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(54) **Puzzle toy.**

(57) A puzzle toy comprising an equilateral tetrahedron shaped frame (50), each of the sides (a,b,c,d) of said frame (50) being divided into nine equal triangular components such that five of said components (5,6,7,8,9; 5', 6', 7', 8', 9') are located along the base of the side to form a base layer, three of said components (2,3,4; 2', 3', 4') are located above said base layer to form an intermediate layer, and the remaining triangle (1,1') is located above the intermediate layer at the apex of the side.

One or more of the triangles are relatively movable about a central pivot point located at the center of the tetrahedron frame (50) in planes (x,y) intersecting the frame and defined by sides of adjacent triangles. Each side (a,b,c,d) of the frame (50), in its ordered disposition, has a different pattern, colour or ornamentation.

By using any corner (61) of the tetrahedron as an apex, the base layer and middle layer can be rotated through 1/3 or 2/3 turns to provide various combinations of colour triangles.

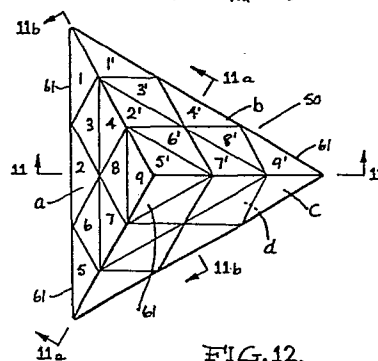
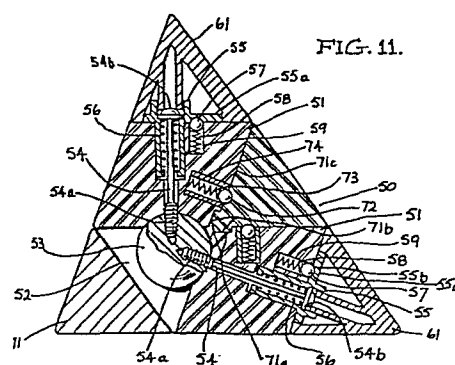


FIG. 12.

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SPATIAL PUZZLE TOY

This invention relates to spatial (ie.
3-dimensional) puzzle toys.

5 The object of the invention is to provide a
spatial puzzle toy both for amusement and the stimulation
of mind and intelligence.

A further objective of the invention is to
provide a spatial puzzle toy wherein the puzzle is more
10 difficult to solve than in other toys of this type which
are already known.

With the above objective in view, the invention
provides a spatial puzzle toy comprising an equilateral
15 tetrahedron shaped frame, each of the sides of said frame
being divided into nine equal triangular components such
that five of said components are located along the base
of the side to form a base layer, three of said components
20 are located above said base layer to form an intermediate
layer, and the remaining triangle is located above the
intermediate layer at the apex of the side, one or more of
said triangles being relatively movable about a central
pivot point located at the center of the tetrahedron frame
25 in planes intersecting said frame and defined by sides of
adjacent triangles, each side of said frame having a
different pattern, colour or ornamentation.

Conveniently, the central pivot point may be
constituted by a metallic ball about which are journaled
30 those triangular components which are not located at the
apex of the sides.

The journalling may take the form of appropriate
complemental magnetic elements located in said components
and co-operating with the ball, whereas those components
35 located at the apex of the sides may be connected to
adjacent components by means permitting rotation of said
apex located components about their axes. Such means may
take the form of a ball or pin.

An alternative preferred form of the invention comprises a relatively small tetrahedron or ball acting as the pivot point and located at the center of the tetrahedron frame. The apex-located and adjacent triangular components
5 are both rotatably mounted about pins extending between the ball and the apexes of the tetrahedron frame or between the respective apexes of said central and frame tetrahedra.

The remaining triangular components are mounted in the frame so as to permit rotational movement thereof in
10 each plane defined by its sides. The above can be accomplished, for instance, by the provision of pivot or swivel means disposed adjacent the edge of the component facing the central ball or tetrahedral pivot point permitting ease of movement about said point. The pivot
15 means can take the form of a small ball mounted in the sides of the non-apex located components and on which the remaining components are mounted.

In the above embodiments, the pins are preferably associated with tensioning means, eg. a spring to avoid
20 loosening of the relevant components during use.

The purpose of the puzzle is to arrange the triangles (which are in four colours) in the tetrahedron frame from a jumbled configuration to an ordered configuration wherein all triangles of one colour occupy
25 only one side of the frame.

In practice, by using any corner of the tetrahedron as an apex, the base layer and middle layer can be rotated through one third or two third turns, thus distributing the coloured triangles at a random pattern
30 of colours over the four faces of the tetrahedron.

Once a random pattern of coloured equilateral triangles has been established over the faces of the tetrahedron, the player of the puzzle then attempts to return them to their original position.

35 In lieu of using colours to identify and differentiate the equilateral triangles on each face of the tetrahedron, other means such as symbols may be used to identify them.

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In a further embodiment of the invention, in lieu of a tetrahedral frame, the frame may be constituted by several intersecting tetrahedra. In all other respects, the toy will function the same way as the tetrahedron puzzle
5 described above. In one embodiment of this modification, a first tetrahedron frame is intersected by four smaller tetrahedron frames so that three equal apexes project from each side of the first tetrahedron frame. These projecting apexes do not move.

10 The invention will now be described and illustrated with reference to the accompanying drawings wherein:-

Figs. 1 - 3 show perspective, top plan and bottom plan views respectively of one form of a toy puzzle
15 according to this invention;

Figs. 4 - 8 show perspective, plan and side views of another form of the puzzle toy according to this invention;

Fig. 9 is an exploded view of the puzzle toy
20 according to Figs. 1 - 3 showing the interior construction of the toy;

Fig. 10 is an exploded view of the puzzle toy according to Figs. 1 - 3 showing an alternative interior construction;

25 Fig. 11 is a sectional view of the puzzle toy according to Figs. 1 - 3 showing yet another interior construction thereof, the view being along section lines 11-11; 11a-11a or 11b-11b in Fig. 12 hereinbelow; and

30 Fig. 12 is another plan view of the puzzle toy according to Figs. 1 - 3.

Referring to Figs. 1 - 3, a tetrahedron frame, generally indicated as 10, consists of four equilateral triangular sides a, b, c, d respectively.

35 Each of the sides a, b, c and d are divided into 9 equal triangles (shown on sides a & b as 1, 2, 3 ... 9 and 1', 2', 3' ... 9' respectively).

The tetrahedron frame 10 is so constructed internally (cf. Figs. 10 & 11) that rotation of one or more of the triangular components can take place in planes defined by sides of adjacent triangles. Thus, rotation can
5 take place, for instance, in planes x & y partially defined by the sides of triangles 2', 3', and 7', 8' and triangles 2', 6' and 4', 8'. The apexes partially defined, for instance, by triangles 5, 9' and 1, 1' rotate about their own axes in planes partially defined by the base of
10 triangles 5 and 9' or 1 and 1'.

Referring to Figs. 4 - 8, a first tetrahedron frame, generally indicated as 20, is intersected by four smaller tetrahedra 21, 22, 23 & 24 (cf. Fig. 5) in such a way that each side, e.g. a and b (cf. Fig. 4) has three
15 apexes (e.g. 31, 32 and 33 in Fig. 5) projecting therefrom. The projecting apexes do not move and the rotation of groups of triangles about planes intersecting the tetrahedron frame occurs in the same manner as described in connection with Figs. 1 - 4.

Referring to Fig. 9, tetrahedron frame 10 has a
20 metallic ball 30 in the geometric centre thereof. Triangular components partially defined by triangles 2, 3, 4, 6, 7 and 8 and 2', 3', 4', 6', 7' and 8' are journaled for rotation about ball 30 by means of complementary magnetic inserts 31,
25 32 attached to the components. The four triangular components (e.g. 1, 1' and 9, 5') constituting the apexes of the frame are mounted by means of pins 33 to the adjacent components, partially defined by triangles 3, 3' and 8, 6'.

It will be appreciated that by means of this
30 internal construction, rotation of groups of triangular components of the tetrahedron frame about any plane defined by the sides of the triangles is possible.

Referring to Fig. 10, which represents an
35 alternative arrangement for accomplishing the above, a central pivot point is provided by a "nuclear" tetrahedron-like figure, generally indicated as 40, which has four apexes 41, 42, 43 and 44. The four apexes of the tetrahedron

frame 10 as well as the adjacent triangular components (e.g. partially defined by triangles 8' and 6) are connected to the "nuclear" apexes 41 - 44 respectively by pins 33. This allows rotation of the above components about the apexes 5 of the "nuclear" tetrahedron.

This leaves components such as those partially defined by triangles 2', 4', 7' and 2, 4, 7 to be inserted and mounted relative to the central tetrahedron so that these components too can rotate about planes defined by 10 their sides. This rotational ability is provided by swivel means (not shown) located along that side of the aforementioned triangular components facing the "nuclear" tetrahedron 40.

Referring to Figs. 11 & 12, a regular tetrahedron 15 shaped puzzle toy frame generally indicated as 50 comprises four regular octahedra 51 joined so as to form a central tetrahedron shaped space 52 therebetween. A ball 53 located in space 52 has four pins 54 extending therefrom through the octahedra 51 and into the tetrahedron shaped apexes 20 61 of the frame 50. Pins 54 are located in ball 53 by means of threaded portions 54a and have head portions 54b mounted in bushes 55 having triangular flanges 55a, the latter being mounted in apexes 61. Pins 54 are mounted on springs 56.

Flanges 55a are furthermore mounted on steel balls 25 57 mounted on springs 58 located in recesses 59 in adjacent octahedra 51. Flanges 55a have three complementary grooves 55b for accommodating the steel balls 57.

Six tetrahedron shaped auxiliary components 71 are mounted between sides of adjacent octahedra 51 by means 30 of tongue and groove connections for rotation about the ball 53. Each component 71 has a pair of tongues 71a which engage complementary grooves 71b.

Each of the two sides 71c (adjacent the octahedra 51) of the auxiliary components 71 are mounted on steel 35 balls 72 mounted on springs 73 located in recesses 74 in the adjacent octahedra 51.

It will be appreciated that the above construction allows rotation of each apex 61 of the frame 50 about its axis. As there are three complementary grooves 55b on each flange 55a to receive the steel ball 57, a ratchet type
5 action is obtained by rotating the apexes 61 to align the ball 57 with each groove 55b.

A similar ratchet type action is obtained when the intermediate layers of the frame 50 are rotated as each ball 72 locates in a complementary groove located in
10 auxiliary components 71.

CLAIMS

1. A puzzle toy comprising an equilateral tetrahedron shaped frame (50), each of the sides (a,b,c,d) of said frame (50) being divided into nine equal
5 triangular components such that five of said components (5,6,7,8,9; 5',6',7',8',9') are located along the base of the side to form a base layer, three of said components (2,3,4; 2',3',4') are located above said base layer to form an intermediate layer, and the remaining triangle
10 (1,1') is located above the intermediate layer at the apex of the side, one or more of said triangles being relatively movable about a central pivot point located at the center of the tetrahedron frame (50) in planes intersecting said frame and defined by sides of adjacent
15 triangles, each side (a,b,c,d) of said frame (50) having a different pattern, colour or ornamentation.
2. A puzzle toy according to claim 1 wherein said central pivot point is constituted by a metallic ball (30) about which are journalled those triangular components
20 (2',3',4',6',7',8'; 2,3,4,6,7,8) which are not located at the apex of the sides, the components located at the apex of the sides (1',1; 9',5) being connected to said adjacent non-apex located components so as to permit rotation of said apex located components about their axes.
- 25 3. A puzzle toy according to claim 2 wherein said journalling is by means of complemental magnetic elements (31) located in said non-apex located components cooperating with the ball (30) and the connection between the apex located and adjacent non-apex located components
30 is by means of pins (33).
4. A puzzle toy according to claim 1 wherein said central pivot point is constituted by a ball (53), said

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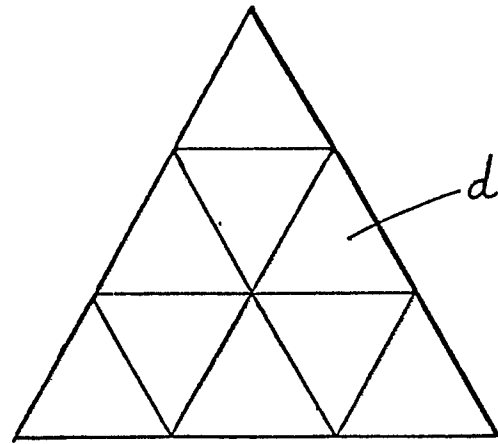
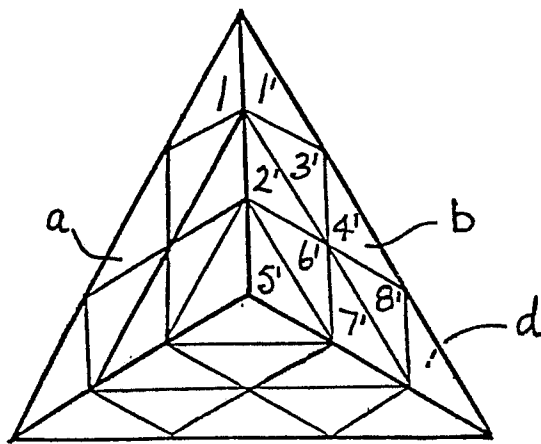
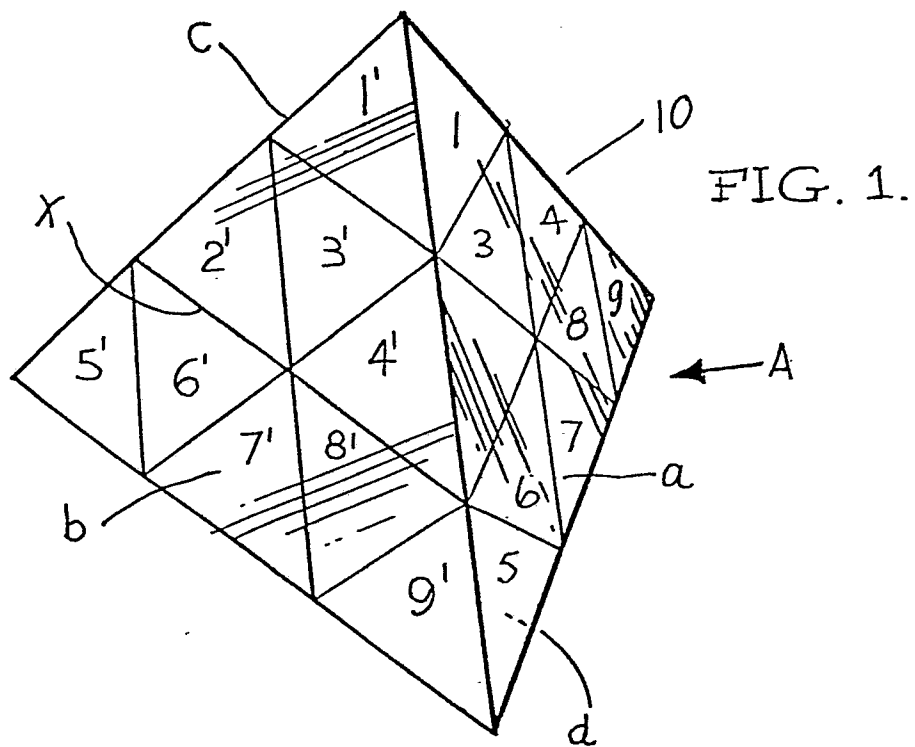
ball having four pins (54) outwardly extending therefrom into the apex located components (61) through the adjacent non-apex located components (51), the remaining components (71) being mounted in the frame for rotation about the
5 ball.

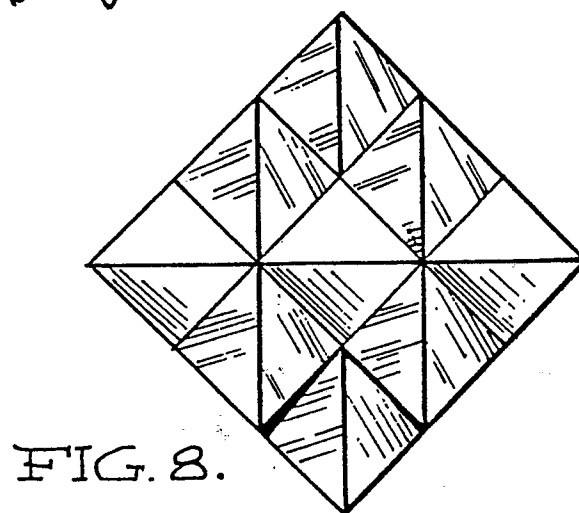
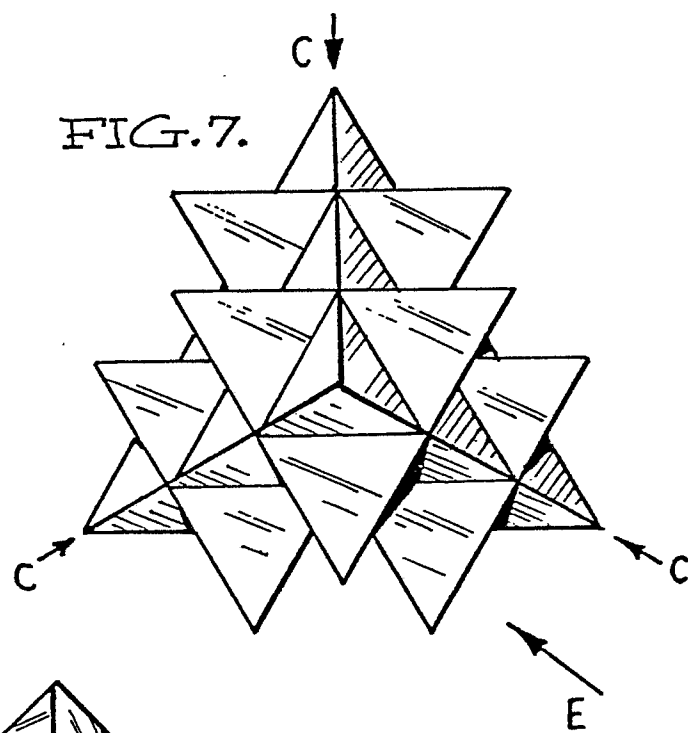
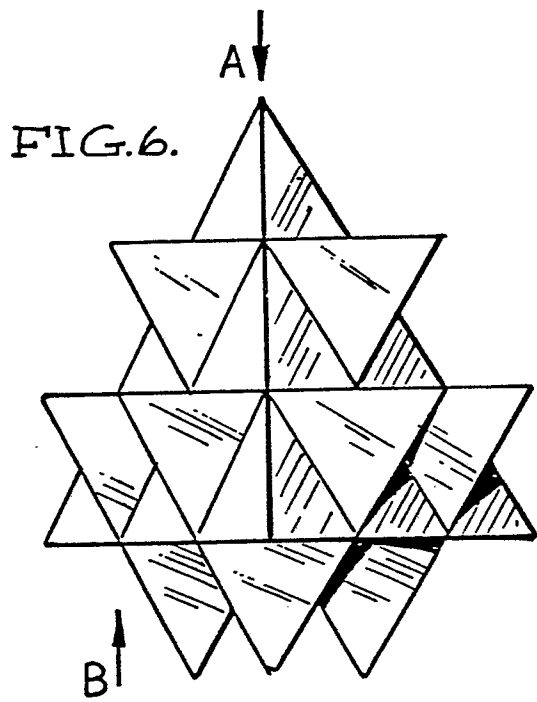
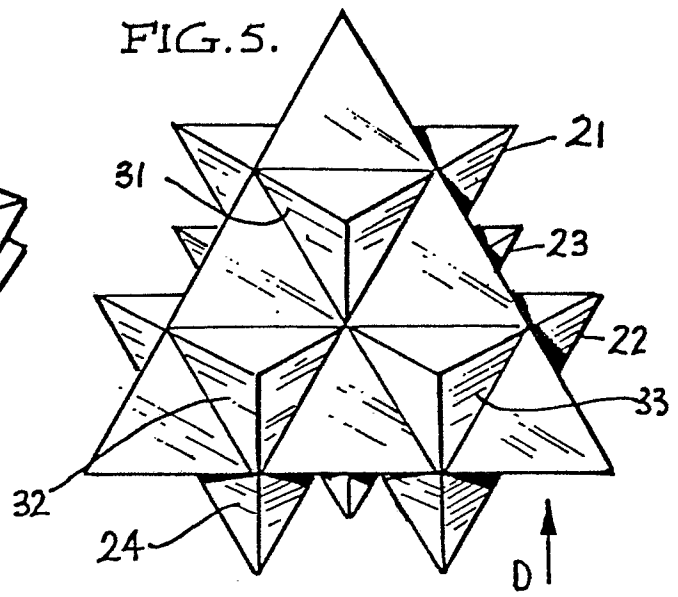
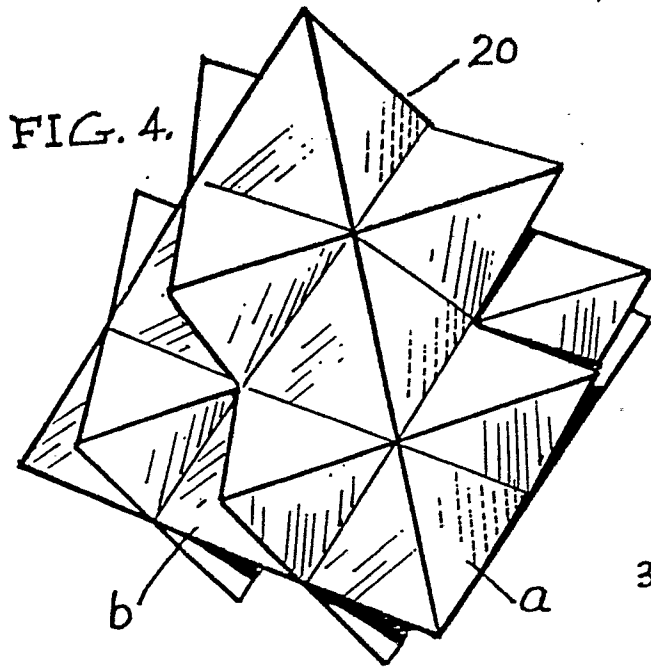
5. A puzzle toy according to claim 1 comprising four regular octahedron shaped components (51) joined together such that said components form a tetrahedron shaped space (52) therebetween, a ball (53) located within
10 said space and having four pins (54) outwardly extending therefrom, each of said pins (54) extending through one of said octahedra (51) and into an adjacent tetrahedral shaped component (61) forming an apex of said toy frame, six tetrahedral shaped auxiliary components (71) mounted
15 in the remaining spaces (to complete the toy frame) for rotation about the ball (53).

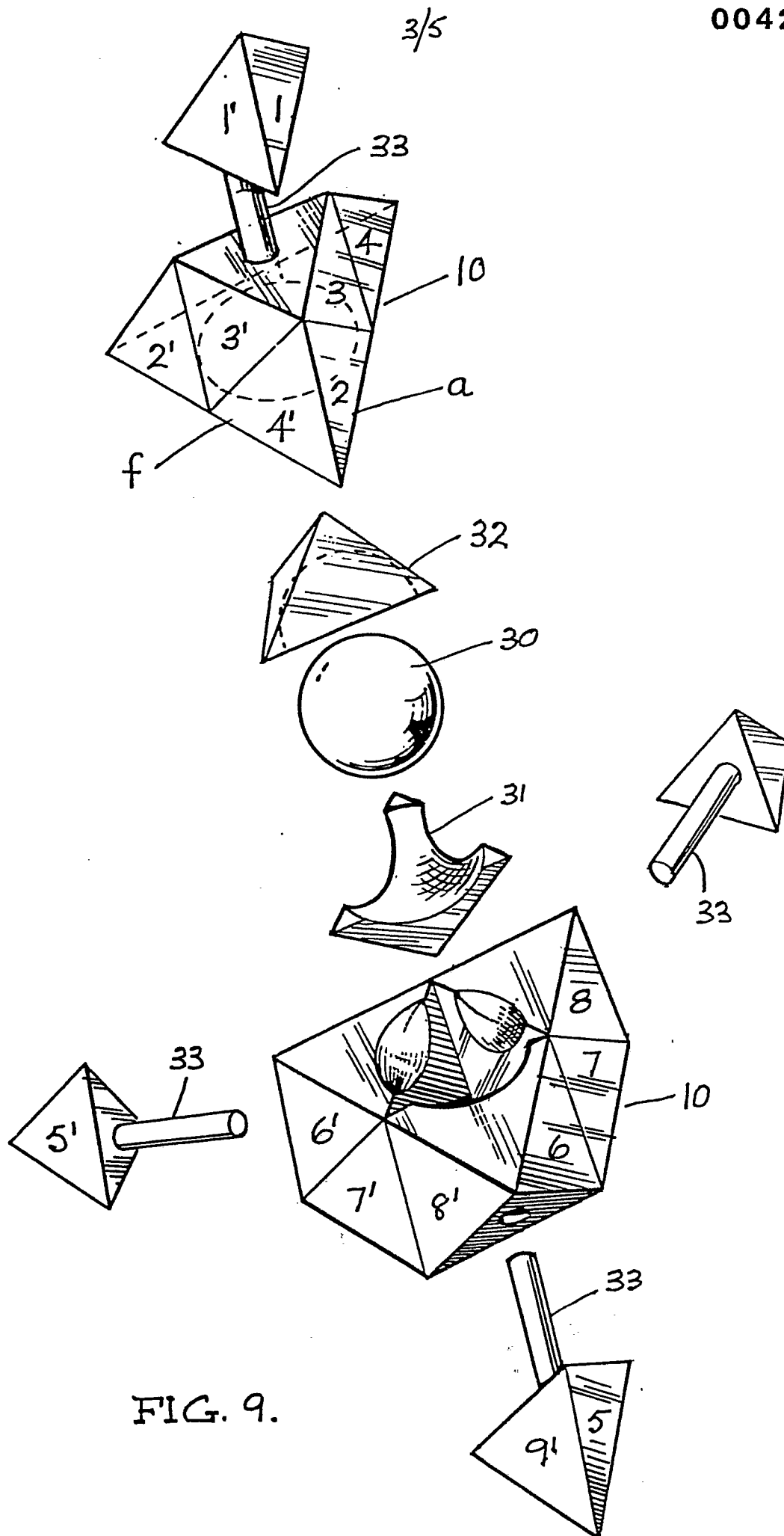
6. A puzzle toy as claimed in claim 5 wherein said six components (71) are mounted in said spaces by means of a tongue and groove connection (71a,71b) between the inner
20 edge of said components (71) and the complementary edges of the adjacent octahedra (51), the sides of the six components which are in contact with the octahedra being additionally mounted on ball bearings (72) located in the complementary sides of the octahedra to enable pivotal
25 movement of said components about the central ball (53).

7. A puzzle toy according to any one of claims 3 to 6 wherein said pins (54) are associated with resilient tensioning means (56).

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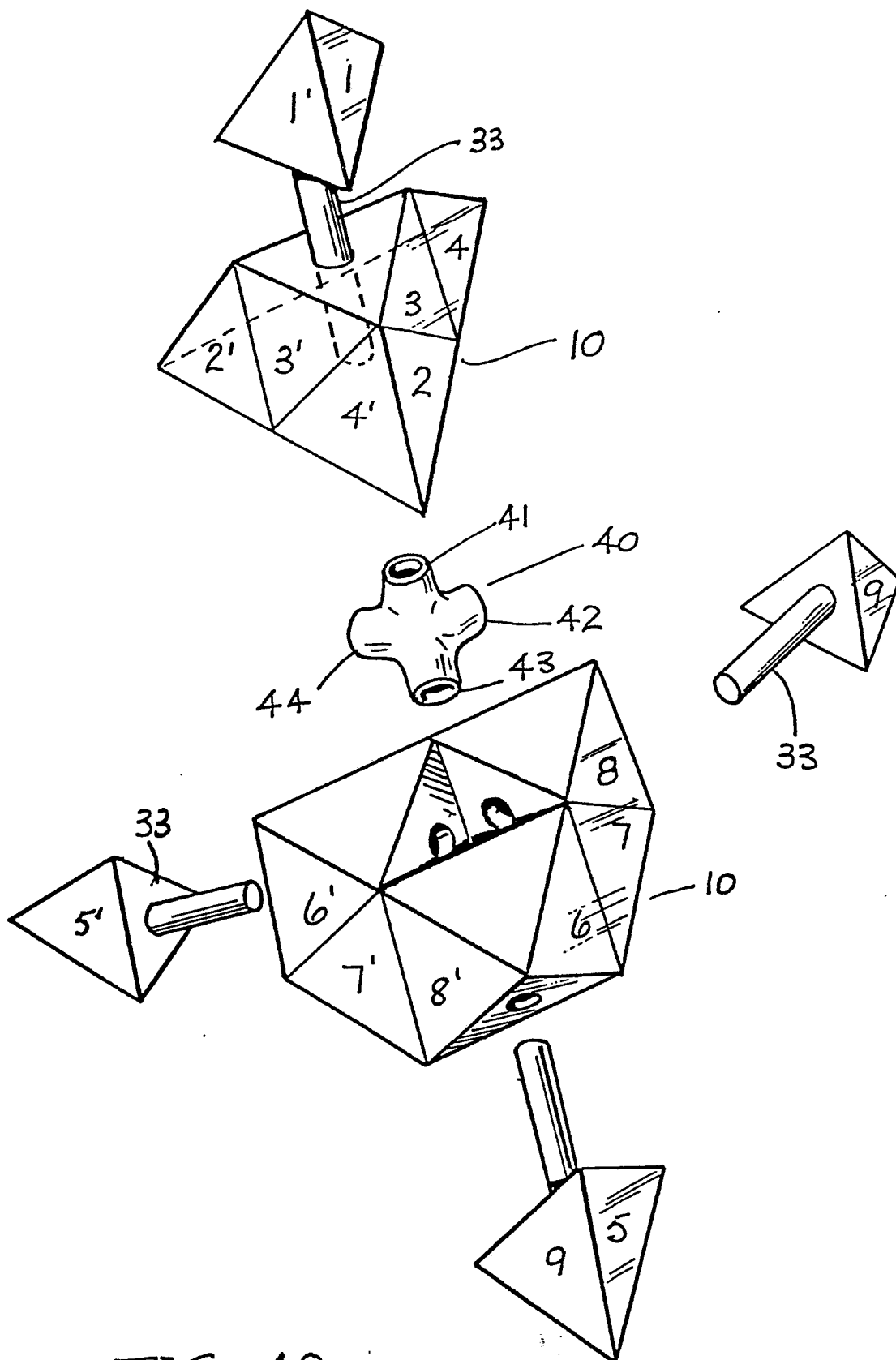


FIG. 10.

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