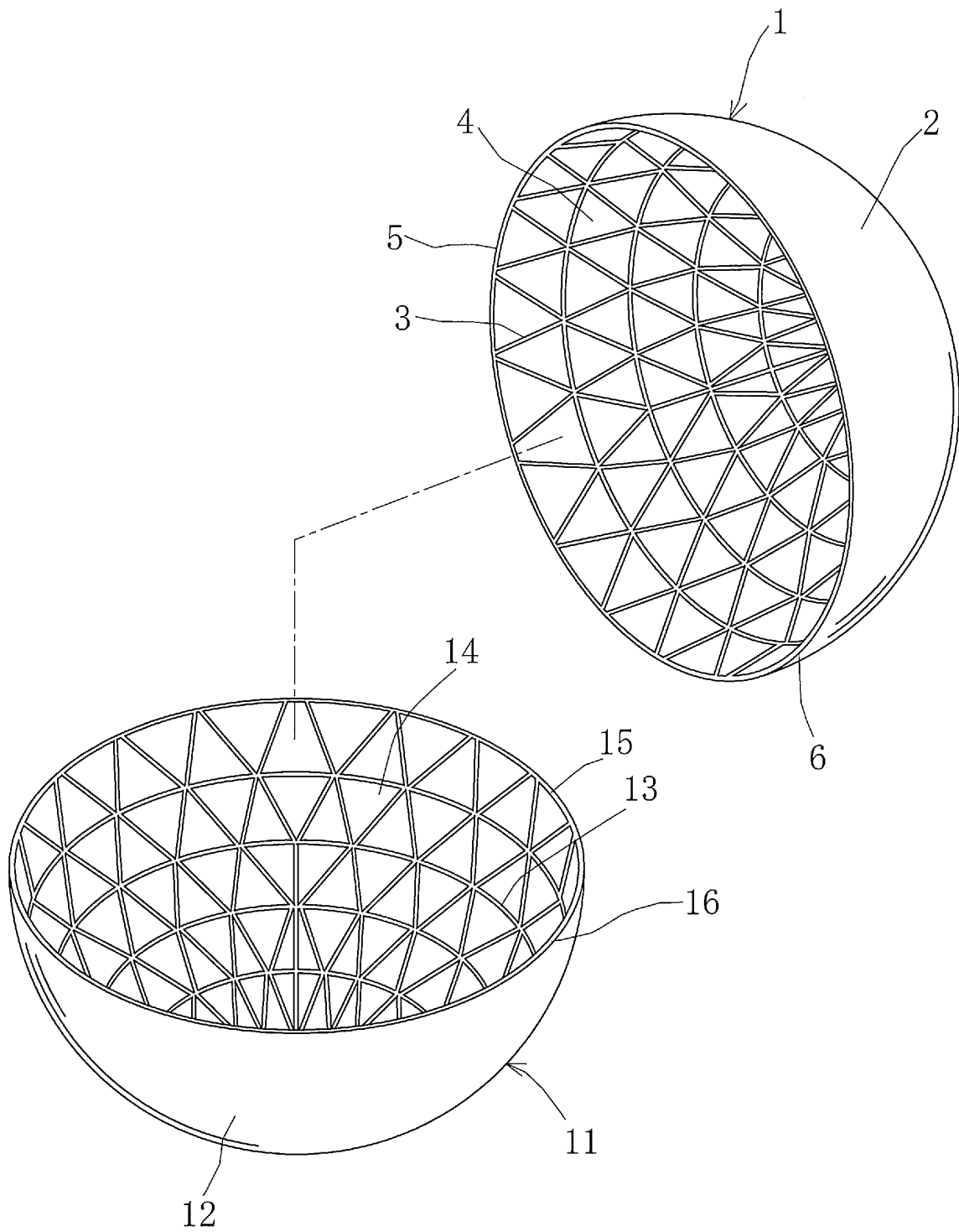


Fig.2

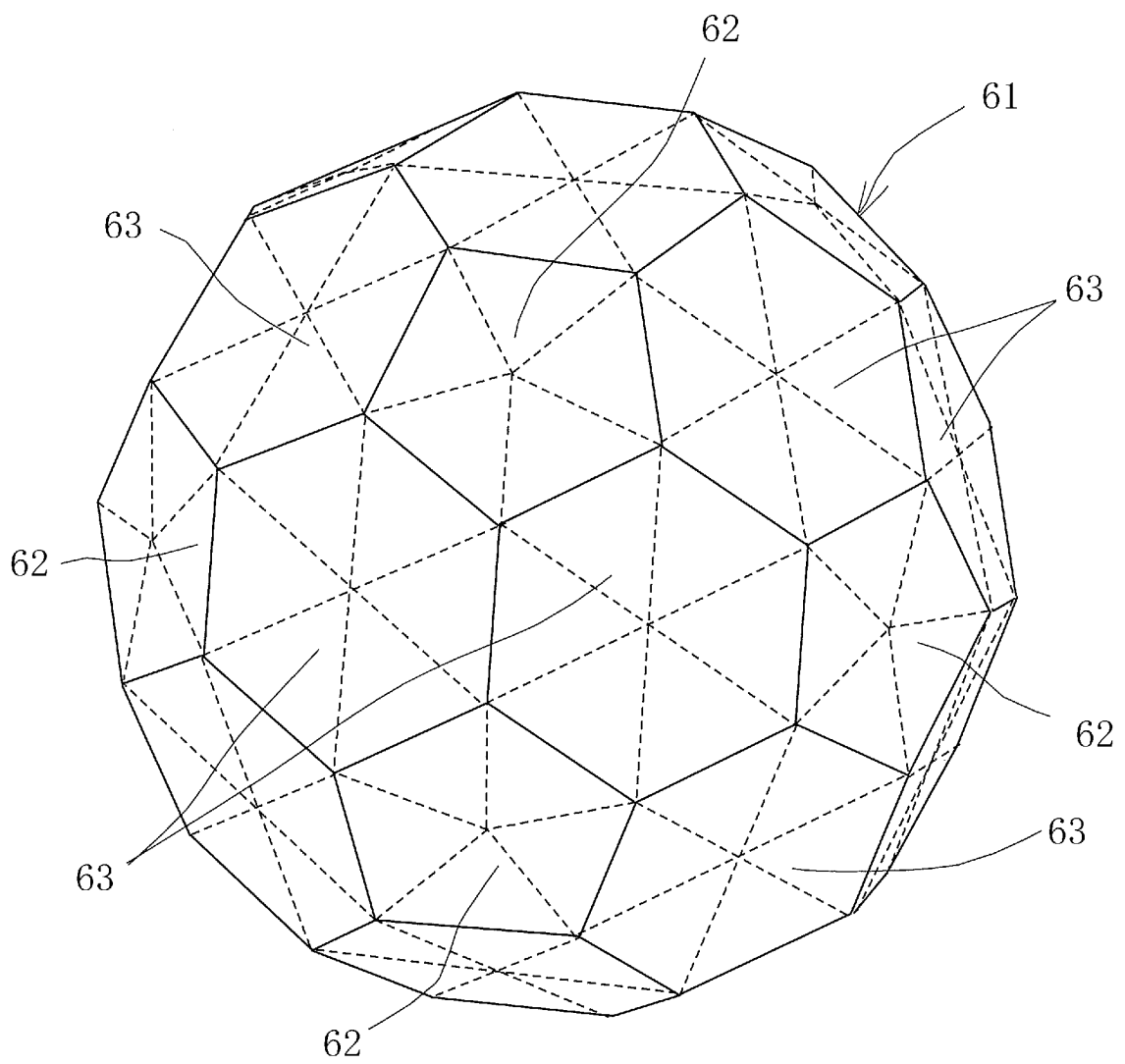


Fig.3

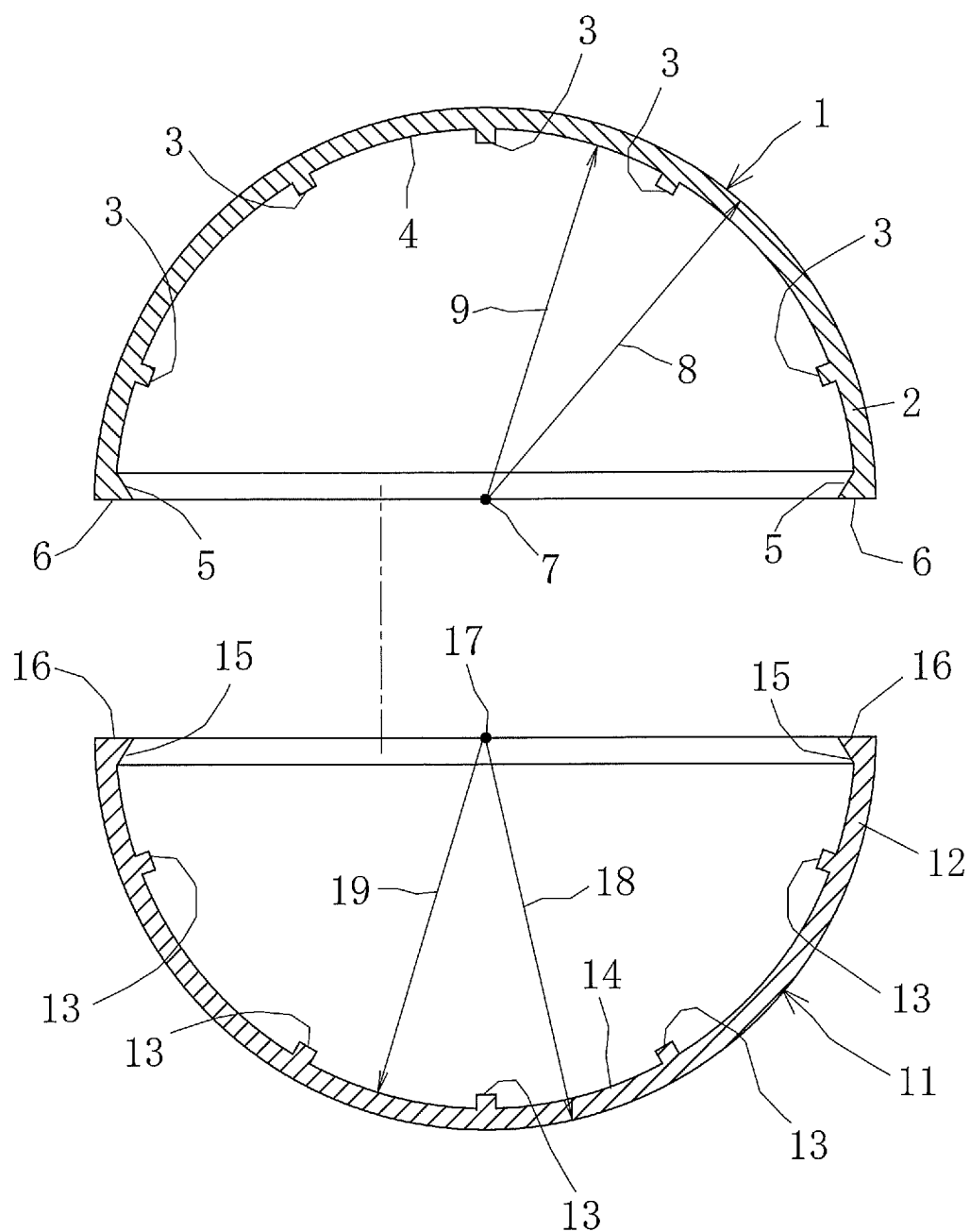


Fig.4

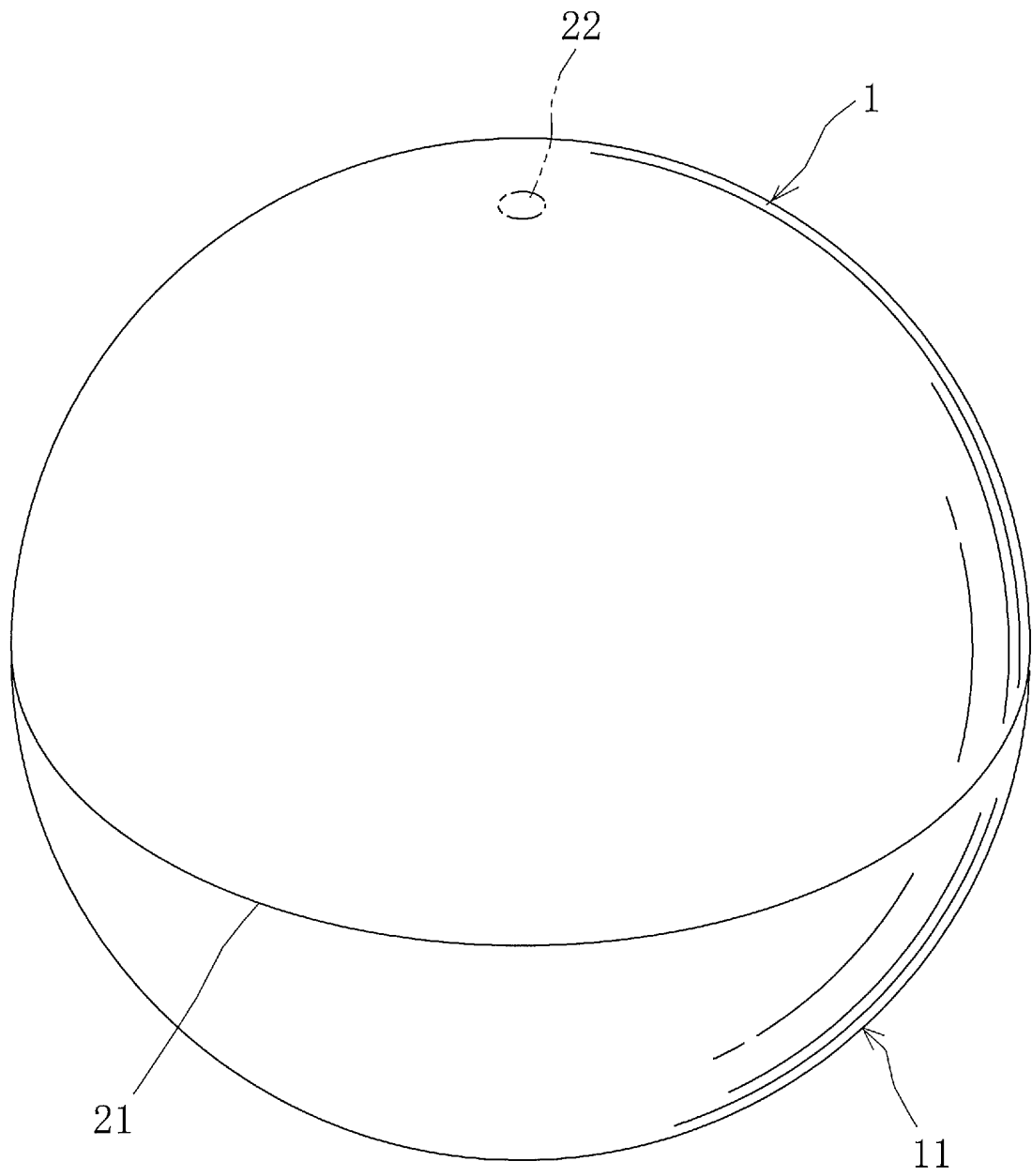


Fig.5

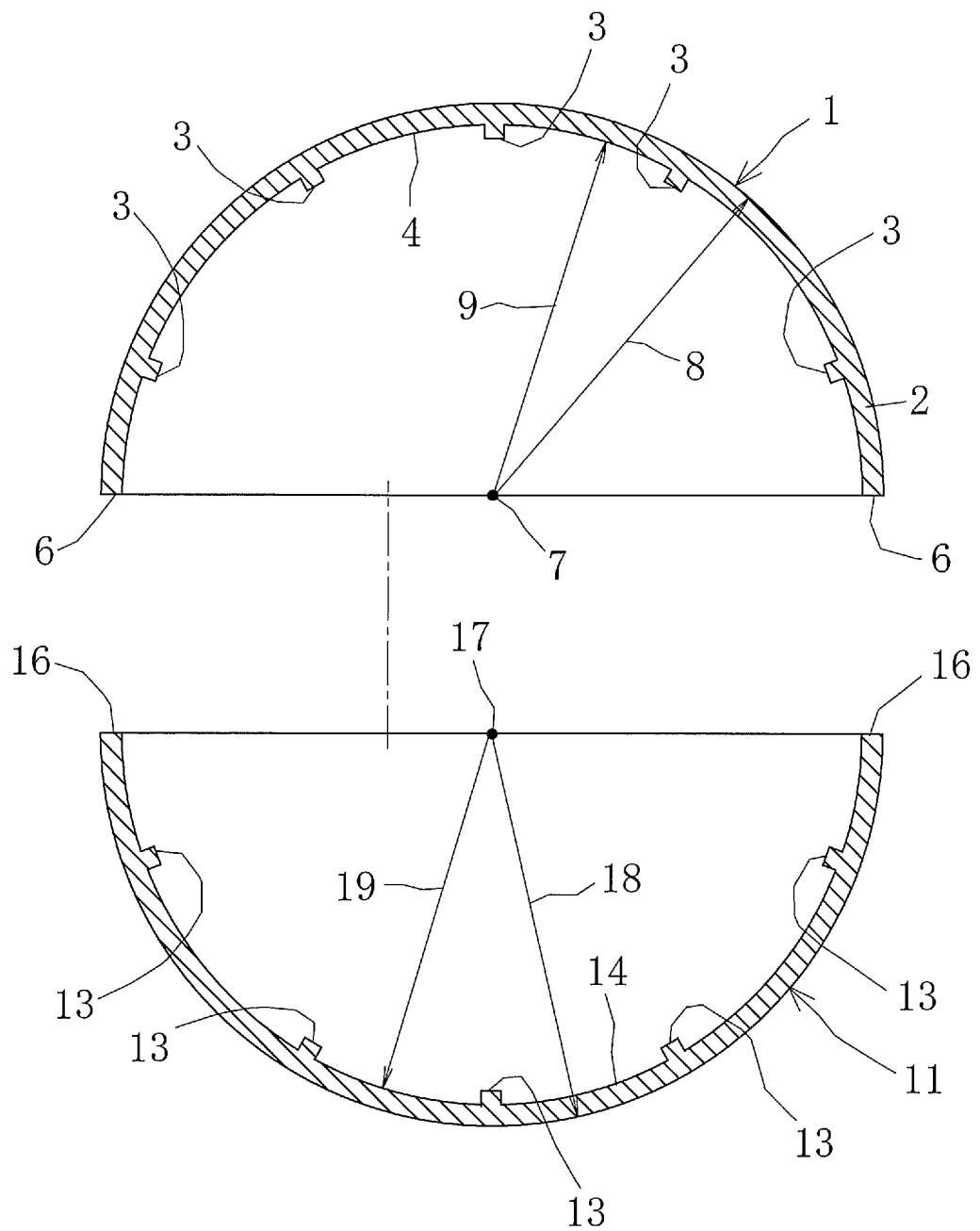


Fig.6

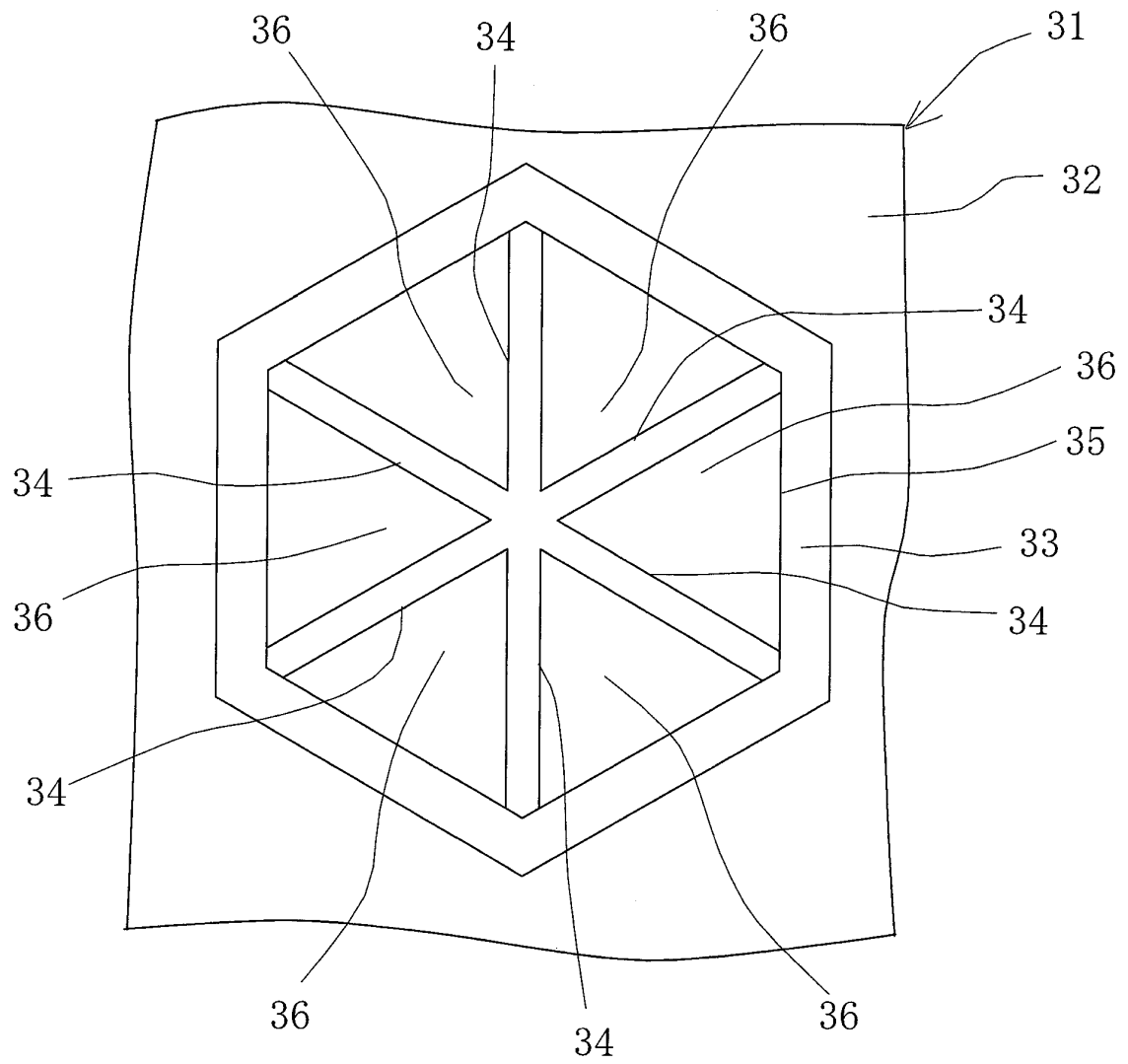


Fig.7

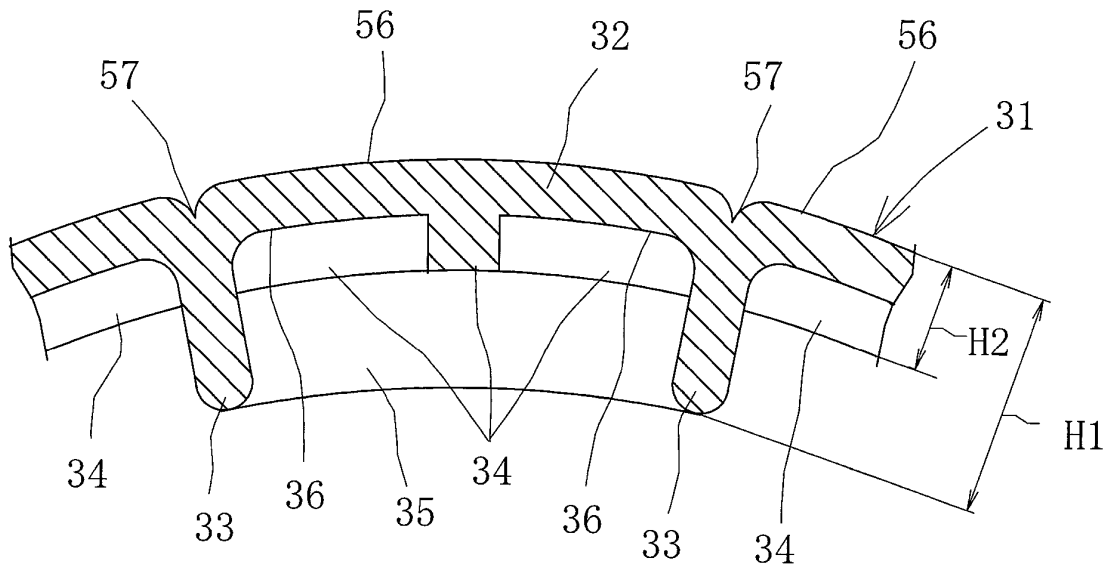


Fig.8

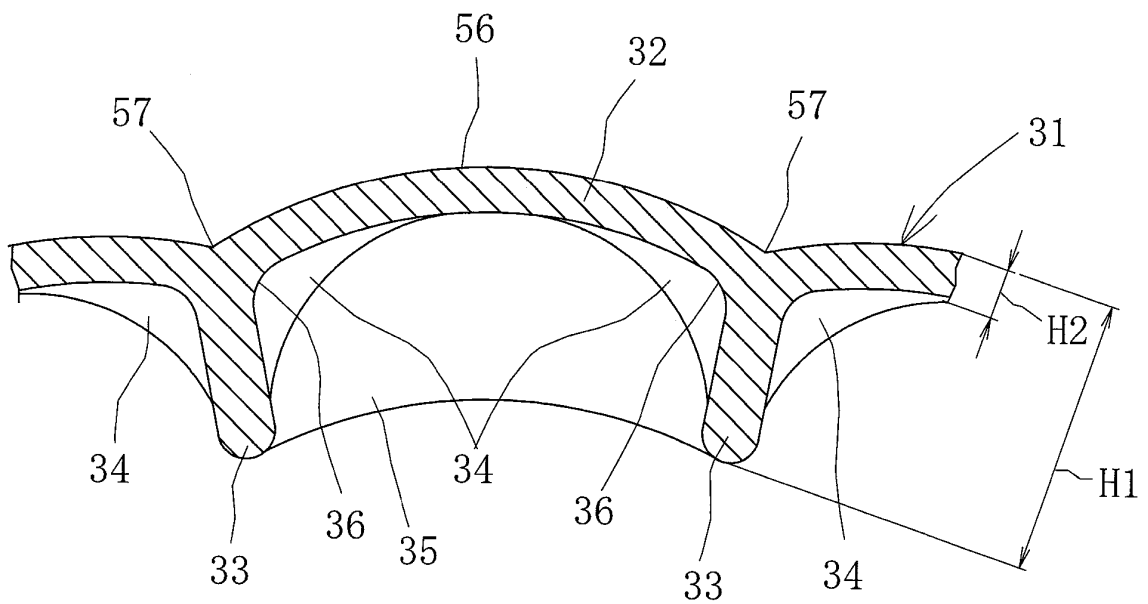


Fig.9

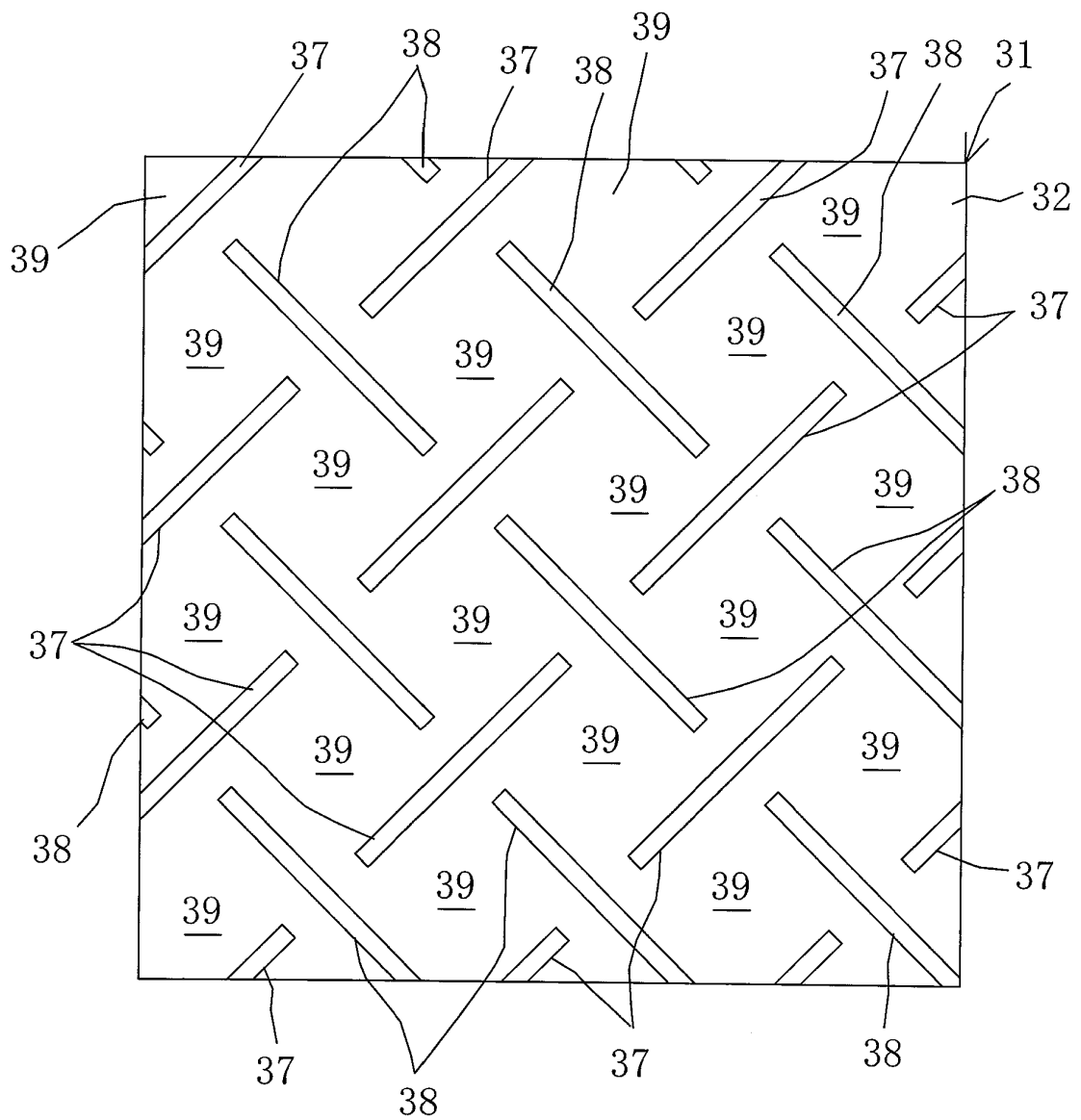


Fig.10

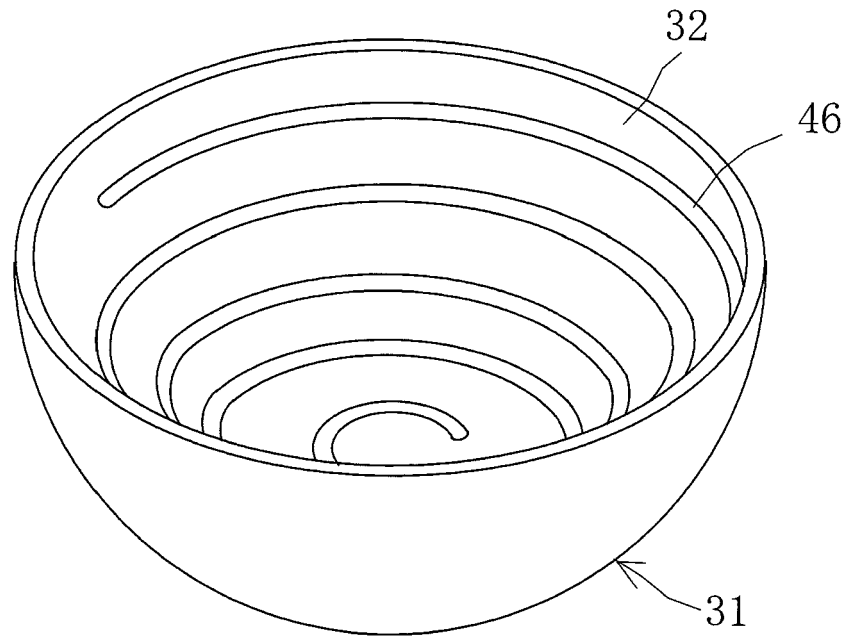


Fig.11

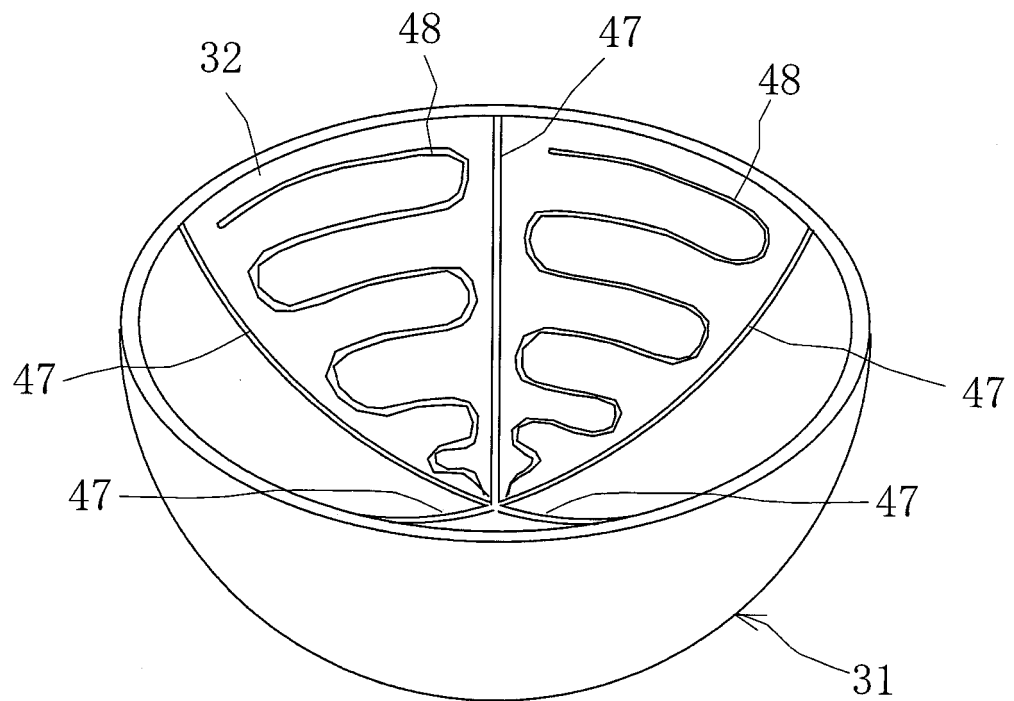


Fig.12

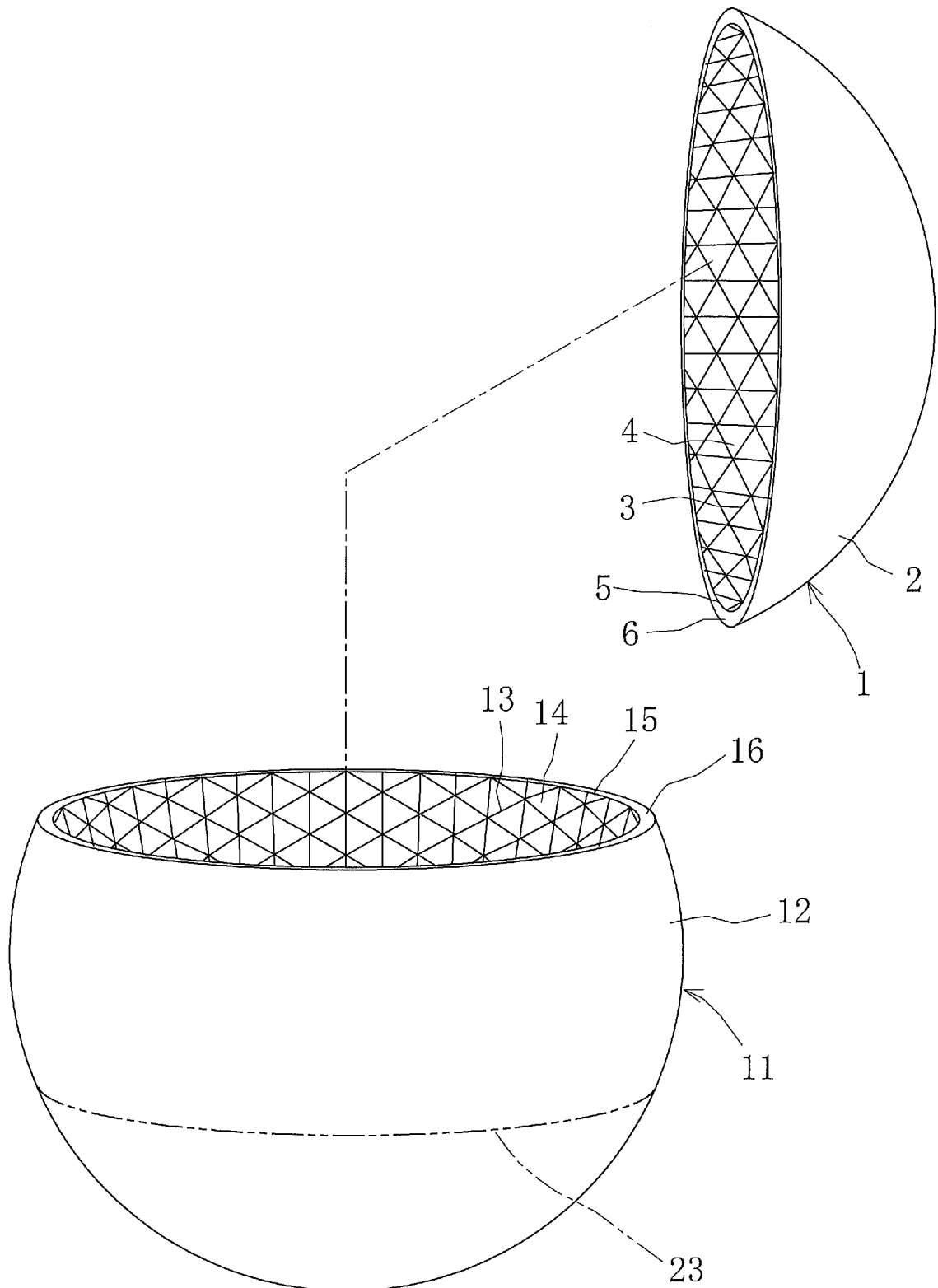


Fig.13

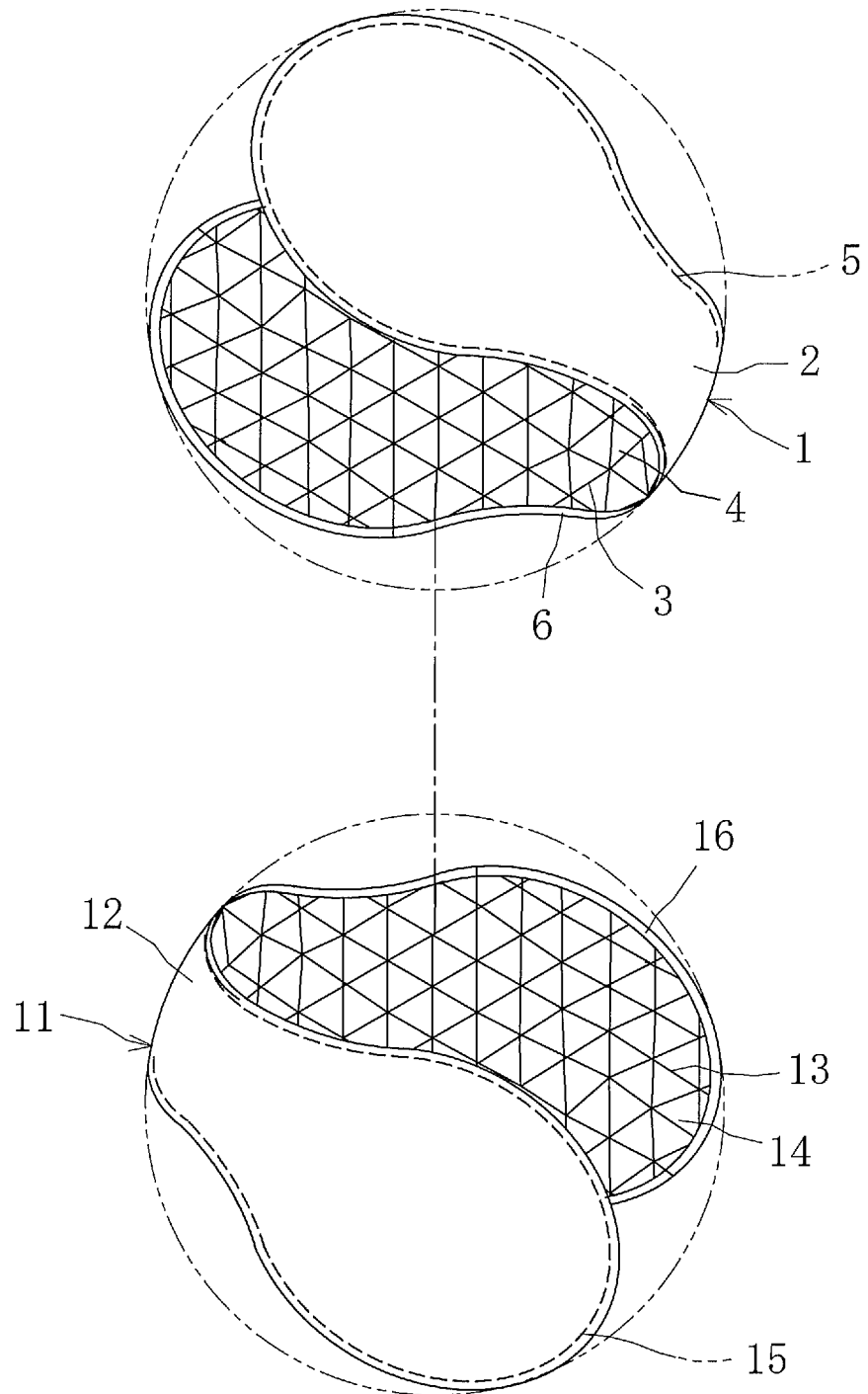


Fig.14

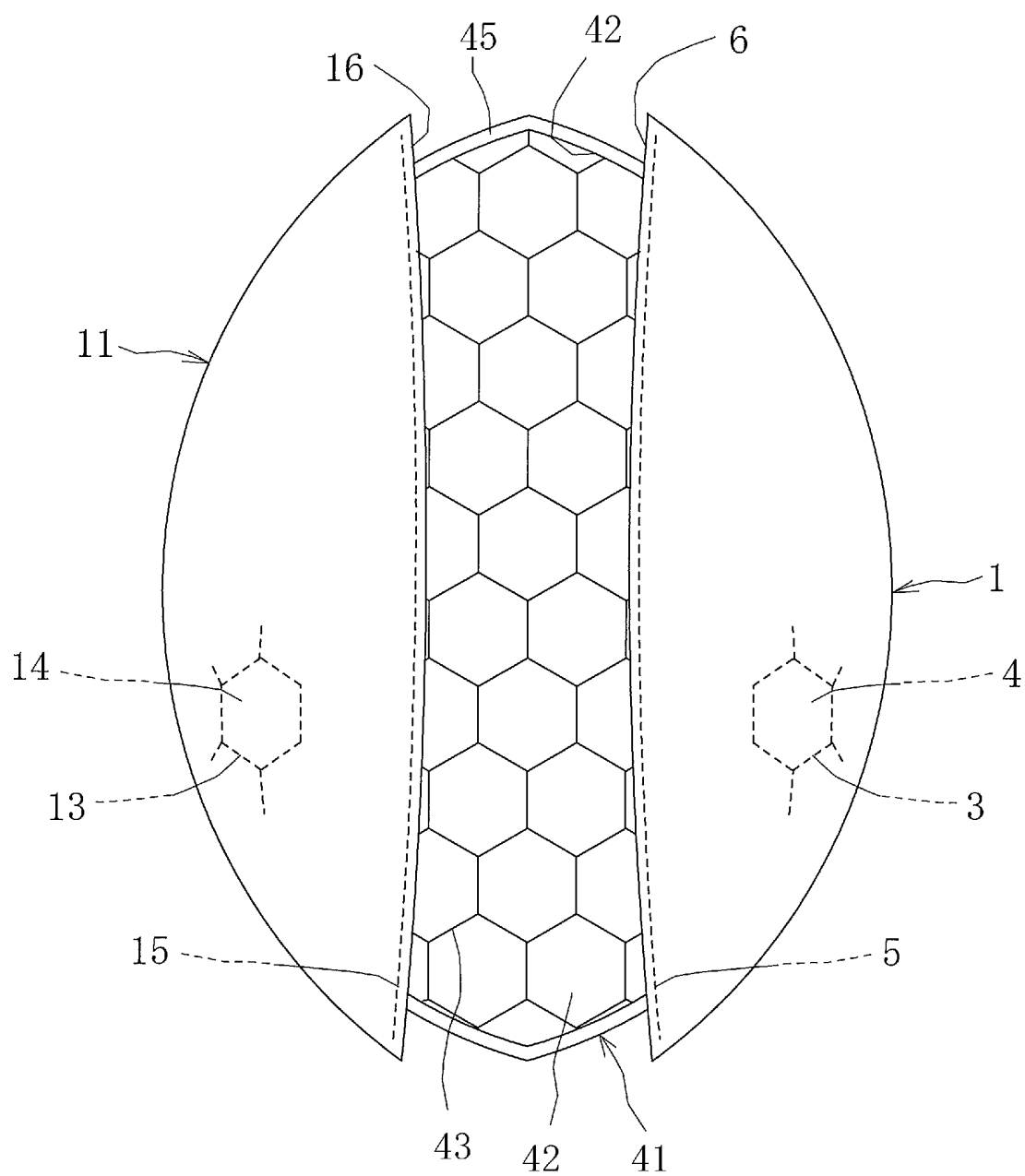


Fig.15

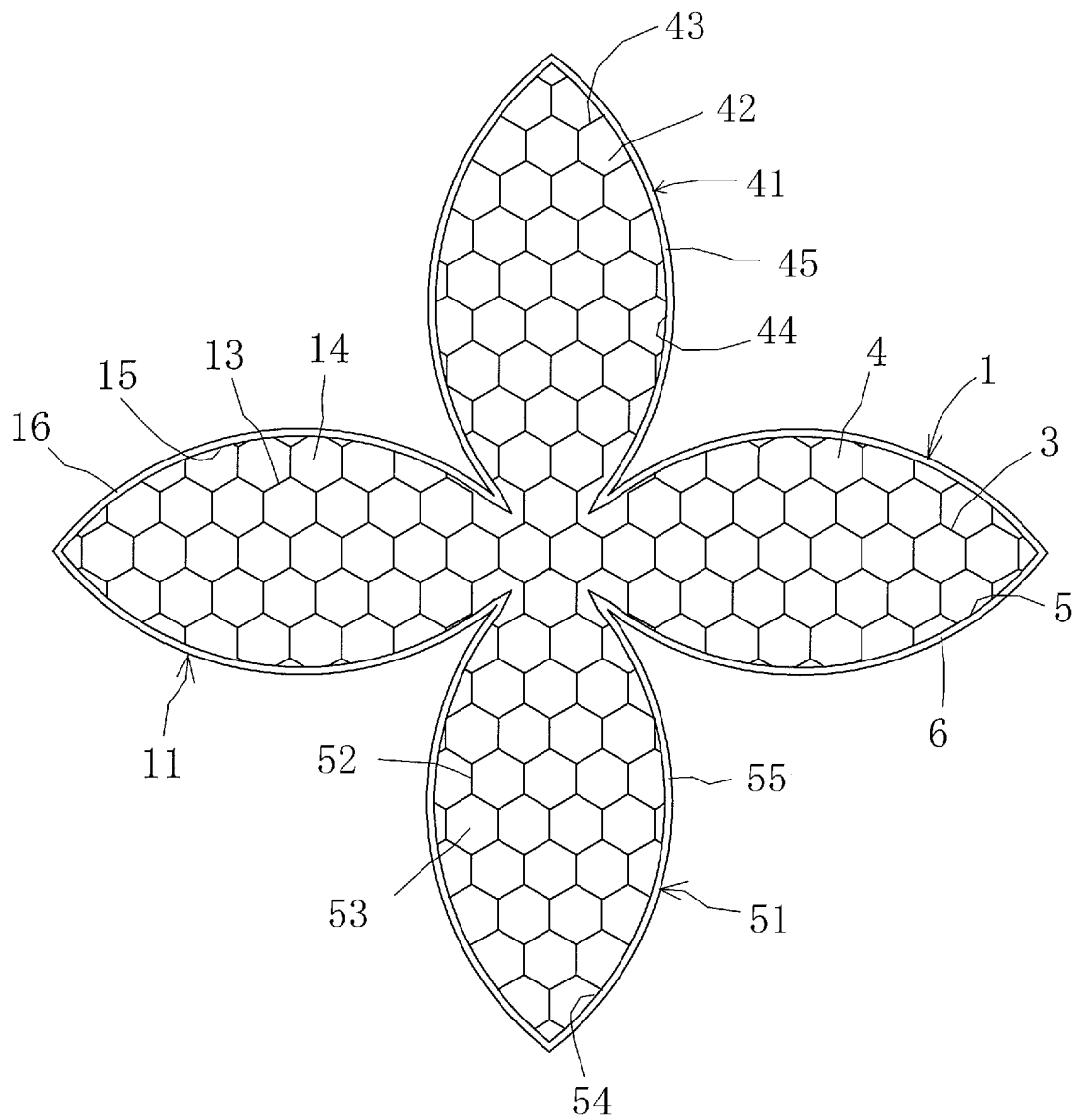


Fig.16

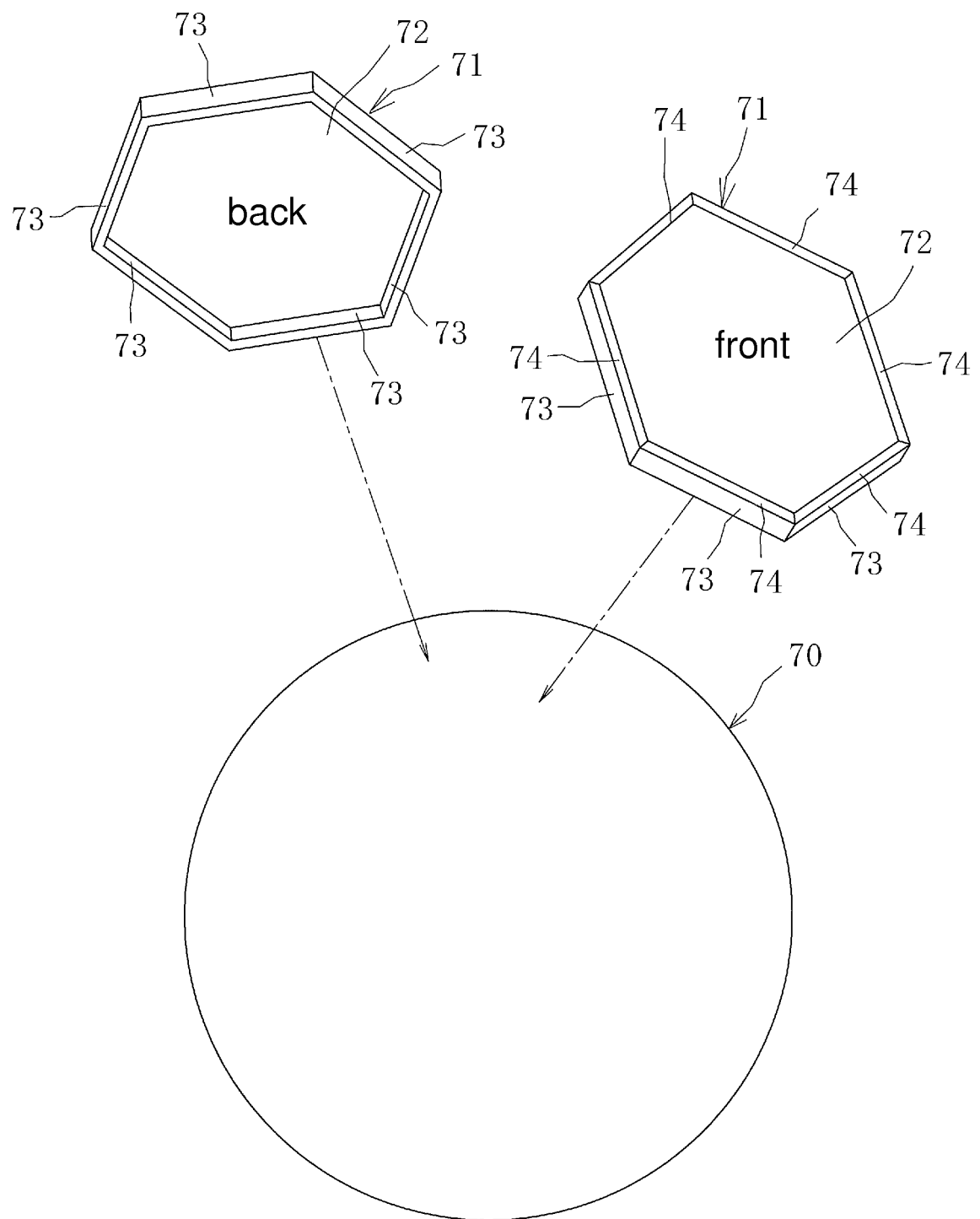


Fig.17

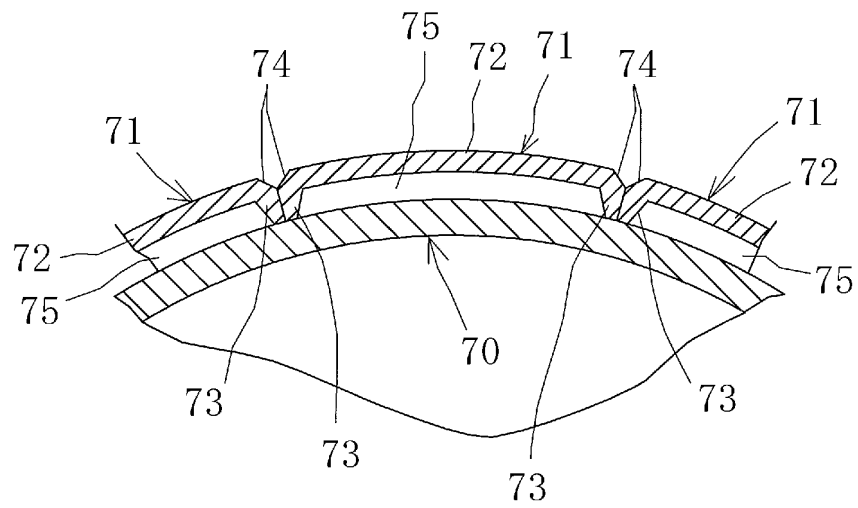


Fig.18

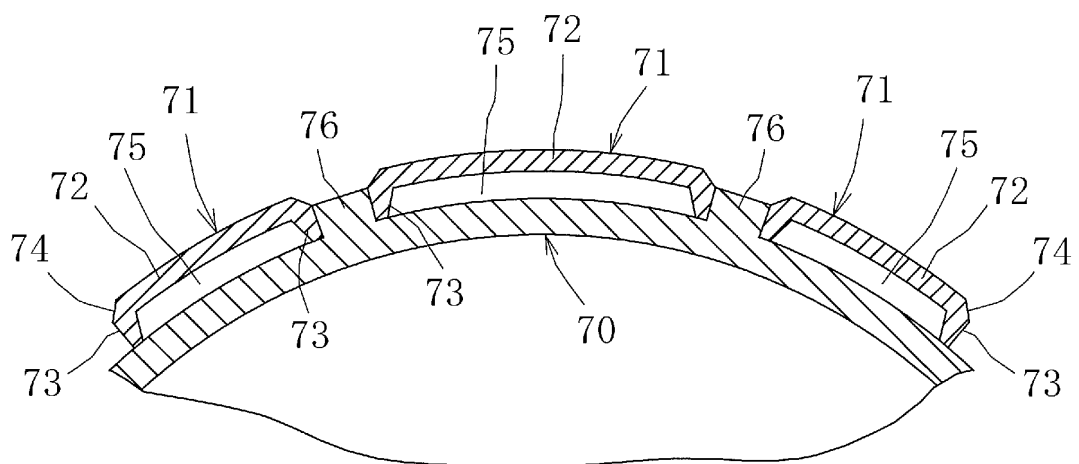


Fig.19

CONVENTIONAL EXAMPLE

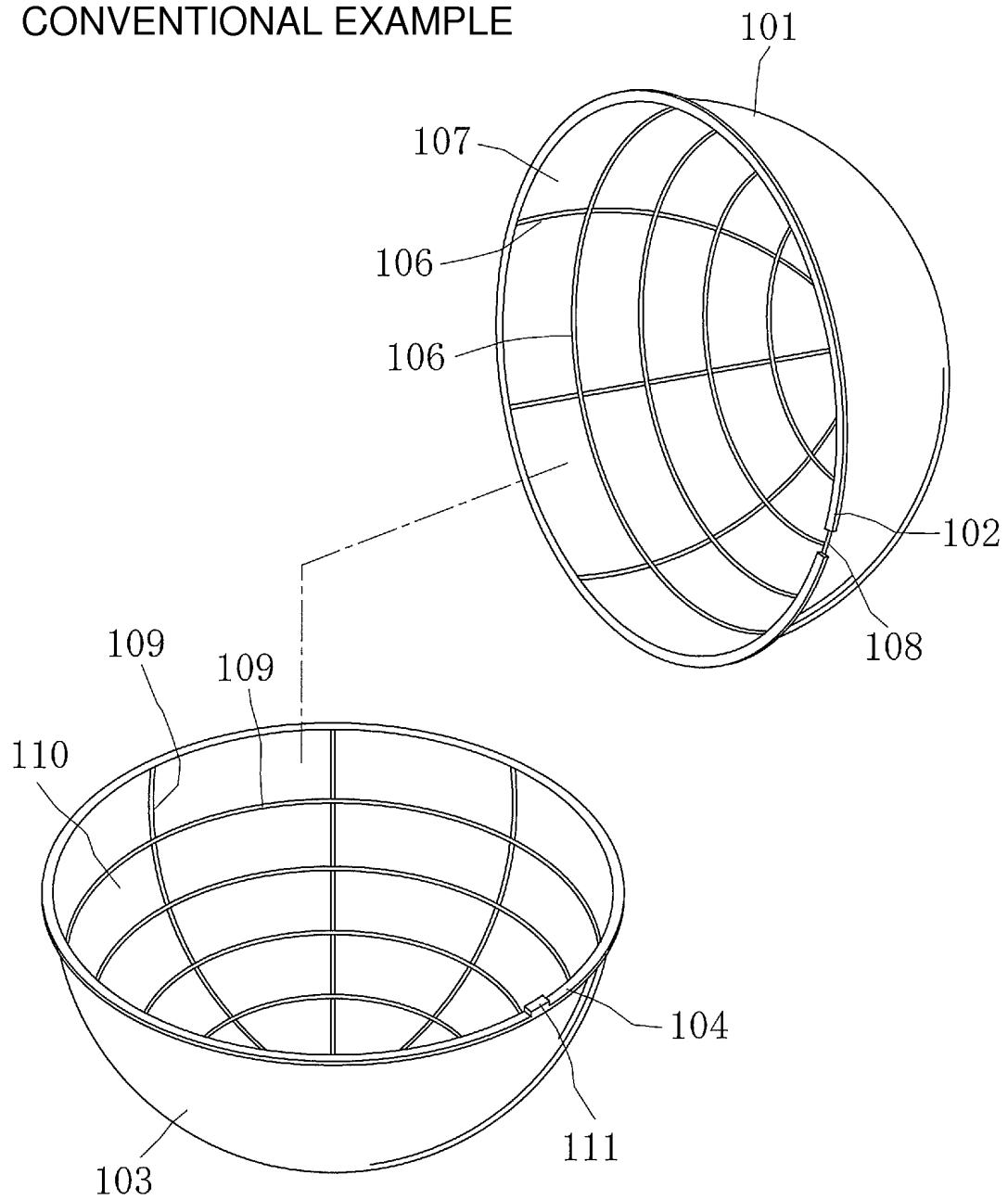
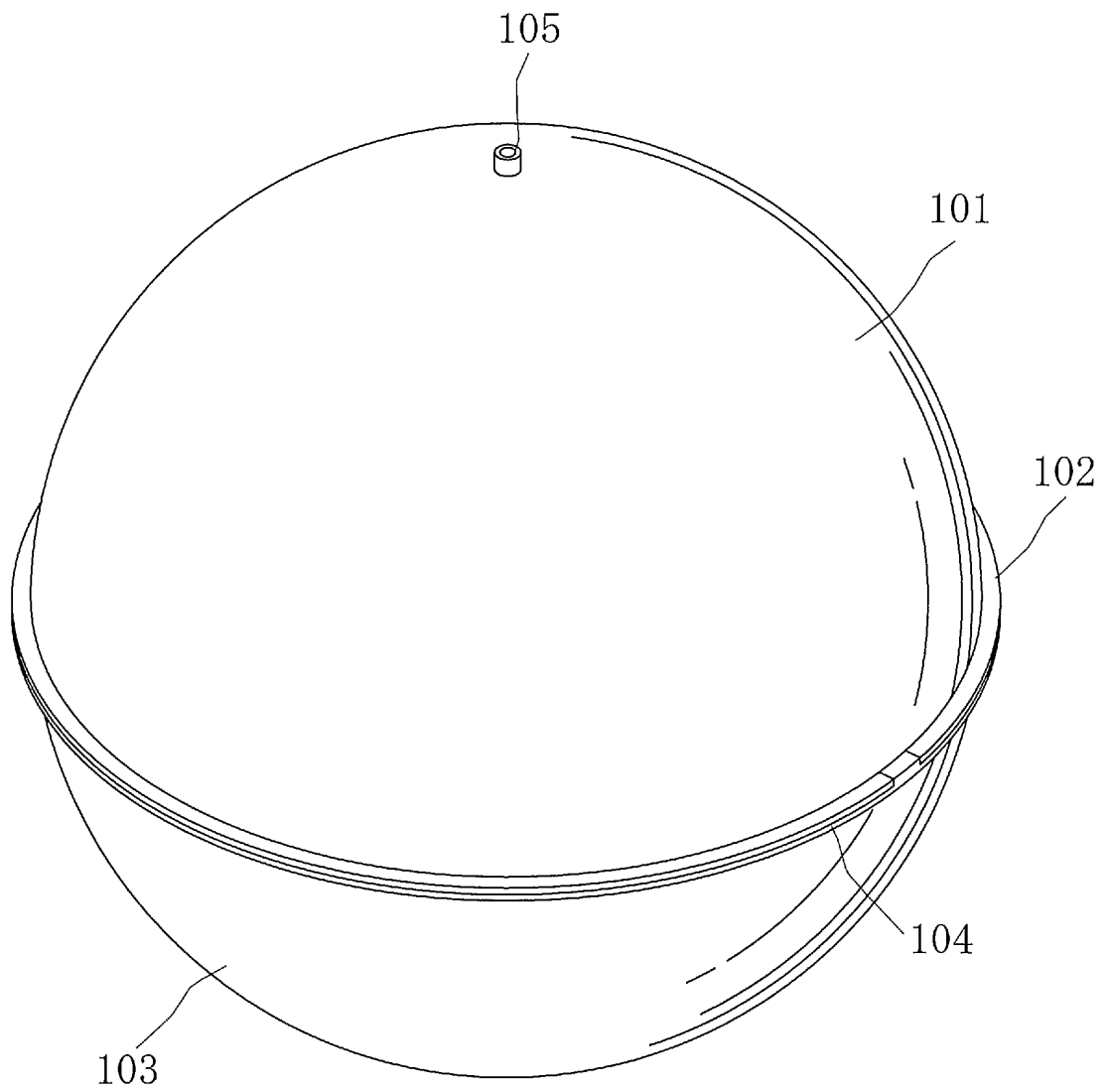


Fig.20

CONVENTIONAL EXAMPLE



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2014/084717

A. CLASSIFICATION OF SUBJECT MATTER

A63B39/00(2006.01) i, A63B41/02(2006.01) i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

A63B39/00, A63B41/02

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2015

Kokai Jitsuyo Shinan Koho 1971-2015 Toroku Jitsuyo Shinan Koho 1994-2015

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X, Y	US 2131756 A (FRED T. Roberts), 04 October 1938 (04.10.1938), specification, page 1, left column, lines 1 to 3; right column, lines 6 to 23; fig. 1 to 5 (Family: none)	1-3
X	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 24974/1989 (Laid-open No. 116468/1990) (Kanayama Kasei Co., Ltd.), 18 September 1990 (18.09.1990), claims; page 3, line 16 to page 4, line 1; fig. 5 to 6 (Family: none)	1, 2

☒ Further documents are listed in the continuation of Box C.

☐ See patent family annex.

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Date of the actual completion of the international search
18 March 2015 (18.03.15)Date of mailing of the international search report
31 March 2015 (31.03.15)Name and mailing address of the ISA/
Japan Patent Office
3-4-3, Kasumigaseki, Chiyoda-ku,
Tokyo 100-8915, Japan

Authorized officer

Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2014/084717

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 3154714 U (Shinhin CHO), 22 October 2009 (22.10.2009), claims; paragraphs [0024], [0041] to [0044]; fig. 1 to 12 (Family: none)	1-3
Y	US 2013/0053193 A1 (JACK, Lo), 28 February 2013 (28.02.2013), fig. 8, 9 (Family: none)	1-3

Form PCT/ISA/210 (continuation of second sheet) (July 2009)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 20130053193 A [0007]