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(54) **Toy of compound curved surfaces.**

(57) An elastic toy ball (1) made up of a plurality of curved surfaces, the contour of which is defined by four convex spherical surfaces (21, 22, 23, 24) or four small spheres of equal or different radius, a plurality of concave curved surfaces (3a, 3b, 3c, 3d) connecting the four convex spherical surfaces and six saddle portions (41, 42, 43, 44, 45, 46).

The elastic toy ball of a peculiar shape according to the present invention has the various advantages as follows:

(1) the ball can be caught by one hand of a little children because of the presence of the concave surfaces, (2) the ball does not roll on excessively because of its peculiar shape, (3) the ball rotates or bounds in various directions at random because of its peculiar shape, (4) the ball can be used as sport goods for an old person or as rehabilitation apparatus for a physically-handicapped person, (5) the ball can be used as building blocks.

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DESCRIPTION

Field of the Invention

The present invention relates generally to a toy made up of compound curved surfaces and more specifically to an irregularly-bounding elastic toy ball made up of a plurality of curved surfaces which is especially suitable for little children.

Description of the Prior Art

The background of the present invention will be explained with respect to its application to a toy ball usually used for little children.

As is well-known, there are various spherical or oval (Rugby) toy balls with which little children can play. These toy balls are usually made of foamed plastic resin or by blowing air into a spherical capsule made of polyvinyl chloride, so as not to bound excessively from the standpoint of safety.

However, in the case when a little child who can only walk on hands and legs plays with a prior-art toy ball, since his hand is small and additionally the ball is spherical or oval in shape, there exist some shortcomings as follows:

(1) When a little child catches the ball by one hand or both hands and then holds it on his breast, the ball easily bounds out of his hands or his breast, dropping

onto the ground.

(2) Especially when he tries to throw the ball, he must first raise his hands by which the ball is caught before throwing it. However, since he cannot hold the ball securely, he tends to drop it soon.

(3) The ball easily rolls on to a far distance and therefore he losts sight of the ball. As a result, he losts his interest in playing with the ball.

(4) Since the rotating motion of the ball is simple, he gets soon tired of playing with the ball.

SUMMARY OF THE INVENTION

With these problems in mind, therefore, it is the primary object of the present invention to provide an elastic toy ball of a peculiar shape having the following advantages:

(1) Since the toy ball is made up of a plurality of concave curved surfaces, a little child can easily catch it by one hand or hold it on his breast securely.

(2) Since the shape is not simply spherical or oval and therefore the ball does not roll on to a far distance, a little child can pick up it soon without losting sight of the ball.

(3) Since the toy ball rotates or bounds in various directions at random, the rotating motion of the ball is interesting to a little child.

(4) When the elasticity and the size of the ball are appropriately designed, the toy ball can also be used

when a grown-up person or an old person takes exercise or when a physically-handicapped person is rehabilitated.

(5) When a plurality of toy balls are piled up one after another, it is possible to use these balls as building blocks.

To achieve the above-mentioned object, the elastic toy ball of compound curved surfaces according to the present invention has a peculiar shape the contour of which comprises at least four convex spherical surfaces defined as the portions of the surfaces of at least four spheres, the centers of which are disposed at points around a center of the toy ball, and a plurality of concave curved surfaces connecting the at least four convex spherical surfaces. In the most standard shape, the contour of the elastic toy ball of compound curved surfaces comprises four convex spherical surfaces defined as the portions of the surfaces of four first spheres of equal radius, the centers of which define a regular tetrahedron, and a plurality of concave spherical surfaces connecting the four convex spherical surfaces and defined by trace of the portion of the surface of a second sphere, the radius of which is twice or more greater than that of the first sphere, between points tangent to the first spheres, when the second sphere is rotated about the first spheres while remaining tangent to at least any two of the four first spheres.

BRIEF DESCRIPTION OF THE DRAWINGS

The features and advantages of the elastic toy ball of compound curved surfaces according to the present invention will be more clearly appreciated from the following description of the preferred embodiments of the invention taken in conjunction with the accompanying drawings in which like reference numerals designate the same or similar elements or sections throughout the figures thereof and in which;

Fig. 1(A) is a perspective view of an exemplary embodiment of the elastic toy ball of compound curved surfaces according to the present invention;

Fig. 1(B) is a perspective view of a regular tetrahedron for assistance in explaining the shape of the elastic toy ball of compound curved surfaces according to the present invention;

Fig. 1(C) is a perspective view of a four spheres arranged at four apexes of a regular tetrahedron shown in Fig. 1(B) for assistance in explaining the shape of the elastic toy ball of compound curved surfaces according to the present invention;

Fig. 2(A) is a perspective view of a first embodiment of the elastic toy ball of compound curved surfaces according to the present invention, in which four spheres are mutually tangent to each other;

Fig. 2(B) is a top view of the first embodiment of the elastic toy ball of compound curved surfaces according to the present invention shown in Fig. 2(A);

Fig. 2(C) is a top view, partly in section taken along the line C-C shown in Fig. 2(A), of the first embodiment of the elastic toy ball of compound curved surfaces according to the present invention;

Fig. 2(D) is a top view, partly in section taken along the line C-C shown in Fig. 2(A), of the first embodiment of the elastic toy ball of compound curved surfaces according to the present invention;

Fig. 3(A) is a perspective view of a second embodiment of the elastic toy ball of compound curved surfaces according to the present invention, in which four spheres are mutually separated from each other;

Fig. 3(B) is a top view of the second embodiment of the elastic toy ball of compound curved surfaces according to the present invention shown in Fig. 3(A);

Fig. 4(A) is a perspective view of a third embodiment of the elastic toy ball of compound curved surfaces according to the present invention; in which four spheres are mutually overlapped with each other; and

Fig. 4(B) is a top view of the third embodiment of the elastic toy ball of compound curved surfaces according to the present invention shown in Fig. 4(A).

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

In view of the above description, reference is now made to a first embodiment of an elastic toy ball made up of a plurality of curved surfaces according to the present invention.

Fig. 1(A) shows a perspective view of a first embodiment of the present invention.

The elastic toy ball 1 is made up of a plurality of curved surfaces, that is, four convex spherical portions 21, 22, 23 and 24 of four small spheres of equal radius, four concave spherical portions 3a, 3b, 3c and 3d of four large spheres of equal radius, and six saddle portions 41, 42, 43, 44, 45 and 46. The centers of the four small spheres define a regular tetrahedron. The four concave spherical portions are defined, respectively, when one of the four large spheres is tangent to three of the four small spheres. The six saddle portions are defined by the trace of the portion of the surface of the large sphere, between points tangent to the small spheres, when the large sphere is rotated about the small spheres while remaining tangent to two of the small spheres.

Further, the elastic toy ball according to the present invention is made of foamed plastic such as foamed urethane.

The shape of the elastic toy ball shown in Fig. 1(A) is described in more detail hereinbelow.

Fig. 1(B) shows a regular tetrahedron 100, the apexes of which are labeled O_1, O_2 and O_3. In the figure, the labels O_0 denotes a center of the regular tetrahedron 100 or the elastic toy ball of the present invention. First, the relationship between the segment $O_1 O_2 = L$ (the side of each triangular surface of the tetrahedron) and the segment $O_0 O_1 = \ell$ (the distance from the center to each apex of the tetrahedron) is calculated, because this relationship is important in this invention as described later.

Since the segment O_1A can be expressed as follows:

$$O_1A = \sqrt{O_1O_2^2 - O_2A^2} = \sqrt{L^2 - \frac{L^2}{4}} = \frac{\sqrt{3}}{2} L$$

the segment O_1B (the height of the tetrahedron) can be obtained as follows:

$$O_1B = \sqrt{O_1A^2 - (\frac{AO_4}{3})^2} = \sqrt{\frac{3L^2}{4} - \frac{L^2}{12}} = \sqrt{\frac{2L^2}{3}} = \frac{\sqrt{6}L}{3}$$

Therefore, the segment $O_1O_0 = \ell$ can be expressed by L:

$$\ell = O_1O_2 = \frac{2}{3} \times O_1B = \frac{2\sqrt{6}}{9}L$$

To form the four convex spherical portions 21, 22, 23, and 24, four small spheres 21', 22', 23' and 24' of equal radius r are located at each apex of a regular tetrahedron 100, as depicted in Fig. 1(C). In other words, the centers O_1, O_2, O_3 or O_4 of the four small spheres are located an equal distance $\underline{\ell}$ away from the center O_0 in such a way that the six angles subtended by the segments O_0O_1 and O_0O_2, the segment O_0O_1 and O_0O_3, the segments O_0O_1 and O_0O_4, the segments O_0O_2 and O_0O_3, the segments O_0O_2 and

O_0O_4, and the segments O_0O_3 and O_0O_4 are all 120 degrees, respectively.

Further, the four small spheres of a small radius r are located so as to be tangent to each other. Therefore, the segment $O_1O_2(L)$ is 2r or equal to the diameter D of the small spheres and the relationship between the segment $O_1O_2(L)$ and the segment $O_0O_1(\ell)$ can be expressed as follows:

$$\ell = \frac{2\sqrt{6}}{9} D = \frac{4\sqrt{6}}{9} r \quad (\because D = 2r)$$

As depicted in Fig. 1(C), it is also possible to consider that the four small spheres 21', 22', 23' and 24' of a small radius r are located so as to be tangent to each triangular surface of a larger tetrahedron 200, and the four convex spherical portions 21, 22, 23, and 24 are the portions of the surfaces of four small spheres 21', 22', 23' and 24', which are enclosed by each apex portion of the larger tetrahedron 200.

To facilitate the understanding of the complicated contours of the elastic toy ball according to the present invention, each portion of the compound curved surfaces are explained hereinafter in conjunction with the regular tetrahedron 100.

In Fig. 1(C), the numeral 1 denotes the first edge segment O_1O_3 of the small regular tetrahedron 100; the numeral 2 denotes the second edge segment O_1O_2 thereof; the numeral 3 denotes the third edge segment O_1O_4 thereof; the numeral 4 denotes the fourth edge segment O_2O_4 thereof; the numeral 5 denotes the fifth edge segment O_3O_4 thereof; the numeral 6 denotes the sixth edge segment O_2O_3 thereof.

Further, the label a denotes the first triangular surface of the regular tetrahedron 100 defined by three edge segments 1, 3 and 5; the label b denotes the second triangular surface defined by three segments 1, 2 and 6; the label c denotes the third triangular surface defined by three segments 2, 3 and 4; the label d denotes the fourth triangular surface defined by three segments 4, 5 and 6.

Therefore, with reference to Fig. 1(A) and Fig. 1(C), the first concave spherical portion 3a corresponds to the first triangular surface a of the regular tetrahedron 100; the second concave spherical portion 3b corresponds to the second triangular surface b of the regular tetrahedron 100; the third concave spherical portion 3c corresponds the third triangular surface c of the regular tetrahedron 100; the fourth concave spherical portion 3d corresponds the fourth triangular surface d of the regular tetrahedron 100.

Further, the first saddle portion 41 corresponds to the first edge segment 1 of the regular tetrahedron 100; the second saddle portion 42 corresponds to the second edge segment 2 of the regular tetrahedron 100; the third saddle portion 43 corresponds to the third edge segment 3 of the regular tetrahedron 100; the fourth saddle portion 44 corresponds to the fourth edge segment 4 of the regular tetrahedron 100; the fifth saddle portion 45 corresponds to the fifth edge segment 5 of the regular tetrahedron 100; the six saddle portion 46 corresponds to the sixth edge segment 6 of the regular tetrahedron 100.

With reference to Fig. 1(A) and Figs. 2(A) and (B), the four concave spherical portions 3a, 3b, 3c and 3d are defined as follows:

The first concave spherical portion 3a is defined as the portion of the surface of a large sphere 31, the radius R of which is twice or more greater than that r of the small sphere 21', when the large sphere 31 is located so as to be tangent to the three small spheres 21', 23' and 24' at three points, respectively, at the same time.

The second concave spherical portion 3b is defined as the portion of the surface of a large sphere 31, the radius R of which is twice or more greater than that r of the small sphere 21', when the large sphere 31 is located so as to be tangent to the three small spheres 21', 22' and 23' at three points, respectively, at the same time.

The third concave spherical portion 3c is defined as the portion of the surface of a large sphere 31, the radius R of which is twice or more greater than that r of the small sphere 21', when the large sphere 31 is located so as to be tangent to the three small spheres 21', 22' and 24' at three points, respectively, at the same time.

The fourth concave spherical portion 3d is defined as the portion of the surface of a large sphere 33, the radius R of which is twice or more greater than that r of the small sphere 21', when the large sphere 31 is located so as to be tangent to the three small spheres 22', 23' and 24' at three points, respectively, at the same time.

In summary, four concave spherical portion 3a, 3b, 3c and 3d are defined as the portion of the surface of a large sphere located so as to be tangent to three spheres corresponding to four triangular surfaces of the regular tetrahedron 100, respectively, at the same time.

In the same way, the six saddle portions 41, 42, 43, 44, 45 and 46 are defined as follows:

The first saddle portion 41 is defined by the trace of the portion of the surface of a large sphere 31, the radius R of which is twice or more greater than that r of the small sphere 21' or 23', when the large sphere 31 is located so as to be tangent to the two small spheres 21' and 23' at two points, respectively, and then rotated about the first small sphere 21' or 23' while remaining tangent to the two points.

The second saddle portion 42 is defined by the trace of the portion of the surface of a large sphere 31, the radius R of which is twice or more greater than that r of the small sphere 21' or 22', when the large sphere 31 is located so as to be tangent to the two small spheres 21' and 22' at two points, respectively, and then rotated about the first small sphere 21' or 22' while remaining tangent to the two points.

The third saddle portion 43 is defined by the trace of the portion of the surface of a large sphere 31, the radius of which is twice or more greater than that r of the small sphere 21' or 24', when the large sphere 31 is located so as to be tangent to the two small spheres 21' and 24' at two points, respectively, and then rotated about the first sphere 21' or 24' while remaining tangent to the two points.

The fourth saddle portion 44 is defined by the trace of the portion of the surface of a large sphere, the radius of which is twice or more greater than that r of the small sphere 22' or 24', when the large sphere is located so as to be tangent to the two small spheres 22' and 24' at two points, respectively, and then rotated about the second sphere 22' or 24' while remaining tangent to the two points.

The fifth saddle portion 45 is defined by the trace of the portion of the surface of a large sphere, the radius R of which is twice or more greater than that r of the small sphere 23' or 24', when the large sphere is located so as to be tangent to the two small spheres 23' and 24' at two points, respectively, and then rotated about the small sphere 23' or 24' while remaining tangent to the two points.

The sixth saddle portion 46 is defined by the trace of the portion of the surface of a large sphere, the radius R of which is twice or more greater than that r of the small sphere 22' or 23', when the large sphere is located so as to be tangent to the two small spheres 22' and 23' at two points, respectively, and then rotated about the small sphere 23' or 24' while remaining tangent to the two points.

The sixth saddle portion 46 is defined by the trace of the portion of the surface of a large sphere, the radius R of which is twice or more greater than that r of the small sphere 22' or 23', when the large sphere is located so as to be tangent to the two small spheres 22' and 23' at two points, respectively, and then rotated about the small spheres 22' or 23' while remaining tangent to the two points.

In summary, the six saddle portions 41, 42, 43, 44, 45 and 46 are defined by the trace of the portion of the surface of a large sphere, between points tangent to the small spheres, when the large sphere is rotated about the small spheres while remaining tangent to the two points.

Furthermore, the above-mentioned four concave spherical portions 3a, 3b, 3c and 3d and the six saddle portions 41, 42, 43, 44, 45 and 46 can be defined at the same time as follows:

In Fig. 2(A), the large sphere, the radius R of which is twice or more greater than the radius r of the small sphere, is rotated about the first small sphere 21' while remaining tangent to at least any two of the other small spheres 22', 23' and 24'. In this case, when the large sphere is tangent to the first small sphere 21' and any one of the small spheres 22', 23', and 24', the saddle portions 41, 42 and 43 are defined; when the large sphere is tangent to the first small sphere 21' and any two of the small spheres 22', 23' and 24', the concave spherical portions 3a, 3b and 3c are defined.

In the same way, the large sphere, the radius R of which is twice or more greater than the radius r of the small sphere is rotated about the second small sphere 22' while remaining tangent to at least any two of the other small spheres 21', 23' and 24'. In this case, when the large spere is tangent to the second small sphere 22' and any one of the small spheres 21', 23' and 24', the saddle portions 42, 44 and 46 are defined; when the large sphere is tangent to the second small sphere 22' and any two of the small spheres 21', 23' and 24', the concave spherical portions 3b, 3c, and 3d are defined.

In the same way, the large sphere, the radius R of which is twice or more greater than the radius r of the small sphere, is rotated about the third small sphere 23' while remaining tangent to at least any two of the other small spheres 21', 22' and 24'. In this case, when the large sphere is tangent to the third small sphere 23' and any one of the small spheres 21', 22' and 24' the saddle portions 41, 45 and 46 are defined; when the large sphere is tangent to the third small sphere 23' and any two of the small spheres 21', 22' and 24', the concave spherical portions 3a, 3b, and 3d are defined.

In the same way, the large sphere, the radius R of which is twice or more greater than the radius r of the small sphere, is rotated about the fourth small sphere 24' while remaining tangent to at least any two of the other small spheres 21', 22' and 23'. In this case, when the large sphere is tangent to the fourth small sphere 24' and any one of the small spheres 21', 22' and 23', the saddle portions 43, 44, and 45 are defined; when the large sphere is tangent to fourth sphere 24' and any two of the small spheres 21', 22' and 23', the concave spherical portions 3a, 3c and 3d are defined.

Further, Fig. 2(B) shows a top view of the first embodiment of the elastic toy ball according to the present invention, by which the four concave spherical portions 3a, 3b, 3c and 3d and the six saddle portions 41, 42, 43, 44, 45 and 46 corresponding to the four triangular surfaces a, b, c and d and the six edge segments 1, 2, 3, 4, 5 and 6 of the regular tetrahedron 100, respectively, may be understandable more clearly.

Fig. 2(C) shows a cross-sectional view taken along the line C-C shown in Fig. 2(A), in which the first, second and third concave spherical portions 3a, 3b and 3c and the first, second and third saddle portions 41, 42 and

43 are depicted.

Figs. 2(D) shows a cross-sectional view taken along the line D-D shown in Fig. 2(A), in which the first, second and third concave spherical portions 3a, 3b and 3c and the first, second and third saddle portion 41, 42 and 43 are depicted in the shape different from that shown in Fig. 2(C).

Fig. 3(A) shows a second embodiment of the elastic toy ball made up of a plurality of curved surfaces according to the present invention. In this embodiment, the relationship between the segments L (the side length of the triangular surfaces of a regular tetrahedron) or the segment ℓ (the distance from the center O_0 to the centers of four small spheres) and the radius r of the small sphere is as follows:

$$\ell = \frac{2\sqrt{6}}{9}L > \frac{4\sqrt{6}}{9}r \text{ or } L > 2r$$

That is to say, four small spheres 21', 22', 23' and 24' are mutually separated from each other.

Fig. 3(B) shows the top view of the second embodiment of the elastic toy ball according to the present invention shown in Fig. 3(A).

Fig. 4(A) shows a third embodiment of the elastic toy ball made up of a plurality of curved surfaces according to the present invention. In the embodiment, the relationship between the segment L (the side length of the triangular surface of a regular tetrahedron) or the segment ℓ (the distance from the center O_0 to the centers of four small spheres) and the radius r of the small sphere is as follows:

$$\ell = \frac{2\sqrt{6}}{9}L < \frac{4\sqrt{6}}{9}r \text{ or } L < 2r$$

That is to say, four small spheres 21', 22', 23' and 24' are mutually overlapped with each other.

Fig. 4(B) shows the top view of the third embodiment of the elastic toy ball according to the present invention shown in Fig. 4(A).

Description has been made of the case where four spheres are disposed at each apex of a regular tetrahedron and the portions of the surfaces of the four spheres are connected by a plurality of concave spherical surfaces by way of example.

However, without being limited to the case described hereinabove, it is possible to embody the elastic toy ball of compound curved surfaces according to the present invention by disposing five spheres at each apex of a regular pentahedron, six spheres at each apex of a regular hexahedron or a plurality of spheres at each apex of polyhedron.

Further, description has been made of the case where four spheres are disposed at each apex of a regular tetrahedron; however, it is also possible to embody the elastic toy ball according to the present invention by disposing a plurality of spheres at each apex of irregular polyhedron.

Further, description has been made of the case where four spheres of equal radius are disposed at each apex of a regular tetrahedron; however, it is also possible to embody the elastic toy ball according to the present invention by disposing a plurality of spheres of different radiuses at each apex of a regular or an irregular polyhedron.

Further, description has been made of the case where the portions of the surfaces of the four spheres are connected by a plurality of concave spherical surfaces by way of example; however, it is also possible to embody the elastic toy ball according to the present invention by connecting the spheres by a plurality of non-spherical concave surfaces.

Further, when the spheres are colored by different colours, since the color of the toy ball changes continuously when the toy ball is rotating, a little children has an interest in playing with the toy ball according to the present invention.

Furthermore, when the shape and the elasticity are appropriate, it is possible to use this toy ball according to the present invention as sport goods suitable for an old person or as a rehabilitation apparatus for a physically-handicapped person.

As described above, in the elastic toy ball made up of a plurality of curved surfaces according to the present invention, since a plurality of spheres are disposed at each apex of a polyhedron and the portions of the surfaces of the spheres are connected by a plurality of concave surfaces, there exist many advantages as follows:

(1) Its shape is not simply spherical or oval, so that a little child can readily catch it by one hand or hold it on his breast.

(2) It does not roll on excessively to a distance, so that a little child does not lost sight of the ball.

(3) It rotates or bounds in various directions at random, so that a little child has an interest in its complicated motion.

(4) Its size and elasticity can be changed freely, so that an old person or a physically-handicapped person can use it as sport goods or rehabilitation apparatus.

(5) The ball can be piled up one after another, so that it is possible to use it as building blocks in addition to the use as a toy ball.

It will be understood by those skilled in the art that the foregoing description is in terms of preferred embodiments of the present invention wherein various changes and modifications may be made without departing from the spirit and scope of the invention, as set forth in the appended claims.

CLAIMS

1. A toy of compound curved surfaces, whose contour comprises:

(a) at least four convex spherical surfaces defined as the portions of the surfaces of at least four spheres, the centers of which are disposed at points around a center of said toy; and

(b) a plurality of concave curved surfaces connecting said at least four convex spherical surfaces.

2. A toy of compound curved surfaces as set forth in claim 1, wherein the radiuses of said at least four spheres are equal to each other.

3. A toy of compound curved surfaces as set forth in claim 1, wherein the radiuses of said at least four spheres are different from each other.

4. A toy of compound curved surfaces as set forth in claim 1, wherein the centers of said at least four spheres are disposed at each apex of an irregular polyhedron.

5. A toy of compound curved surfaces as set forth in claim 1, wherein the centers of said at least four spheres are disposed at each apex of a regular polyhedron.

6. A toy of compound curved surface as set forth in

either claim 4 or 5, wherein the polyhedron is tetrahedron.

7. A toy of compound curved surface as set forth in either claim 4 or 5, wherein the polyhedron is pentahedron.

8. A toy of compound curved surface as set forth in either claim 4 or 5, wherein the polyhedron is hexahedron.

9. A toy of compound curved surface as set forth in claim 1, wherein a plurality of said concave curved surfaces are defined as concave spherical surfaces.

10. A toy of compound curved surfaces as set forth in claim 9, wherein the radius of the sphere defining said concave spherical surfaces is twice or more greater than that of the spheres defining said at least four convex spherical surfaces.

11. A toy of compound curved surfaces as set forth in claim 9, wherein a plurality of said concave curved surfaces are defined as non-spherical concave surfaces.

12. A toy of compound curved surfaces, whose contour comprises:

(a) four convex spherical surfaces defined as the portions of the surfaces of four first spheres of equal radius, the centers of which define a regular tetrahedron, and

(b) a plurality of concave curved surfaces connecting said four convex spherical surfaces and defined by trace of the portion of the surface of a second sphere, between points tangent to the first spheres, when the second sphere is rotated about the first spheres while remaining tangent to at least any two of the four first spheres.

13. A toy of compound curved surfaces as set forth in claim 12, the radius of the second sphere is twice or more greater than that of the first sphere.

14. A toy of compound curved surfaces as set forth in claim 12, wherein the relationship between the distance $\underline{\ell}$ from the center of said toy to each apex of the regular tetrahedron and the radius $\underline{r}$ of the four first sphere is $\ell = \frac{4\sqrt{6}}{9} r$, that is, the four first spheres are mutually tangent to each other.

15. A toy of compound curved surfaces as set forth in claim 12, wherein the relationship between the distance $\underline{\ell}$ from the center of said toy to each apex of the regular tetrahedron and the radius $\underline{r}$ of the four first sphere is $\ell > \frac{4\sqrt{6}}{9} r$, that is, the four first spheres are mutually separated from each other.

16. A toy of compound curved surfaces as set forth in claim 12, wherein the relationship between the distance $\underline{\ell}$ from the center of the toy to each apex of regular tetrahedron and the radius $\underline{r}$ of the four first sphere is $\ell < \frac{4\sqrt{6}}{9}r$, that is, the four first spheres are mutually overlapped with each other.

17. A toy of compound curved surfaces as set forth in claim 12, wherein said toy is made of foamed plastic.

18. A toy of compound curved surfaces as set forth in claim 17, wherein said foamed plastic is foamed urethane.

FIG. 1 (A)

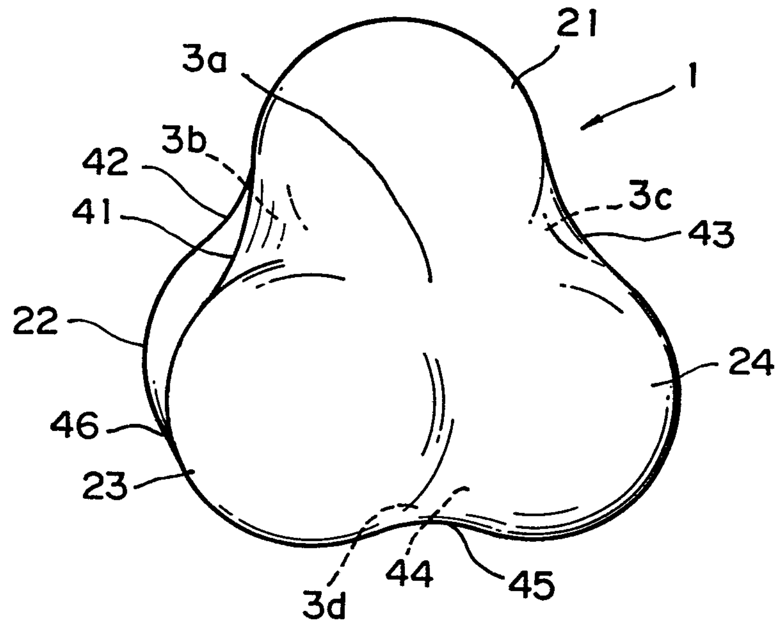

FIG. 1 (B)

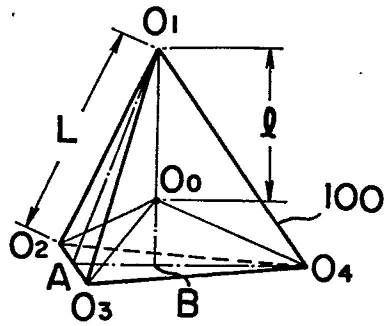

FIG. 1 (C)

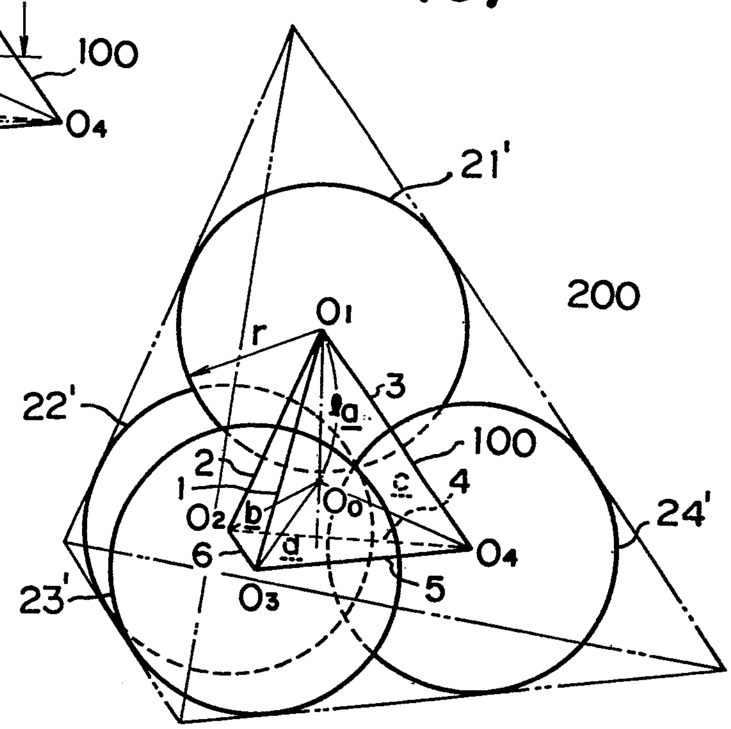

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FIG.2(A)

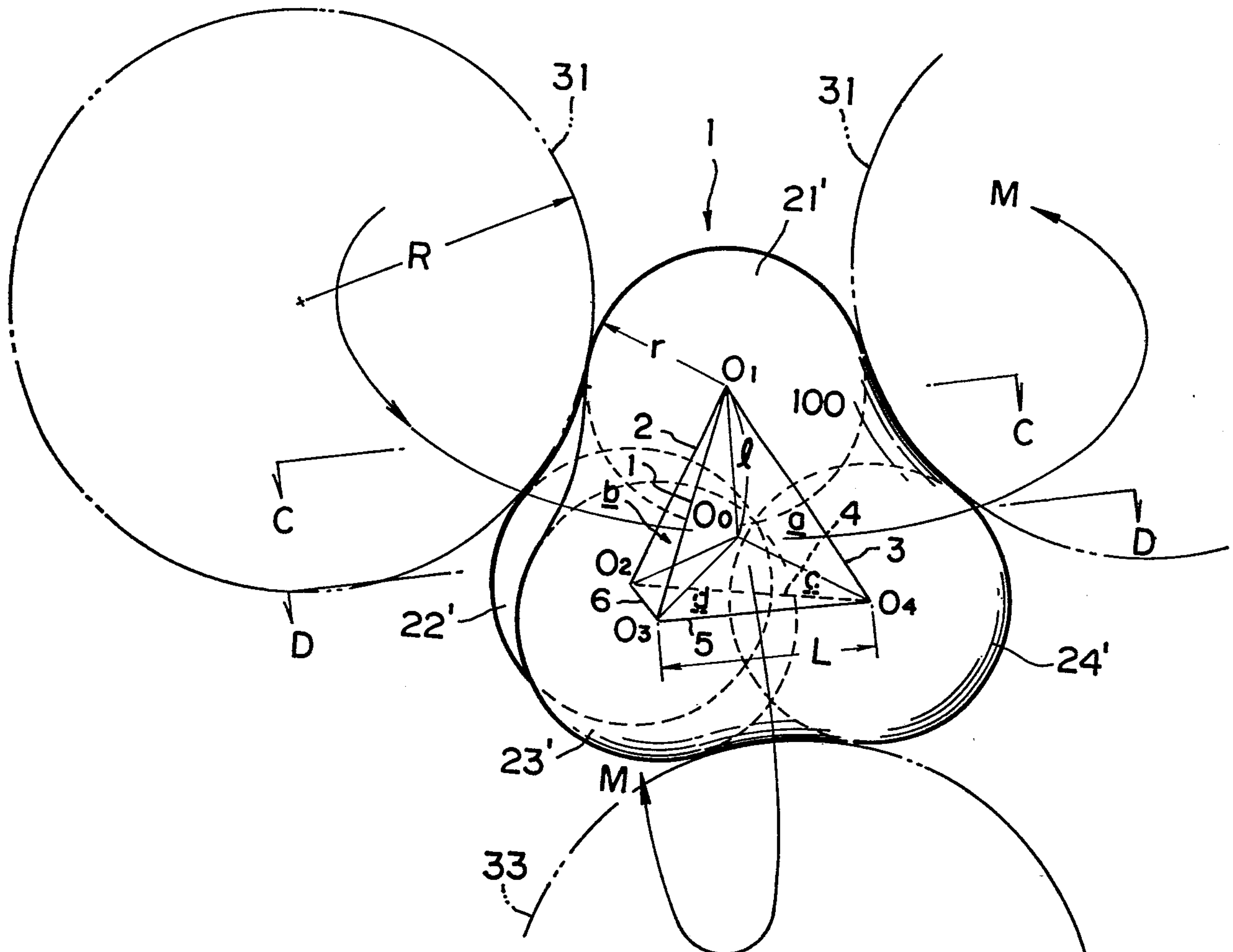


FIG.2(B)

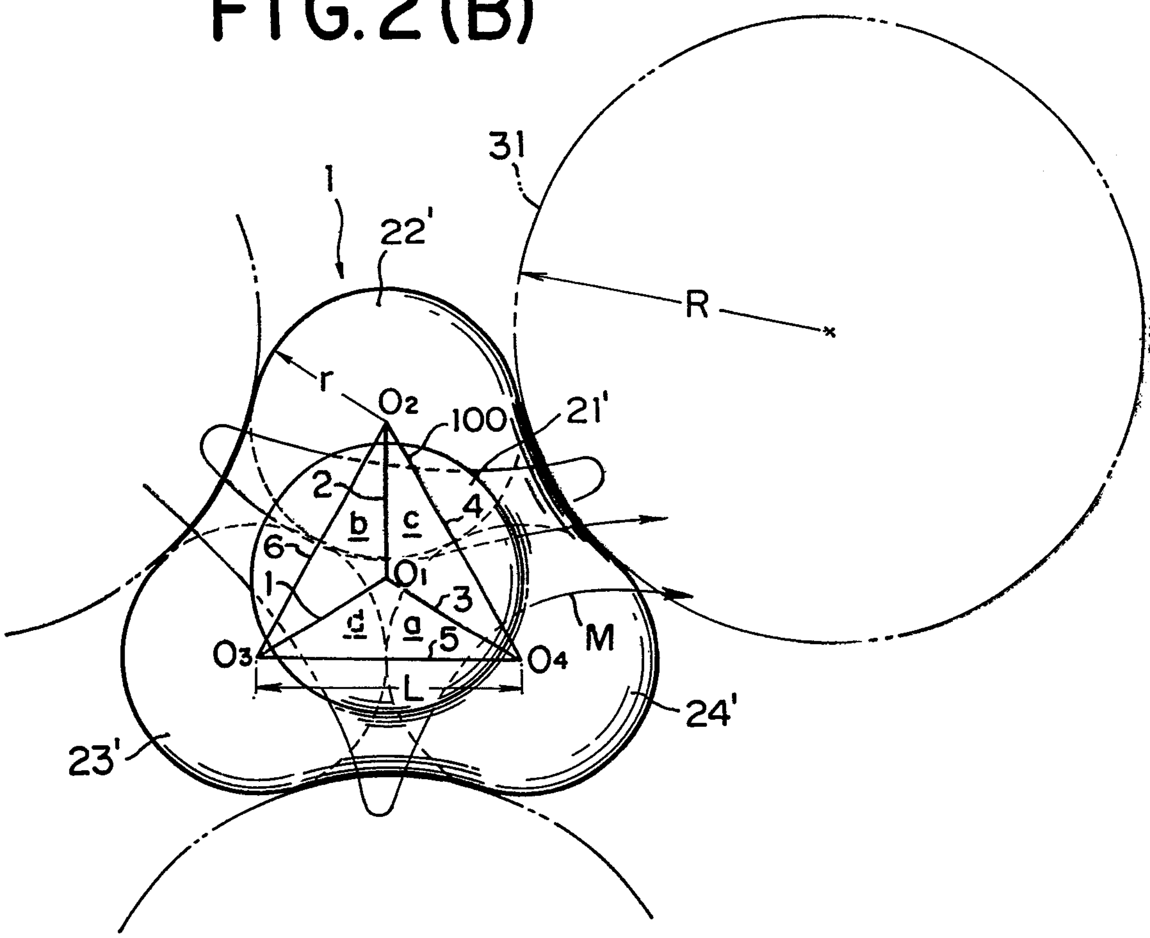


FIG.2(C)

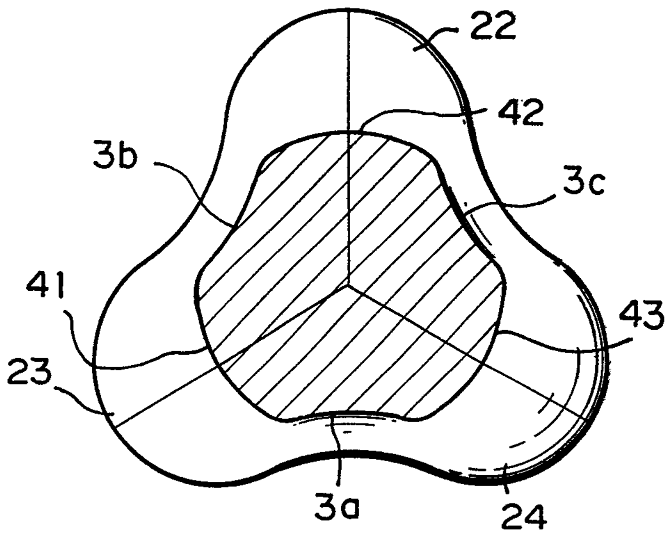


FIG.2(D)

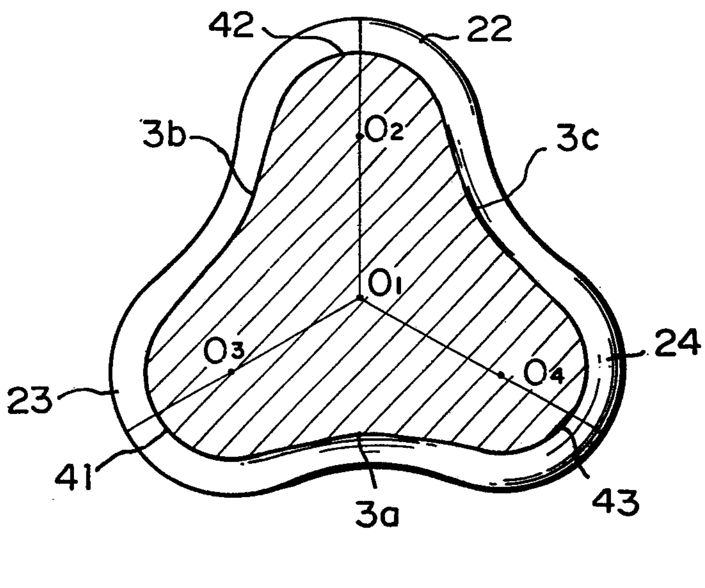


FIG. 3 (A)

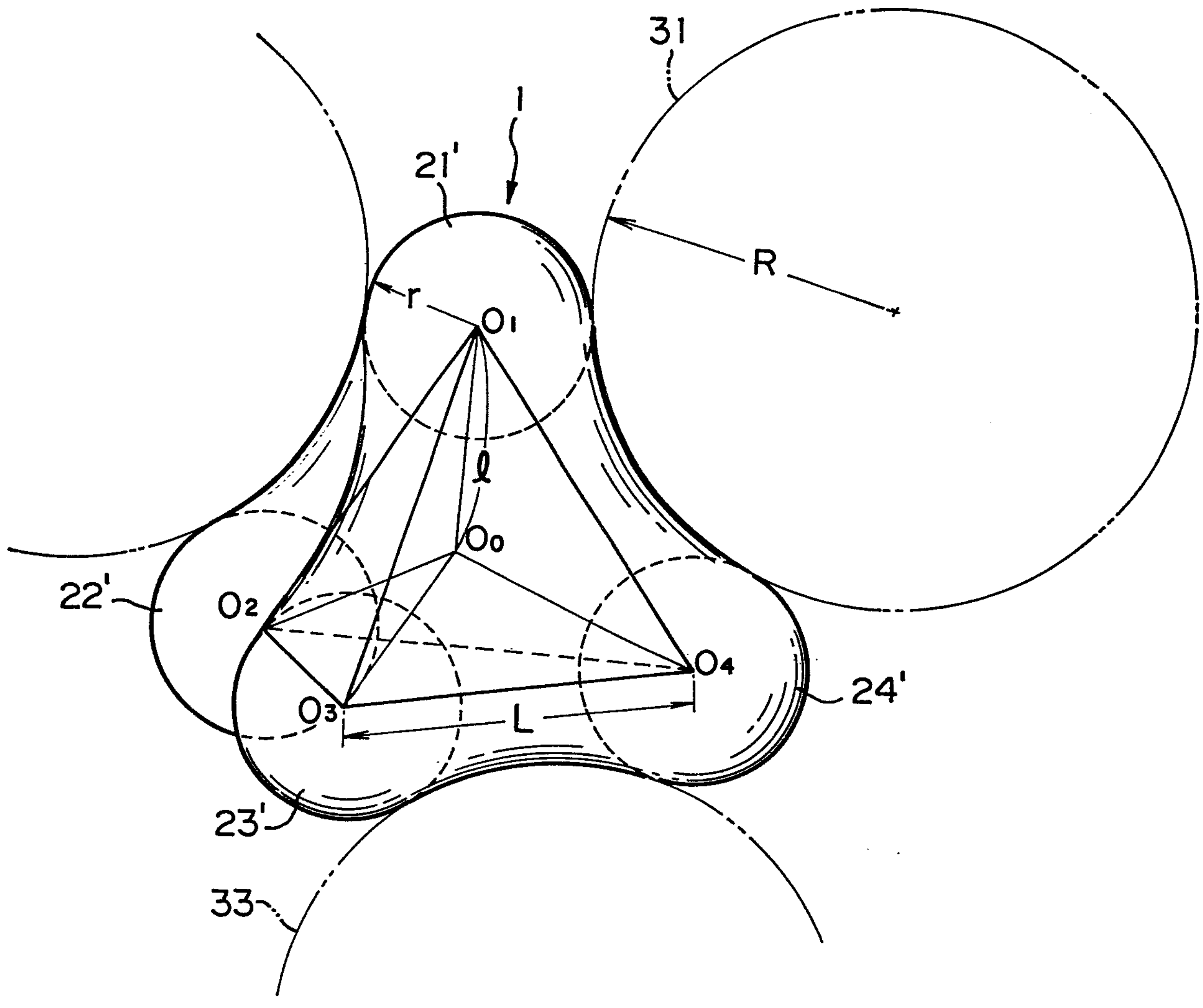


FIG. 3 (B)

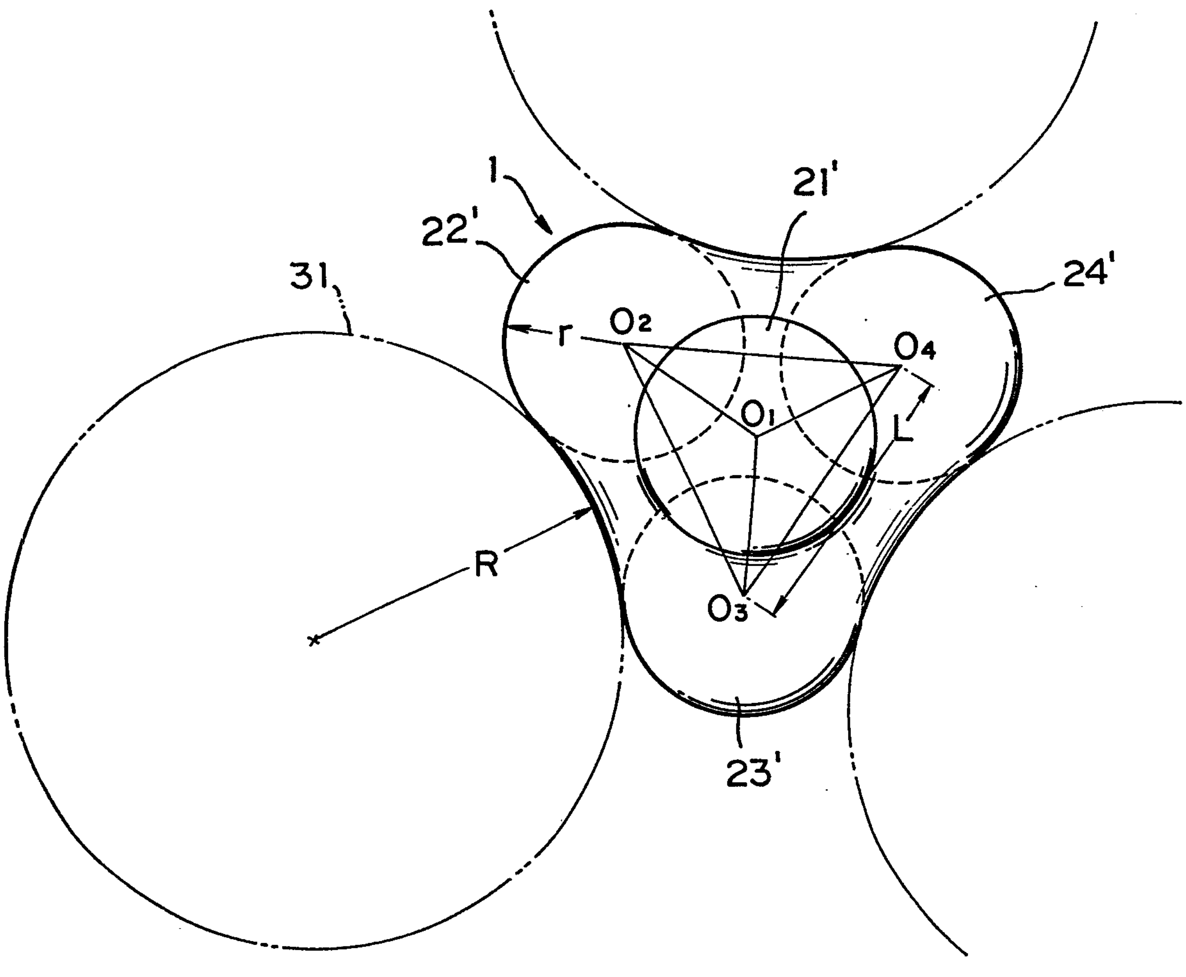


FIG.4 (A)

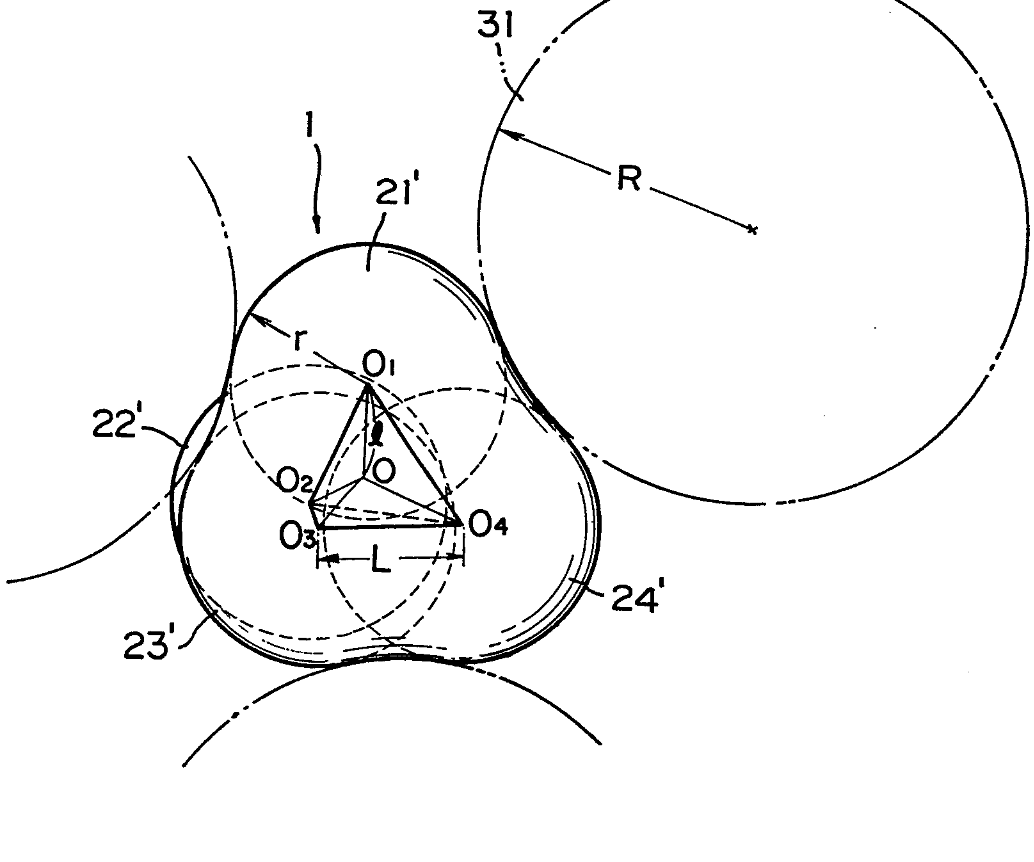
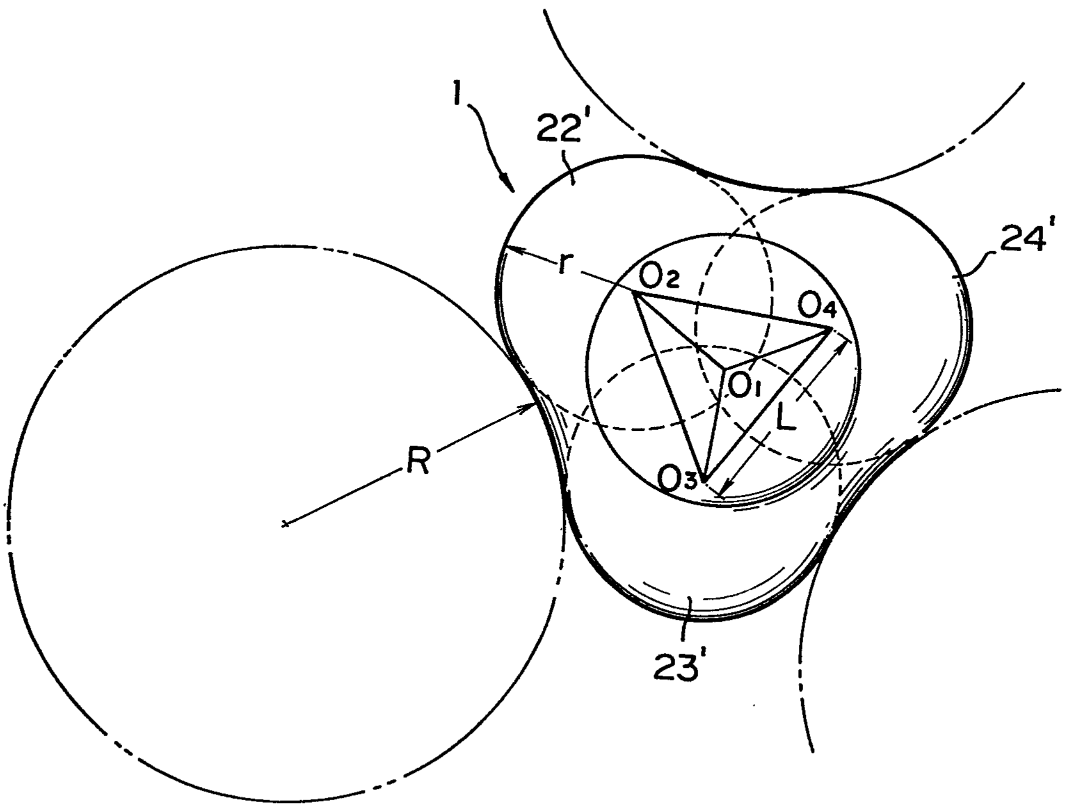


FIG.4 (B)



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EUROPEAN SEARCH REPORT

0106928

Application number

EP 82 30 6325

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. 3)
X	US-A-2 031 240 (VAN DEEST) * Column 1, line 41 - column 2, line 32; figures *	1,2,5	A 63 B 43/00
Y		4,6,7, 8	
A		9-17	

Y	FR-A-2 101 123 (COUDERC) * Claims; figure *	4	

Y	US-A-2 151 030 (HINSEN) * Column 1, line 42 - column 2, line 26; figures *	6,7,8	
	---		TECHNICAL FIELDS SEARCHED (Int. Cl. 3)
A	FR-A-1 261 616 (SACHNOVSKY) * Abstract; figure *	1-18	A 63 B

A	US-A-2 078 382 (HANSHAW) * Column 2, lines 27-44; figure *		

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	24-01-1984	GERMANO A.G.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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