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(54) **THREE-DIMENSIONAL BRAIN TEASER**

(57) The invention pertains to toys, more specifically to mechanical three-dimensional brain teasers, which can be used for play and also as a training device for developing manual dexterity, a souvenir or an educational aid. The three-dimensional brain teaser is in the form of a body of revolution having three continuous grooves on the surface thereof, which are arranged symmetrically about the body of revolution and intersect at six points. Movable components capable of moving along one continuous groove and from one continuous groove into another are arranged in the continuous grooves. The points of intersection of the continuous grooves lie in three half planes, wherein the points of intersection of each pair of the three continuous grooves lie in the same half plane, and the sections of the continuous grooves arranged between said points of intersection contain an equal number of movable components, and the remaining two sections of each continuous groove, which are located between the points of intersection in the adjacent half planes, contain an unequal number of movable components.

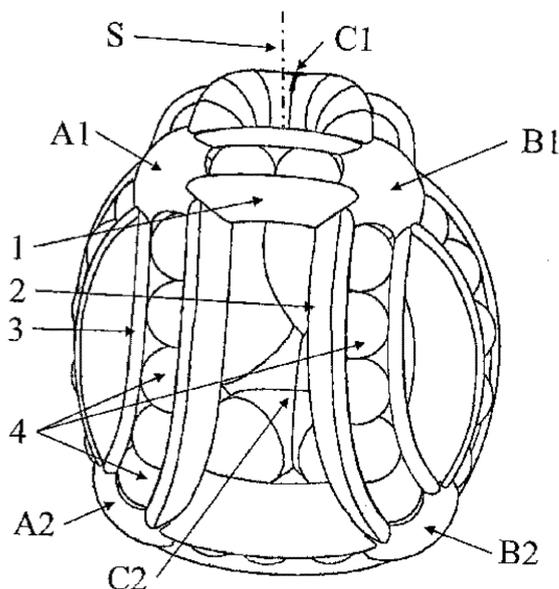


Fig. 1

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Description

[0001] The present invention pertains to toys, more specifically to mechanical three-dimensional brain teasers, and can be used for play and also as a training device for developing manual dexterity, a souvenir or an educational aid.

[0002] Brain teasers with movable components, arranged in a common housing and moving along the surface of shapes having various three-dimensional shapes are known from the prior art (PCT Application No. WO 97/26059 of July 24, 1997). The main drawback of such brain teasers is the simplified approach to the shaping of the playing surface and to the combinatorial game theory.

[0003] The brain teaser (PCT Application No. WO 8201322 of April 29, 1982), which comprises a spherical housing with annular grooves formed in it, which are arranged on large circles of the sphere in orthogonal planes and intersect at six points, while movable components capable of moving from one annular groove into another at the points of intersection of the annular grooves are arranged in the annular grooves, comes closest to the technical solution according to the present application.

[0004] The drawback of this technical solution is that for each movable component, there exists a second movable component, whose position depends on the position of the first one, which limits the combinatorial game theory.

[0005] The technical result ensured by the set of features mentioned is the broadening of the combinatorial game theory thanks to a change in the sequence of the mutual intersection of the continuous grooves and to the presence of an unequal number of movable components on different sections of the continuous groove, which are arranged between the points of intersection of the continuous grooves, as well as an improvement of the ergonomics of the toy due to the possibility of designing it in the form of different three-dimensional bodies of revolution, the fact that the movable components are provided with a relief, the prevention of jamming of the movable components and the reduction of the force required to move them.

[0006] An additional technical result is the simplification of the manufacture of the housing of the toy according to the casting method from a plastic due to the use of two types of housing parts, inner parts and outer parts, which are joined together during assembly along the surface formed by sliding of a straight line perpendicular to the direction of sliding along the trajectory of the continuous grooves.

[0007] The technical result is achieved in that the three-dimensional brain teaser has the shape of a body of revolution, on the surface of which three continuous grooves are formed, which intersect at six points of intersection, and movable components capable of moving along one continuous groove and from one continuous groove into another are arranged in the continuous grooves, and the

points of intersection of the continuous grooves are located in three half planes, and the points of intersection of each pair of three continuous grooves are located in one half plane, and the sections of the continuous grooves arranged between them contain an equal number of movable components, and the remaining two sections of each continuous groove, arranged between the points of intersection of the continuous grooves, which are located in adjacent half planes, contain an unequal number of movable components;
 5 and in that the movable components are made in the form of balls;
 as well as in that the half planes are defined by the axis of the body of revolution and are arranged symmetrically relative to it;
 10 as well as in that the body of revolution is made in the form of an ellipsoid;
 as well as in that one of the sections of each continuous groove, which contain an unequal number of movable components, contains an even number of movable components;
 15 as well as in that the continuous grooves are narrowed or closed at the points of intersection of the continuous grooves;
 20 as well as in that flexible components fixing the movable component are formed at the points of intersection;
 as well as in that star wheels, which are capable of rotating and are equipped with flexible fixing components, are installed at the points of intersection of the movable components adjoining the points of intersection of the continuous grooves;
 25 as well as in that a track, the coefficient of friction between which and the movable component is greater than the coefficient of friction between the movable components and the side surface of the continuous groove, is provided on the bottom of the continuous grooves;
 30 as well as in that a track with a toothed surface is formed on the bottom of the continuous grooves and depressions or notches interacting with the toothed surface of the track are formed on the surface of the movable components;
 35 as well as in that depressions forming a relief comprising geometric shapes, numerical or letter symbols are formed on the surface of the movable components;
 40 as well as in that the three-dimensional brain teaser contains three sets with identical numbers of movable component, each of which comprises movable components painted in the same color different from the color of the movable components of the other set, and it contains six movable components having a color different from the movable components in the sets;
 45 as well as in that the housing of the toy has a marking indicating one or more predetermined positions of the movable components;
 as well as in that the movable components have a graphic marking, and an analogous marking indicating the required position of the movable component is provided on the housing;
 50 as well as in that the housing of the brain teaser com-

prises two types of inner parts and three types of outer parts, which are joined together during the assembly of the toy along the surface formed by the sliding of a straight line perpendicular to the direction of sliding along the trajectory of the continuous grooves;
 as well as in that the outer parts of the housing of the brain teaser are transparent, while the inner ones are non-transparent or have a dull surface;
 as well as in that the housing of the brain teaser comprises three types of inner parts and three types of outer parts, which are joined together during the assembly of the toy along a surface formed by the sliding of a straight line perpendicular to the direction of sliding along the trajectory of the continuous grooves;
 as well as in that the outer parts of the housing of the brain teaser are transparent and the inner parts are non-transparent or have a dull surface.

[0008] The essence of the present invention is explained by the specification, schematic drawings and drawings, in which

Figure 1 shows an isometric view of a variant of the housing of the brain teaser;

Figure 2 shows a geometric (three-dimensional) schematic view of the structure of the trajectories of the continuous grooves of the brain teaser;

Figure 3 shows a three-dimensional sketch of a variant of the housing of the brain teaser in a cross section with the star wheels installed; and

Figure 4 and Figure 5 show schematic diagrams of variants of the assembly of the housing of the toy from inner and outer parts.

[0009] The three-dimensional brain teaser (Figure 1) is a body of revolution relative to the axis S, on the surface of which body three continuous grooves 1, 2, 3 are formed, in which movable components 4 (for example, balls) capable of moving both along one groove and from one continuous groove into other sites (points) of intersection of the continuous grooves are formed. The body of revolution may have different shapes, for example, the shape of an ellipsoid. The points of intersection of the continuous grooves A1, A2, B1, B2, C1, C2 are shown as covered points. Figure 2 shows a (three-dimensional) geometric view of the structure of the trajectories of the continuous grooves. The points of intersection of the continuous grooves are located in three half planes A, B, C, which may be defined by an axis of the body of revolution S and are arranged symmetrically relative to the axis S, i.e., they diverge from it at an angle of 120° relative to one another. The continuous grooves 1 and 3 intersect in half plane A at the points A1 and A2. The continuous grooves 1 and 2 intersect in the half plane B at the points B1 and B2. The continuous grooves 2 and 3 intersect in the half plane C at the points C1 and C2. The points of

intersection of each pair of the three continuous grooves are located in one half plane and the sections of the continuous grooves arranged between them, A1-A2, B1-B2 and C1-C2, contain equal numbers of movable components 4, while the two sections of each continuous groove, which are located between the points of intersection of the continuous grooves lying in the adjacent half planes contain unequal numbers of movable components 4, and one of these sections may contain an even number of movable components 4, while another section may contain an odd number of movable components 4. For example, the section of the continuous groove 1 lying between the points of intersection A1 and A2 contains a number of movable components 4 equal to those in the section of the continuous groove 1 lying between the points of intersection B1 and B2, while the section of the continuous groove 1 located between the points of intersection A1 and B1 contains a number of movable components 4 that is not equal to the number to those in the section of the continuous groove 1 lying between the points of intersection A2 and B2.

[0010] To improve the ergonomics (comfort of use), the sections of the continuous grooves 1, 2 and 3 arranged between the points of intersection of the continuous grooves lying in one half plane contain a greater number of movable components 4 than do the sections of the continuous grooves arranged between the points of intersection of the continuous grooves lying in the adjacent half planes. The sections with greater number of movable components 4 are most suitable for moving the movable components 4 in this case.

[0011] As the trajectories of the continuous grooves 1, 2, 3 are arranged along a three-dimensional curve not lying within the plane, this makes it possible for the continuous grooves 1, 2, 3 to be designed as grooves intersecting at right angles (or at an angle close to the straight angle) and to contain different numbers of movable components 4 on the sections of the continuous grooves 1, 2, 3 lying between the points of intersection of the continuous grooves. The intersection of the continuous grooves 1, 2, 3 at right angles creates the best conditions for the movement of the movable components 4, reducing the possibility of their jamming at the points of intersection of the continuous grooves 1, 2, 3.

[0012] In case the movable components 4 are designed in the form of balls, the width of the groove is reduced or the groove is designed as a closed groove in order to prevent them from falling out of the continuous grooves 1, 2 and 3 at the points of intersection of the continuous grooves.

[0013] Flexible components fixing the movable component 4 exactly at the point of intersection of the continuous grooves 1, 2, 3 may be installed to prevent jamming of the movable components 4 at the points of intersection of the continuous grooves 1, 2, 3. The flexible components may be components of the housing of the brain teaser or installed additionally in the housing.

[0014] Another variant of fixing the movable compo-

nents 4 in order to prevent their jamming at the points of intersection of the continuous grooves 1, 2, 3 provides for installation of star wheels 5 (Figure 3), which rotate during the movement of the movable components 4 (not shown in the figure) and rotate during the movement of the movable components 4 (not shown in the figure) and have a flexible component 6 of their own, which fixes them, at points located adjacent to the points of intersection of the continuous grooves 1, 2, 3. Thus, the star wheels 5 fix the movable components 4 located at points located adjacent to the points of intersection of the continuous grooves 1, 2, 3 and these, in turn, fix the movable components 4 located directly at the points of intersection of the continuous grooves 1, 2, 3.

[0015] In case the movable components 4 are in the form of balls, a track, whose surface has a coefficient of friction with the surface of the ball-shaped movable component 4 that is greater than the side surface [sic - Tr.Ed.] of the continuous grooves 1, 2, 3, may be provided on the bottom of the continuous grooves 1, 2, 3 for ease of movement of said balls. This is achieved by making the surface rough or by arranging strips of material having a coefficient of friction that is greater than that of the material from which the housing of the toy is made, e.g., rubber, on the bottom of the continuous grooves 1, 2, 3. To move the ball, it is necessary to press it in this case to the track, pushing it and causing it at the same time to perform a rotary motion in the direction of displacement. A track having a toothed surface may also be provided for this purpose on the bottom of the continuous groove 1, 2, 3, while depressions or notches interacting with the surface of the track and transforming the rotary motion applied to the ball 4 into a reciprocating motion of the ball 4 are provided on the surface of the balls 4. The track with the toothed surface may be recessed deep in the continuous groove, and the teeth may be arranged in the recessed part thereof, at the edges or over the entire width of the track. The depressions or notches are provided on the balls 4 such that the surface of one ball 4 cannot interact with the surface of another one.

[0016] In addition, a relief, comprising geometric shapes, numerical or letter symbols, may be provided on the surface of the movable components 4 by means of the depressions. In this case, the player will be able to use the toy "blindly," receiving information on the positions of the movable components 4 by touch.

Example of Operation of the Device

[0017] During the displacement of one of the movable components 4 located in the continuous groove 1, said movable component pushes the remaining movable components 4 located in the continuous groove 1, which leads to a displacement of the movable components 4 located in the continuous groove 1, and the movable components located at the points of intersection A1, A2, B1, B2 of the continuous groove 1 with the movable components 2 and 3 are replaced by the movable components

4 following them in the continuous groove 1.

[0018] Further, the movable components 4 located at the points of intersection B1 and B2 of the continuous groove 2 with the continuous groove 1 are replaced in the continuous groove and transferred into the continuous groove 2 during the displacement of the movable components 4 located in the continuous groove 2.

[0019] Thus, the movable components 4 moved from the continuous groove 1 into continuous groove 2 via the points of intersection B1 and B2.

[0020] The movable components 4 can be analogously moved in pairs from any continuous groove into the adjacent continuous groove.

[0021] The housing of the brain teaser may be assembled from two types of inner parts and three types of outer parts (Figure 4), one part I, three parts II, one part III, three parts IV and three parts V, i.e., from 11 parts. Parts IV and V are inner parts in this case and may be non-transparent or have a dull surface, while parts I, II and III are outer parts and may be transparent, which enables the player to see the arrangement of the balls 4 better. Provisions are made in another variant of manufacturing of the housing of the brain teaser for the presence of three types of inner parts and three types of outer parts (Figure 5), one part I, three parts II, one part III, one part IV, three parts V and one part VI, i.e., for assembling said housing from 10 parts. Parts IV, V and VI are inner parts in this case and may be non-transparent or have a dull surface, while parts I, II and III are outer parts and may be transparent, which enables the player to see the arrangement of the balls 4 better.

[0022] The inner and outer parts are joined together during assembly along the surface formed by the sliding of a straight line that is perpendicular to the direction of sliding along the trajectory of the continuous grooves, which makes it possible to avoid undercuts, to simplify the construction of the press mold and does not require additional tools for extracting the article from the press mold in case the parts are manufactured according to the molding) method from a plastic. In addition, to impart additional rigidity to the housing of the brain teaser, the points at which the inner parts are joined together may not coincide with the points at which the outer parts are joined together. The joining together of the housing may be accomplished by providing catches (not shown in the drawings) and/or adhesive or other means.

Combinatorial Theory

[0023] The trajectories of the continuous grooves 1, 2, 3 are arranged along a three-dimensional curve not lying in the plane, which makes it possible to arrange different numbers of movable components 4 on the sections of the continuous groove, which sections are arranged between the points of intersection of the continuous grooves 1, 2, 3, and thus makes it possible to broaden the combinatorial theory of the toy. In addition, the arrangement of different numbers of movable components 4 on the

sections of the continuous groove that are located between the points of intersection of the continuous grooves 1, 2, 3 makes it possible to eliminate the drawback inherent in the prior-art toys, namely, the presence of dependence of the positions of the movable components 4. For example, another movable component, which will always be located at the point that is diametrically opposite the point at which the first one is located will always correspond to each movable component in the closest analog cited, which reduces the combinatorial game theory. Any of the movable components 4 can be located at any point of the other movable components 4 in the technical solution according to the present application.

[0024] An uneven number of movable components 4 is arranged in each continuous groove in order to increase the number of game combinations.

[0025] One of the variants of designing the toy provides for the presence of three sets of painted movable components 4, and each set comprises movable components 4 painted in the same color different from the color of the movable components 4 of the other set, and additional six movable components 4 painted in a color different from the color of the movable components 4 in the sets. The player must arrange these six movable components 4 at the points of intersection of the continuous grooves, which additionally increases the complexity of solving the brain teaser.

[0026] The movable components 4 may also have a graphic marking comprising numerical, letter or other symbols (unique for each movable component or for the movable component in each set of movable components), and an analogous marking indicating the required position of the movable component 4 is provided on the housing of the brain teaser in order to increase the combinatorial game theory.

[0027] In order to improve understanding of the task to be solved by the player, the housing of the toy may have a marking indicating one or more predetermined required positions of the movable components 4.

Claims

1. Three-dimensional brain teaser in the form of a body of revolution, on the surface of which three continuous grooves intersecting at six points are formed, and movable components capable of moving along one continuous groove and from one continuous groove into another are arranged in the continuous grooves, **characterized in that** the points of intersection of the continuous grooves are located in three half planes, and the points of intersection of each pair of three continuous grooves are located in one half plane and the sections of the continuous grooves arranged between said points of intersection contain an equal number of movable components, while the remaining two sections of each continuous groove, which are located between adjacent

half planes, contain an unequal number of movable components.

2. Three-dimensional brain teaser of claim 1, **characterized in that** the movable components are ball-shaped.
3. Three-dimensional brain teaser of claims 1 and 2, **characterized in that** the half planes are defined by the axis of the body of revolution and are arranged symmetrically relative to it.
4. Three-dimensional brain teaser of claims 1 and 2, **characterized in that** the body of revolution is in the form of an ellipsoid.
5. Three-dimensional brain teaser of claims 1 and 2, **characterized in that** one of the sections of each continuous groove containing an unequal number of movable components contains an even number of movable components and another section contains an uneven number of movable components.
6. Three-dimensional brain teaser of claim 2, **characterized in that** the continuous grooves are narrowed or closed at the points of intersections.
7. Three-dimensional brain teaser of claims 1 and 2, **characterized in that** flexible components fixing the movable component are provided at the points of intersection of the continuous grooves.
8. Three-dimensional brain teaser of claims 1 and 2, **characterized in that** star wheels, which are capable of rotating and are equipped with flexible fixing components, are installed at the sites at which the movable components located adjacent to the points of intersection of the continuous grooves are arranged.
9. Three-dimensional brain teaser of claim 2, **characterized in that** a track, the coefficient of friction between which and the movable component is greater than the coefficient of friction between the movable component and the side surface of the continuous groove, is provided on the bottom of the continuous grooves.
10. Three-dimensional brain teaser of claim 2, **characterized in that** a track with a toothed surface is provided on the bottom of the continuous grooves, while depressions or notches interacting with the toothed surface of the track are provided on the surface of the movable components.
11. Three-dimensional brain teaser of claims 1 and 2, **characterized in that** depressions forming a relief of geometric shapes, numerical or letter symbols are

provided on the surface of the movable components.

12. Three-dimensional brain teaser of claims 1 and 2, **characterized in that** it comprises three sets with identical numbers of movable components, each of which comprises movable components painted in the same color different from the color of the movable components of another set, and it additionally contains six movable components having a color different from the color of the movable components in the sets. 5
10
13. Three-dimensional brain teaser of claims 1 and 2, **characterized in that** the housing of the toy has a marking indicating one or more predetermined positions of the movable components. 15
14. Three-dimensional brain teaser of claims 1 and 2, **characterized in that** the movable components have a graphic marking, and an analogous marking indicating the required position of the movable components is provided on the housing, 20
15. Three-dimensional brain teaser of claims 1 and 2, **characterized in that** the housing of the brain teaser comprises two types of inner parts and three types of outer parts joined together during the assembly of the brain teaser along a surface formed by the sliding of a straight line that is perpendicular to the direction of sliding along the trajectory of the continuous grooves. 25
30
16. Three-dimensional brain teaser of claim 15, **characterized in that** the outer parts of the housing of the brain teaser are transparent and the inner parts are non-transparent or have a dull surface. 35
17. Three-dimensional brain teaser of claims 1 and 2, **characterized in that** the housing of the brain teaser comprises three types of inner parts and three types of outer parts, which are joined together during the assembly of the brain teaser along a surface formed by the sliding of a straight line that is perpendicular to the direction of sliding along the trajectory of the continuous grooves. 40
45
18. Three-dimensional brain teaser of claim 17, **characterized in that** the outer parts of the housing of the brain teaser are transparent and the inner parts are non-transparent or have a dull surface. 50

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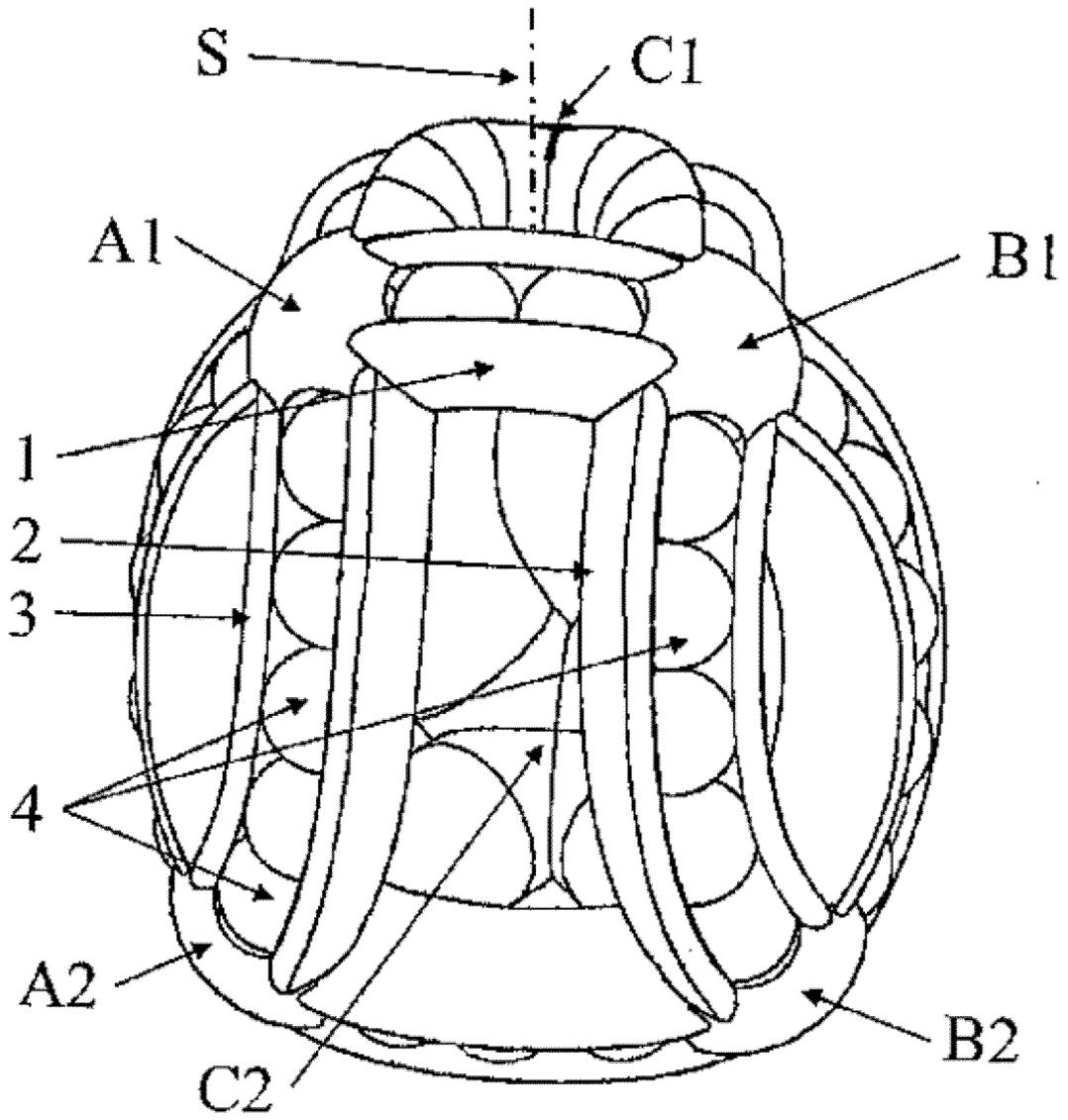


Fig. 1

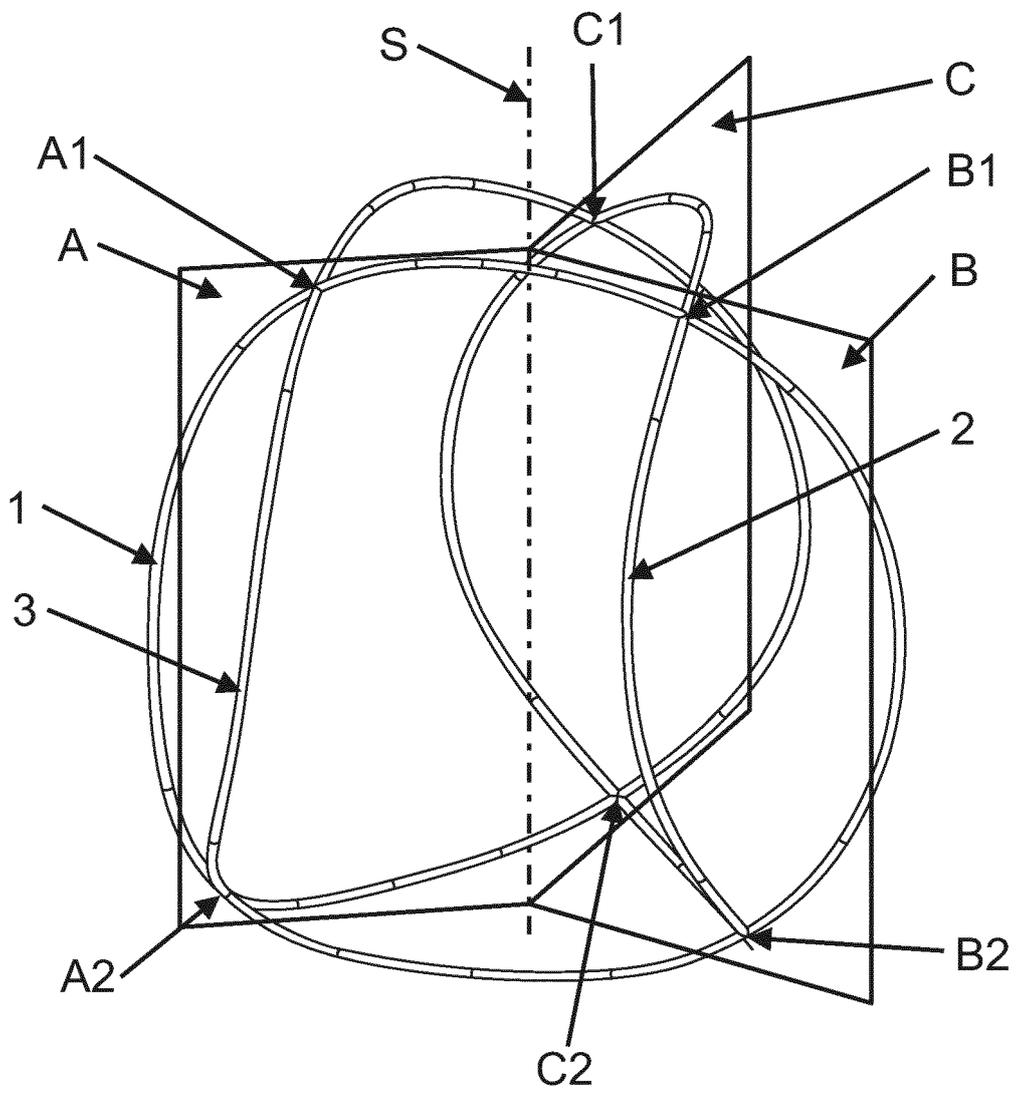


Fig. 2

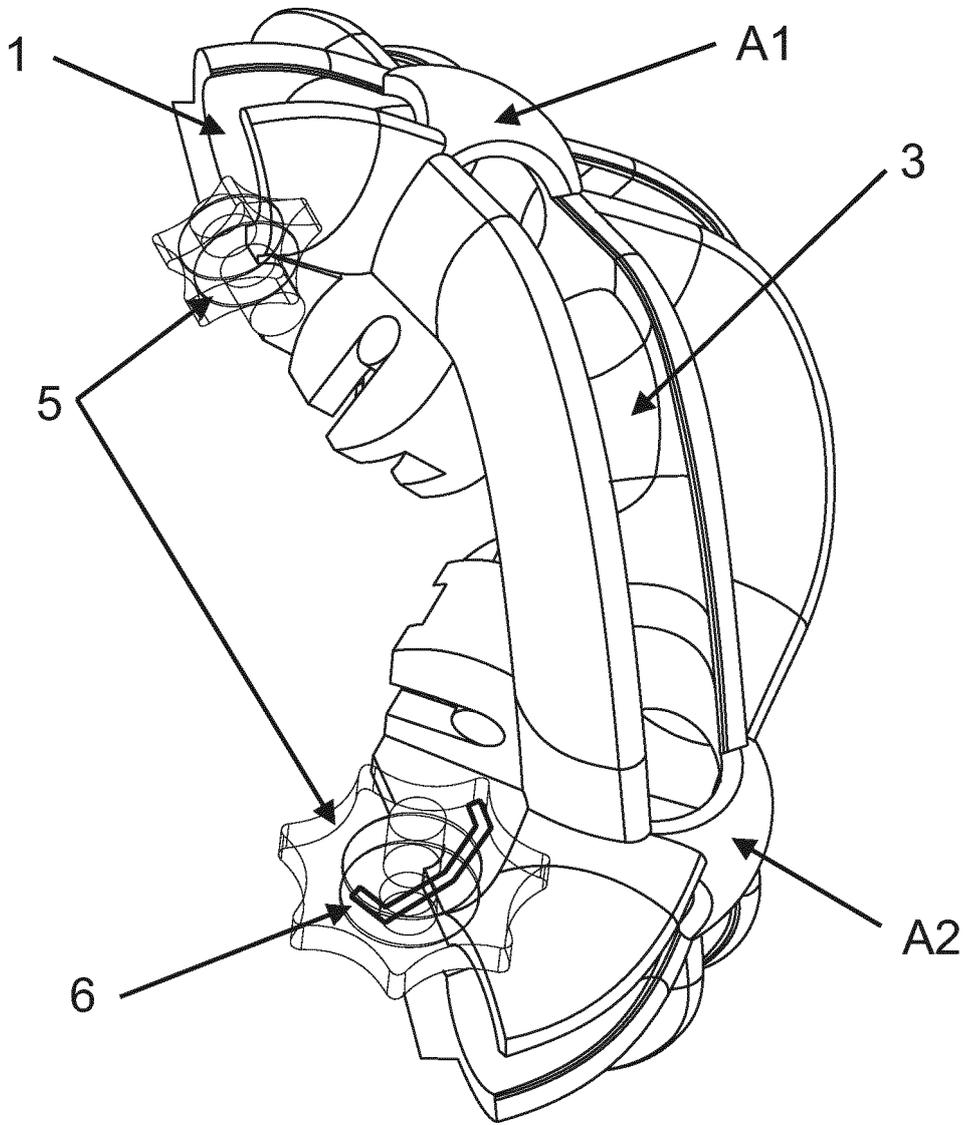


Fig. 3

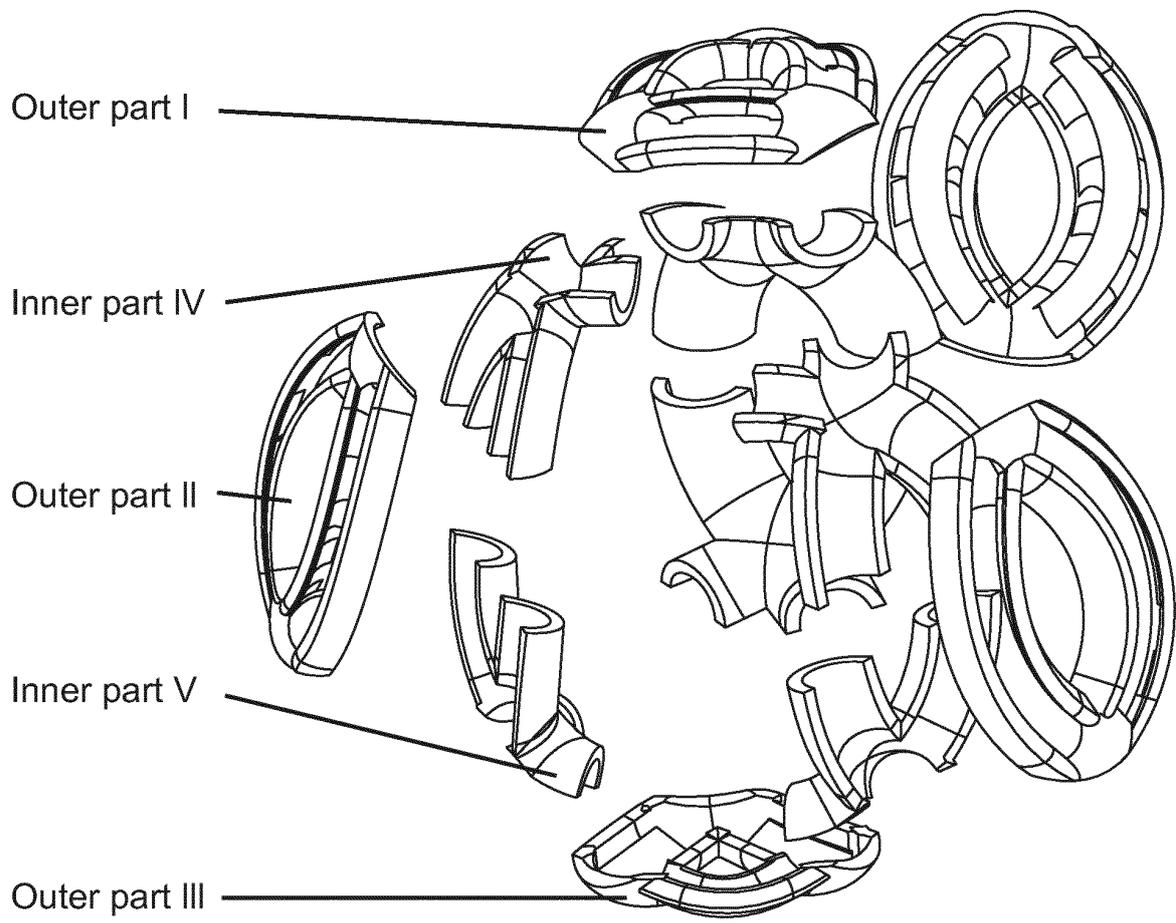


Fig. 4

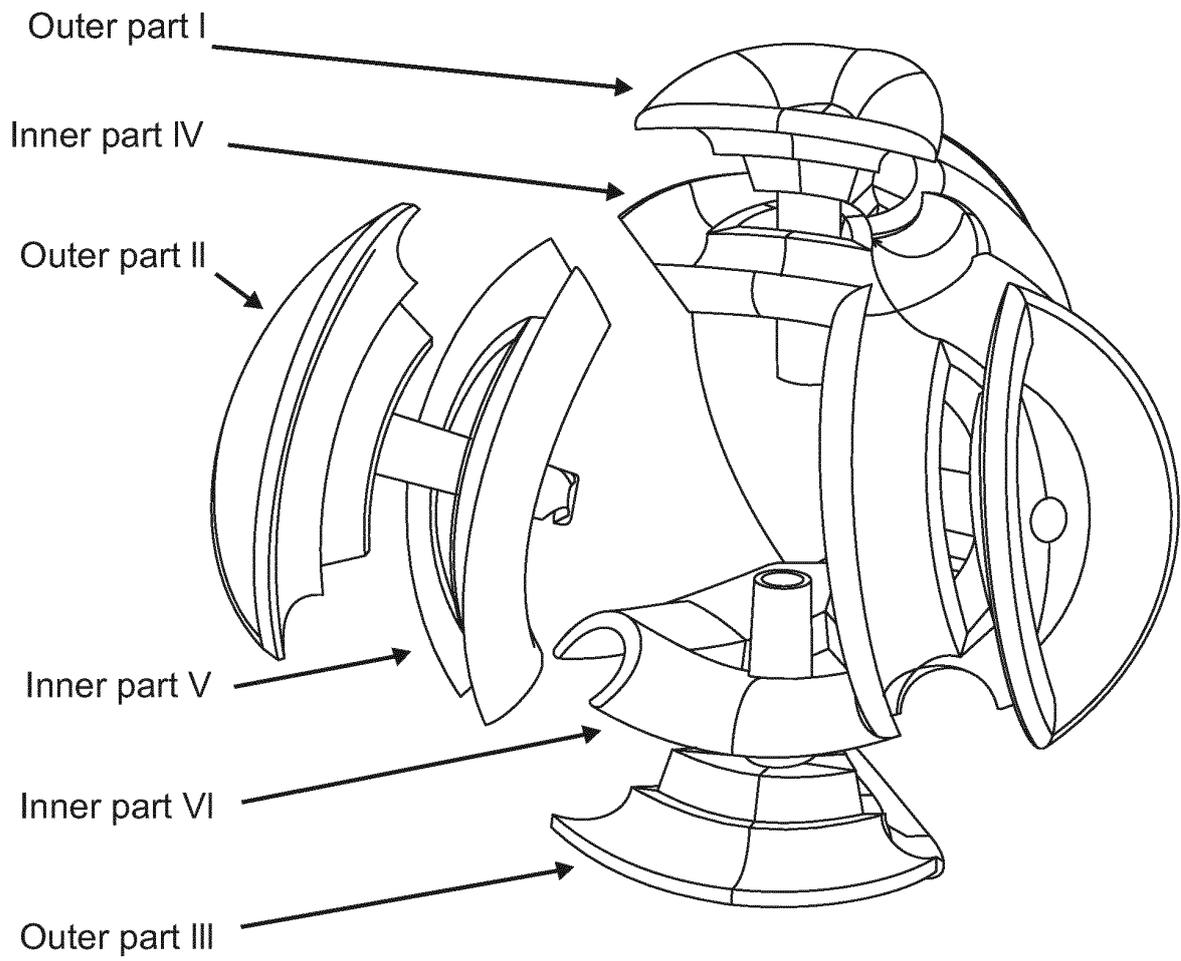


Fig. 5

INTERNATIONAL SEARCH REPORT

International application No. PCT/RU 2012/000523

A. CLASSIFICATION OF SUBJECT MATTER		
A63F 9/08 (2006.01) A63B 23/16 (2006.01)		
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) A63F 9/00-9/34, A63B 23/16		
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 practicable, search terms used) PATSEARCH, ESP@CENET, RUPAT, USPTO		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	SU 1480835 A1 (VSESOYUZNYI NAUCHNO-ISSLEDOVATESLKII INSTITUT TEKHNOLOGII NASOSNOGO MASHINOSTROENIYA) 23.05.1989	1-18
A	RU 2015721 C1 (MANTASHYAN PAVEL NIKOLAEVICH) 15.07.1994	1-18
A	RU 2051731 C1 (BRAUN VLADIMIR GENRIKHOVICH) 10.01. 1996	1-18
A	US 2005/0230908 AI (FELIX-ABDON PEREZ GABEZA H up.) 20.10.2005	1-18
<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input type="checkbox"/> See patent family annex.		
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Date of the actual completion of the international search 12 October 2012 (12.10.2012)		Date of mailing of the international search report 09 November 2012 (09.11.2012)
Name and mailing address of the ISA/ Facsimile No.		Authorized officer Telephone No.

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Patent documents cited in the description

- WO 9726059 A [0002]
- WO 8201322 A [0003]