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(71) Applicant *(for all designated States except US)*: **INSTITUTO SUPERIOR TÉCNICO** [PT/PT]; Avenida Rovisco Pais, P-1049-001 Lisbon (PT).

(72) Inventor; and
(75) Inventor/Applicant *(for US only)*: **RUA, Maria Helena Neves Pereira Ramalho** [PT/PT]; Rua Dr. António de Almeida, n° 13, 9°-B, P-2780-090 Oeiras (PT).

(74) Agent: **OLIVEIRA, Arlindo Manuel Limede de**; Instituto Superior Técnico, Avenida Rovisco Pais, P-1049-001 Lisbon (PT).

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(54) Title: INFLATABLE BALL FOR FOOTBALLING AND RECREATIONAL ACTIVITIES

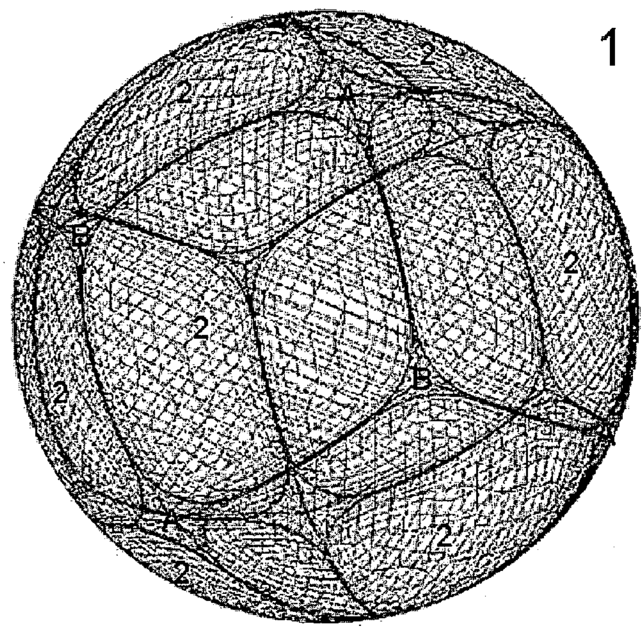

Figure 1

(57) Abstract: This invention relates to an inflatable ball (1) for footballing and recreational activities. It is based on a new geometric model. It considers the use of unrolled folding curved surfaces - cylindrical surfaces - to create spherical three- dimensional structures - domes and geoids - to replace the current structures that make use of plane geometrical figures such as the truncated icosahedron. It is a configuration that corresponds to a ball (1) with 12 faces or panels (2), 24 edges (3) and 14 vertices, six are type (A) and eight are type '(B), which takes advantage of the curvature of solids to replicate a warped, spherical figure and moulds are not needed to make them. That is, with the advantage that it can be made based on development of surfaces.

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Published:

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— *with amended claims (Art. 19(1))*

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11 October 2012

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DESCRIPTION

INFLATABLE BALL FOR FOOTBALLING AND RECREATIONAL ACTIVITIES

Field of invention

Technical area to which the invention belongs

This invention relates to an inflatable ball (1) for footballing and recreational activities, and therefore hollow, that can be used in any area where balls are used: sports, culture and science.

State of the art

This invention relates to an inflatable ball (1) for footballing and recreational activities. It is based on a new geometric model suitable for building spherical three-dimensional structures. Even though it has potential for use in areas such as the building industry, this invention has been developed with a view to producing inflatable balls for footballing and recreational purposes.

According to FIFA the first footballs of the modern era, so called because they were specifically designed and made to be used in games, appeared at the end of the 19th century, under the rules devised by the first football association, formed in England on 26 October 1863.

The geometry of the balls, made from tanned leather and ox bladder, resembled that of the Earth. They consisted of panels stitched together. They were wider at the equator and narrowed towards the poles.

The first major improvement was a geometric adjustment to the shape. As the inflation system improved, with a rubber air chamber, it could keep its round shape for longer. This model to some extent resembled today's volleyball balls. It was basically composed of 18 faces or panels and was officially in use until

1966 when it was replaced by a ball of similar geometry, but better made, to comply with the strict requirements of FIFA to be considered the 'official ball'.

1970 saw the launch of the first 'truncated icosahedron' model, which has lasted until the present day. Major changes have been made since then: not in the format of the ball but in the quality of the materials and construction systems, which have systematically led to the ball becoming a tough, ergonomic object.

The World Cup competitions, in addition to demanding quality guarantees, have also served as a laboratory for introducing increasingly sophisticated products.

Models were launched in Germany (2006) and South Africa (2010) whose surface geometry differed from their predecessor. However, given the manufacturing process of the official ball for the last tournament it is verifiable that the icosahedric shape persists in the interior. Differences are seen in the layers of the covering, designed to enhance the object's performance.

The football-making process is today divided into two, duly patented, aspects: materials, and geometry.

The materials have seen more developments and experimentation in recent times, the aim being to unite the functionality requirements of roundness, bounce and rebound with the toughness and durability requirements under use, such as surface impermeability, suitability to the pitch covering, resistance to wear, and other aspects beyond the scope of this invention.

The geometric aspect has not changed since 1970, with the use of an inflated truncated icosahedron (one of the 13 Archimedean solids) to represent a spherical dome. Occasional experiments have been tried with other shapes, but they used moulds on the traditional geometric model.

This invention is intended to contribute to that aspect.

Summary of invention

This invention relates to an inflatable ball (1) for footballing and recreational activities. It is based on a new geometric model. It considers the use of unrolled folding curved surfaces - cylindrical surfaces - to create spherical three-dimensional structures - domes and geoids - to replace the current structures that make use of plane geometrical figures such as the truncated icosahedron. It is a configuration that corresponds to a ball (1) with 12 faces or panels (2), 24 edges (3) and 14 vertices (intersections of the edges), six are type (A), ends of segment $\pi r/2$ (5), and eight are type (B), ends of segment $r\sqrt{2}$ (4), which takes advantage of the curvature of solids to replicate a warped, spherical figure without needing to use moulds. That is, with the advantage of being made based on development of surfaces.

Detailed description of the invention

This invention is a ball (1) suitable for footballing and recreational activities, composed of 12 faces or panels (2), which are reflected on the surface of the ball (1), each corresponding to sections of cylindrical surfaces, that is, unrolled folding curved surfaces.

In practice, when the twelve faces or panels (2) of the ball (1), which are quadrilateral in shape and all equal, are arranged with different orientations they form a three-dimensional structure with a spherical format.

The ball (1) may thus be described as a geometric figure, a Non-polyhedron, composed of 12 faces or panels (2), 24 edges (3) and 14 vertices, six of type (A) and eight of type (B),

The advantage of adapting this geometric figure to a sphere is that, because it has fewer cylindrical faces or panels, and a smaller number of vertices (compared with the previous model - inflated truncated icosahedrons), there are fewer areas that have to be inflated, and it is easier to achieve the desired

outcome: the ball (1). The cumulative stress in the vertices can be distributed along the edges and thence it is transmitted equally to all the faces or panels.

The invention thus comprises of an inflatable ball for footballing and recreational activities composed of an inner air chamber and outer covering formed by 12 all equal quadrilateral faces or panels (2), with each panel (2) bounded by 4 edges (3) of equal length by which the panels are joined to one another. Each panel (2) is bounded on its circumference by four other panels (2).

The panels (2) have a curved surface due to their being superimposed on a Non-polyhedron composed of 12 faces or panels (2), 24 edges (3) and 14 vertices, six of type (A) and eight of type (B), yielded by the intersection of three cylinders of equal diameter (d = 22 cm) where each of its axes establishes, in the space, an angle of 90°, oriented along the xx, yy and zz orthonormal axes whose faces or panels are all equal and correspond to portions of a cylinder.

The panels (2) are bounded by 4 edges (3) which, since they result from the intersection of three cylinders with orthonormal axes of equal diameter, correspond to sections of an ellipse, whose smaller axis is r (radius of the cylinder), 11 cm, and larger axis is $r\sqrt{2}$, dimension between 15,55 cm and 15,56 cm, when converted to decimals, since the intersection between each pair of cylinders is 45°.

The panels (2) are doubly symmetrical plane geometric figures, both in relation to segment πr/2 (5), which corresponds to one quarter of the circumference of the base of the cylinder, and in relation to the segment $r\sqrt{2}$ (4) which corresponds to the portion of the generating line that passes through the mid-point of the previous segment, which intersects it also at its mid-point, and which corresponds to the maximum moment of this magnitude, equal to twice the cosine of 45°, angle at which each pair of cylinders intersects. Each panel has four opposing

vertices, two type (A), ends of the segment πr/2 (5), and two type (B), ends of the segment $r\sqrt{2}$ (4). The area of each panel (2) is between 160,70 cm^2 and 160,80 cm^2, its perimeter is between 47,00 linear cm and 47,30 linear cm, making between 1928,40 cm^2 and 1929,60 cm^2 of material; and between 2256,00 cm and 2270,40 cm of outline necessary for joining according to the vertices of each end of the ellipse portion: (A) to (A) and (B) to (B).

The panels (2) thus correspond to the joining of four faces or panels on vertex (A), with tessellation [4,4,4,4], and the joining of three faces or panels on vertex (B), with tessellation [4,4,4], seeing tessellation as the splitting of the area into regions.

Each edge (3) is delimited at 45°, with the least pronounced curve prevailing, and it is supported on a vertex that corresponds to the ends of two orthogonal segments which intersect at the mid-point, where the first (4) measures $r\sqrt{2}$, a dimension between 15,55 cm and 15,56 cm, and the second (5), given by the unrolling of the circumference portion, measures πr/2, a dimension between 17,27 cm and 17,28 cm, after the surface development of each panel.

Each edge (3) thus corresponds to a portion of an ellipse that is supported on two vertices, where the end of the ellipse portion corresponding to the point above the smaller axis is supported on the vertex (A) of the segment πr/2 (5), and the end of the ellipse sectioned by the planes at 45° corresponds to the vertex (B) of the segment $r\sqrt{2}$ (4).

Each edge (3) is between 11,80 cm and 11,85 cm long, and when joined two by two they yield a stitched area of 283,20 cm to 284,40 cm, which joins all the panels (2).

There are basically three advantages of using this new geometric form:

1 - smaller number of ball (1) components,

from:

32 faces or panels, 90 edges and 60 vertices (truncated icosahedrons),

to:

12 faces or panels (2), 24 edges (3) and 14 vertices, six of type (A) and eight of type (B), (proposed Non-polyhedron).

As it is made of fewer faces or panels (2), which are larger and all the same, and evenly distributed, the result is a more balanced shape that is easier to assemble, yielding an object with reduced friction and better performance.

2 - current manufacturing processes can be easily adapted to this geometry. Since this model comprises unrolled faces or panels (2), all that is needed is for the moulds to be adapted to the cutting proposed herein. There is no need to alter the assembly routine or use any other equipment.

3 - lower production cost and less wastage. As the object is composed of quadrilateral faces or panels (2) repeating them takes better advantage of the cutting area of the mould, leading to less wastage of the raw material, from 40% or more to 12%, compared with cutting a ball of the kind currently produced. As a result, better management of the material used is anticipated, including the arrangement of the decorative motifs to be printed on the roll of material. It is estimated that 30% less stitching is needed than with present patterns:

from:

(90 edges x 4,5 cm) = 405 cm (truncated icosahedron),

to:

(24 edges (3) x 11,8 cm) = 283,2 cm (proposed Non-polyhedron).

So we can conclude that the product described could successfully replace its predecessors.

Description of the figures

Figure 1 shows the structure of the ball (1).

Figure 2 shows the ball (1) created by inflating the proposed Non-polyhedron.

Figure 3 shows the proposed Non-polyhedron.

Figure 4 represents the creation of the proposed Non-polyhedron, by the intersection of three cylinders of equal diameter and with orthonormal axes between them.

Figure 5 shows the intersection, the bearing (European Method), and the true shape of the edge (3) from the proposed Non-polyhedron.

Figure 6 shows the surface development of the face or panel (2) created by the proposed Non-polyhedron.

Figure 7 shows the construction of the ball (1), showing the joining of the panels (2) of the proposed Non-polyhedron.

Figure 8 shows an arrangement for cutting the panels (2).

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Related patents

European Patent - 652794 - Inflatable Ball for Ball Games, in particular Football - 09-07-1993 - A63B 41/08 (2006.01)

European Patent - 946230 - A Football Teaching Aid - 15-10-1997 - A63B 69/00 (2006.01)

European Patent - 598542 - Inflatable Sports Ball - 09-11-1993 - A63B 41/08 (2006.01)

(WO2004056424) BALL FOR BALL GAME AND METHOD FOR MANUFACTURING THE SAME

Hollow inflatable balls (connecting valves to inflatable elastic bodies B60C29/00; valves, e.g. self-closing valves F16K) A63B41

Date: December, 16th, 2011.

CLAIMS

1. Inflatable ball (1) for footballing and recreational activities comprising an inner air chamber and an outer covering formed by multiple panels, this outer covering being composed of 12 panels (2), quadrilateral in shape and all identical, with each panel (2) being delimited by four edges (3) of equal length through which the aforementioned panels are joined together, with each panel (2) circumferentially bounded by four other panels characterised in that these panels (2) have a curved surface resulting from the overlay of a Non-polyhedron comprising of 12 faces or panels (2), 24 edges (3) and 14 vertices, six of type (A) and eight of type (B), yielded by the intersection of three cylinders of equal diameter, 22 cm, each of whose axes establishes, in the space, an angle of 90°, oriented along the xx, yy and zz orthonormal axes whose faces or panels (2) are all equal and correspond to portions of a cylinder.

2. Inflatable ball (1) for footballing and recreational activities, according to claim 1, characterised in that the aforementioned panels (2) are bounded by 4 edges (3) which, since they result from the intersection of three cylinders with equal diameter and orthonormal axes, correspond to portions of an ellipse, whose smaller axis is r, measuring 11 cm, and larger axis is $r\sqrt{2}$, a dimension between 15,55 cm and 15,56 cm.

3. Inflatable ball (1) for footballing and recreational activities, according to the preceding claims, characterised in that the aforementioned panels (2), correspond to doubly symmetrical plane geometric figures, both in relation to the segment $\pi r/2$ (5) and in relation to the segment $r\sqrt{2}$ (4).

4. Inflatable ball (1) for footballing and recreational activities, according to the preceding claims, characterised in that the aforementioned panels (2), contain four vertices, opposing to each other, two type (A) and two type (B).

5. Inflatable ball (1) for footballing and recreational activities, according to the preceding claims, characterised in that the aforementioned panels (2) have, each of them, an area between 160,70 cm^2 and 160,80 cm^2, with a perimeter between 47,00 linear cm and 47,30 linear cm, making between 1928,40 cm^2 and 1929,60 cm^2 of material and between 2256,00 cm and 2270,40 cm of outline necessary for joining according to the vertices of each end of ellipse portion: (A) to (A) and (B) to (B).

6. Inflatable ball (1) for footballing and recreational activities, according to the preceding claims, characterised in that the aforementioned panels (2), correspond to the joining of four faces or panels (2) on vertex (A), with tessellation [4,4,4,4], and the joining of three faces or panels (2) on vertex (B), with tessellation [4,4,4].

7. Inflatable ball (1) for footballing and recreational activities, according to the preceding claims, characterised in that each edge (3) is delimited at 45°, with the least pronounced curve prevailing.

8. Inflatable ball (1) for footballing and recreational activities, according to the preceding claims, characterised in that each edge (3) is supported on a vertex that corresponds to the ends of two orthogonal segments which intersect on its mid-point, where the first (4) measures $r\sqrt{2}$, a dimension between 15,55 cm and 15,56 cm, and the second (5), given by the unrolling of the circumference portion, measures $\pi r/2$, a

dimension between 17,27 cm and 17,28 cm, after the surface development of each panel.

9. Inflatable ball (1) for footballing and recreational activities, according to the preceding claims, characterised in that each edge (3) corresponds to a portion of an ellipse that is supported on two vertices, where the end of the ellipse portion corresponding to the point above the smaller axis is supported on the vertex (A) of the segment πr/2 (5), and the end of the ellipse sectioned by the planes at 45° corresponds to the vertex (B) of the segment $r\sqrt{2}$ (4).

10. Inflatable ball (1) for footballing and recreational activities, according to the preceding claims, characterised in that each edge (3) is between 11,80 cm and 11,85 cm long, and when joined two by two they yield a stitched area of 283,20 cm to 284,40 cm, which joins all the panels (2).

Date: December, 16th, 2011.

AMENDED CLAIMS
received by the International Bureau on 09 July 2012 (09.07.2012)

1. Inflatable ball (1) for footballing and recreational activities comprising an inner air chamber and an outer covering formed by multiple panels, this outer covering being composed of 12 panels (2), quadrilateral in shape and all identical, with each panel (2) being delimited by four edges (3) of equal length through which the aforementioned panels are joined together, with each panel (2) circumferentially bounded by four other panels characterised in that these panels (2) have a curved surface resulting from the overlay of a Non-polyhedron comprising of 12 faces or panels (2), 24 edges (3) and 14 vertices, six of type (A) and eight of type (B), yielded by the intersection of three cylinders of equal diameter, 22 cm, each of whose axes establishes, in the space, an angle of 90°, oriented along the xx, yy and zz orthonormal axes whose faces or panels (2) are all equal and correspond to portions resulting from the intersection of the aforementioned cylinders.

2. Inflatable ball (1) for footballing and recreational activities, according to claim 1, characterised in that the aforementioned panels (2) are bounded by 4 edges (3) which, since they result from the intersection of three cylinders with equal diameter and orthonormal axes, correspond to portions of an ellipse, whose smaller axis is r, measuring 11 cm, and larger axis is $r\sqrt{2}$, a dimension between 15,55 cm and 15,56 cm.

3. Inflatable ball (1) for footballing and recreational activities, according to the preceding claims, characterised in that the aforementioned panels (2), correspond to doubly symmetrical plane geometric figures,

both in relation to the segment πr/2 (5) and in relation to the segment $r\sqrt{2}$ (4).

4. Inflatable ball (1) for footballing and recreational activities, according to the preceding claims, characterised in that the aforementioned panels (2), contain four vertices, opposing to each other, two type (A) and two type (B).

5. Inflatable ball (1) for footballing and recreational activities, according to the preceding claims, characterised in that the aforementioned panels (2) have, each of them, an area between 160,70 cm^2 and 160,80 cm^2, with a perimeter between 47,00 linear cm and 47,30 linear cm, making between 1928,40 cm^2 and 1929,60 cm^2 of material and between 2256,00 cm and 2270,40 cm of outline necessary for joining according to the vertices of each end of ellipse portion: (A) to (A) and (B) to (B).

6. Inflatable ball (1) for footballing and recreational activities, according to the preceding claims, characterised in that the aforementioned panels (2), correspond to the joining of four faces or panels (2) on vertex (A), with tessellation [4,4,4,4], and the joining of three faces or panels (2) on vertex (B), with tessellation [4,4,4].

7. Inflatable ball (1) for footballing and recreational activities, according to the preceding claims, characterised in that each edge (3) is delimited at 45°, with the least pronounced curve prevailing.

8. Inflatable ball (1) for footballing and recreational activities, according to the preceding claims,

characterised in that each edge (3) is supported on a vertex that corresponds to the ends of two orthogonal segments which intersect on its mid-point, where the first (4) measures $r\sqrt{2}$, a dimension between 15,55 cm and 15,56 cm, and the second (5), given by the unrolling of the circumference portion, measures $\pi r/2$, a dimension between 17,27 cm and 17,28 cm, after the surface development of each panel.

9. Inflatable ball (1) for footballing and recreational activities, according to the preceding claims, characterised in that each edge (3) corresponds to a portion of an ellipse that is supported on two vertices, where the end of the ellipse portion corresponding to the point above the smaller axis is supported on the vertex (A) of the segment $\pi r/2$ (5), and the end of the ellipse sectioned by the planes at 45° corresponds to the vertex (B) of the segment $r\sqrt{2}$ (4).

10. Inflatable ball (1) for footballing and recreational activities, according to the preceding claims, characterised in that each edge (3) is between 11,80 cm and 11,85 cm long, and when joined two by two they yield a stitched area of 283,20 cm to 284,40 cm, which joins all the panels (2).

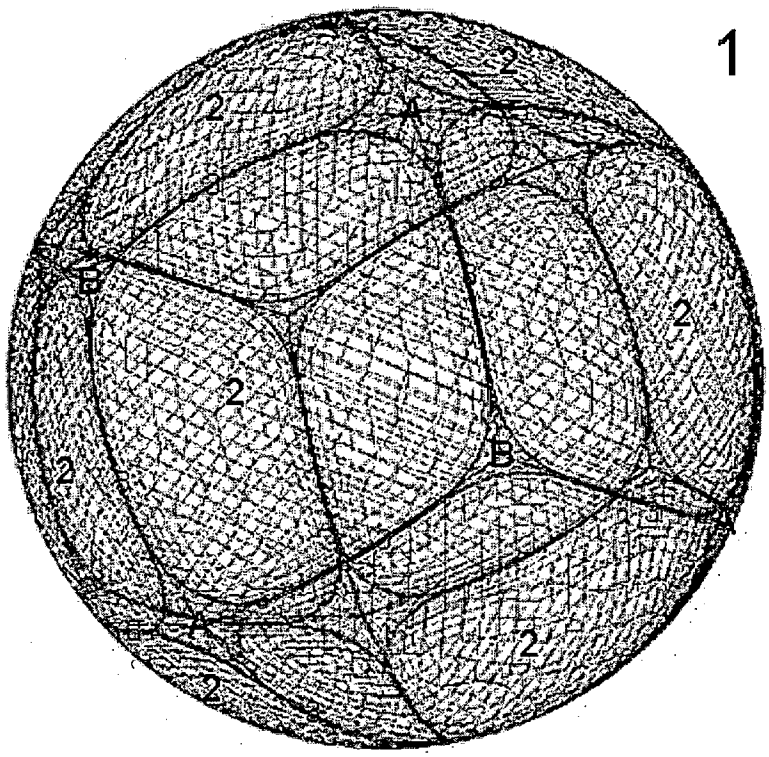

Figure 1

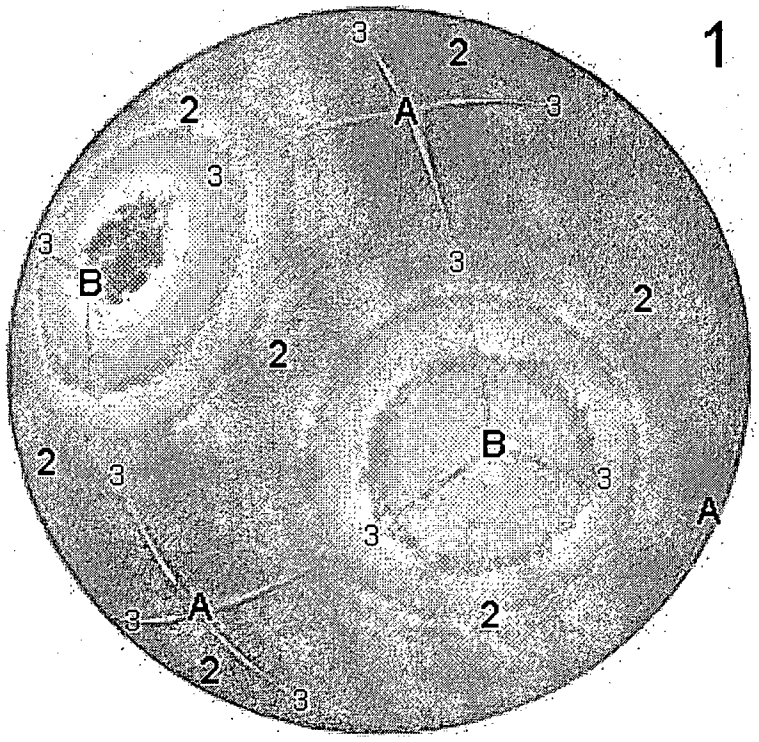

Figure 2

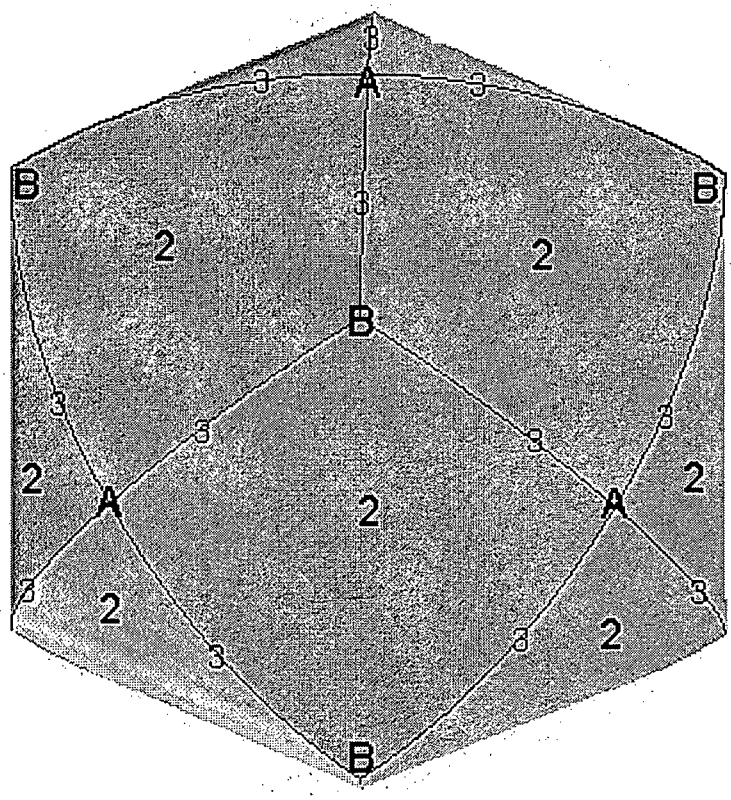

Figure 3

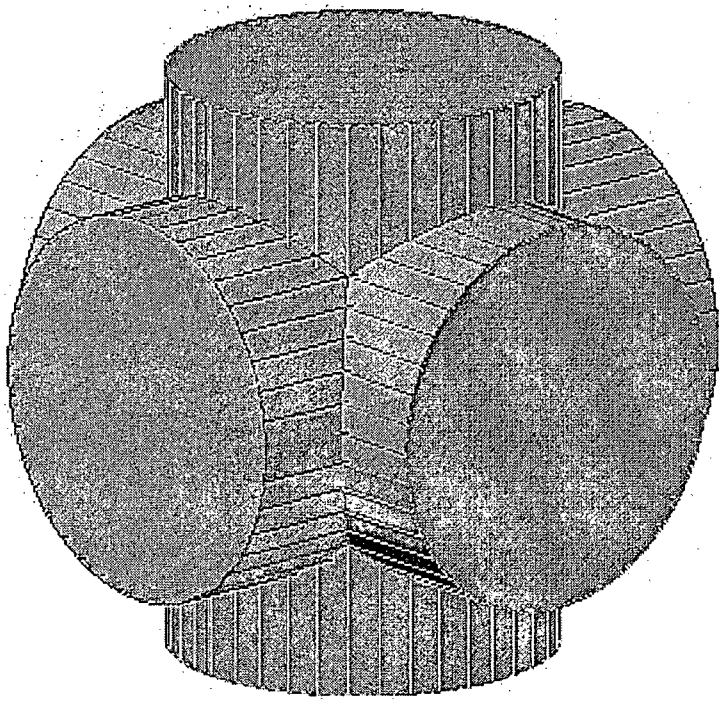

Figure 4

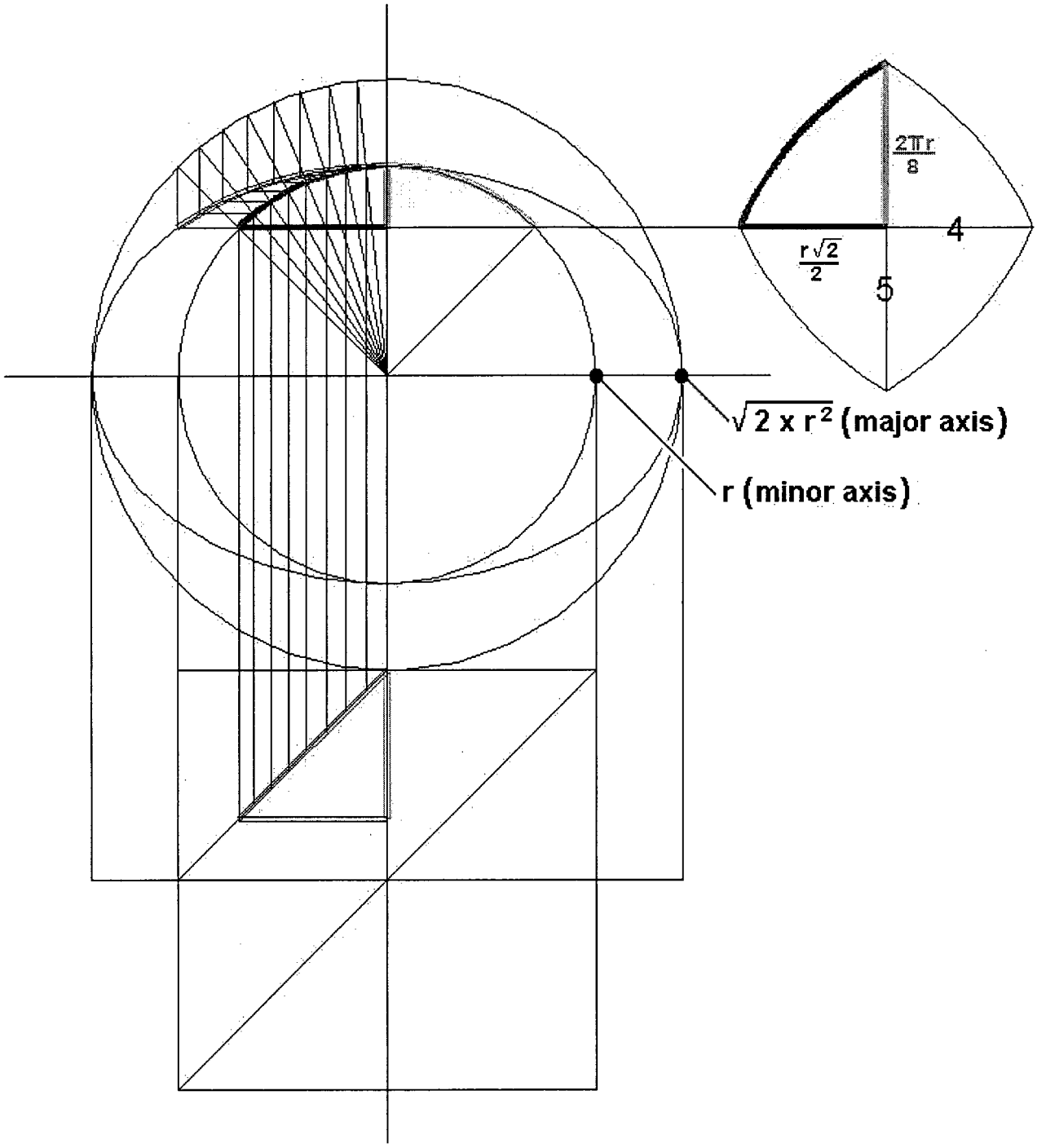

Figure 5

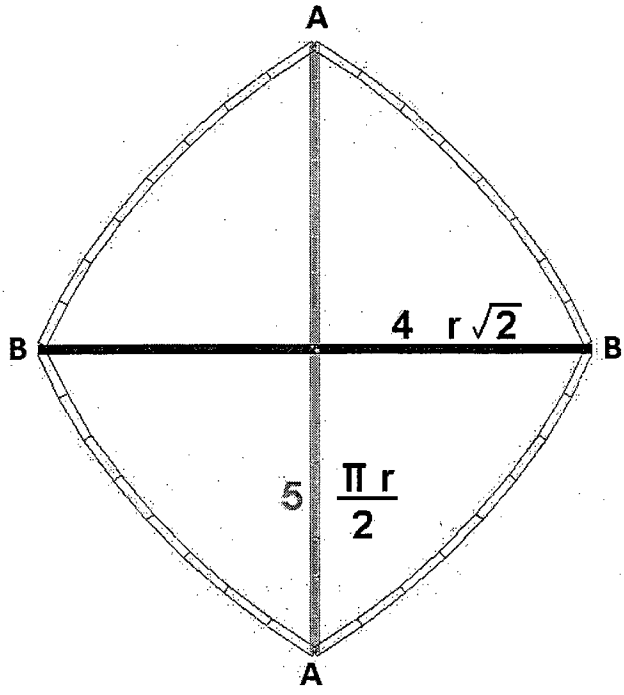

Figure 6

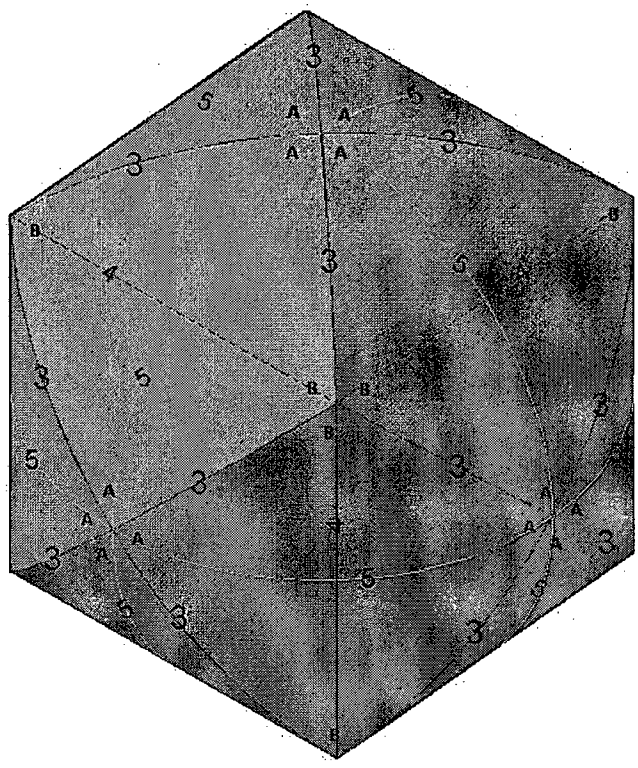

Figure 7

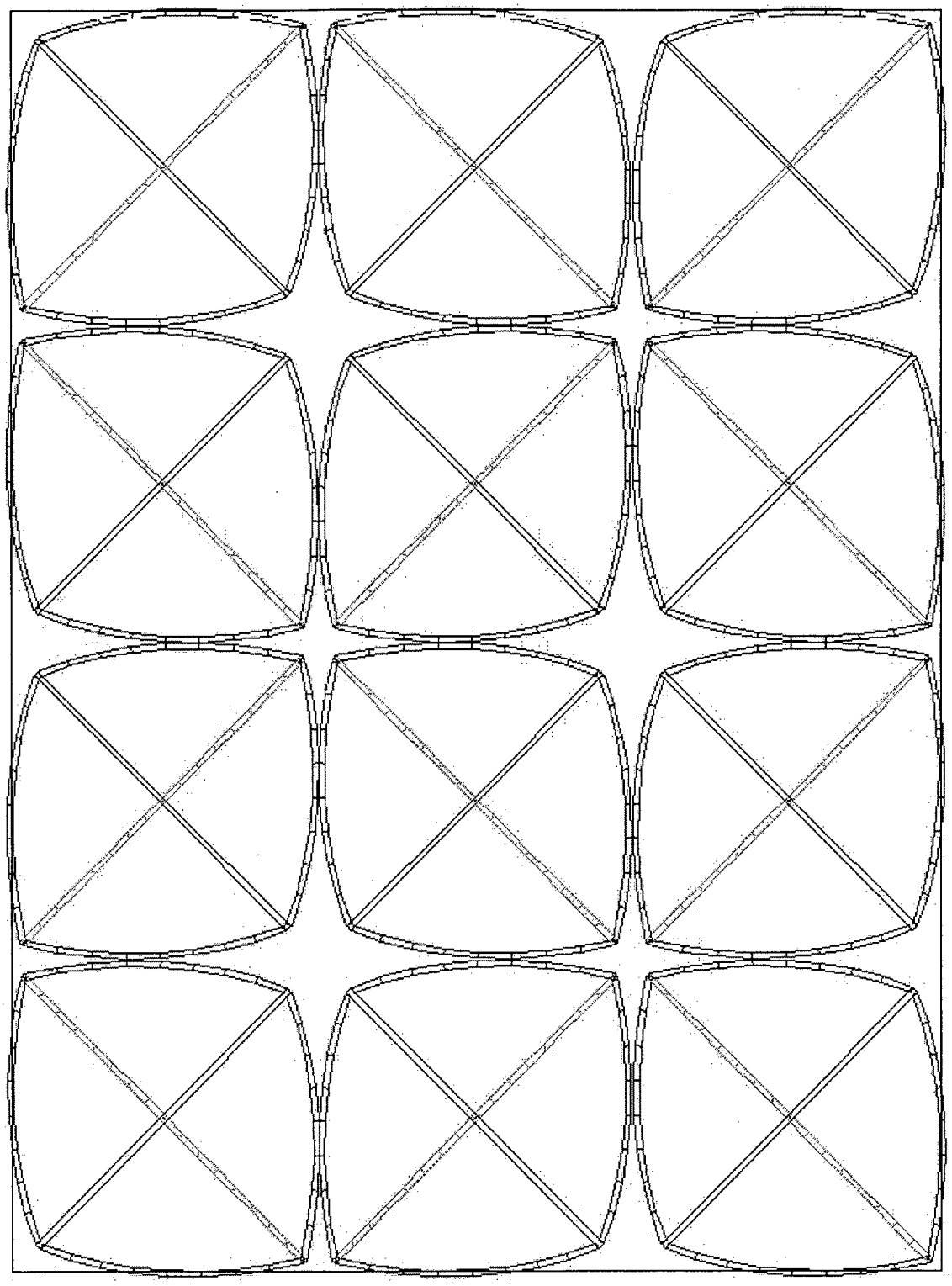

Figure 8

INTERNATIONAL SEARCH REPORT

International application No
PCT/PT2011/000045

A. CLASSIFICATION OF SUBJECT MATTER
INV. A63B41/08
ADD.

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)
A63B

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

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4 856 781 A (SHISHIDO HIDEOMI [JP] ET AL) 15 August 1989 (1989-08-15) column 4, line 50 - column 8, line 16; figures 1-8	1-10
A	WO 01/83047 A1 (MOLTEN CORP [JP]; ADIDAS INTERNAT B V [NL]; SHISHIDO HIDEOMI [JP]; DOB) 8 November 2001 (2001-11-08) page 1, line 20 - page 2, line 4; figure 14	1-10

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

☒ See patent family annex.

* Special categories of cited documents :

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
26 April 2012	07/05/2012

Name and mailing address of the ISA/	Authorized officer
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/PT2011/000045

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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