

[54] **ASSEMBLY PUZZLE**

[76] Inventor: **Stewart T. Coffin**, Old Sudbury Road, R.F.D. 1, Lincoln, Mass. 01773

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[51] Int. Cl. .... **A63f 9/12**

[58] Field of Search ..... **273/160; 46/28**

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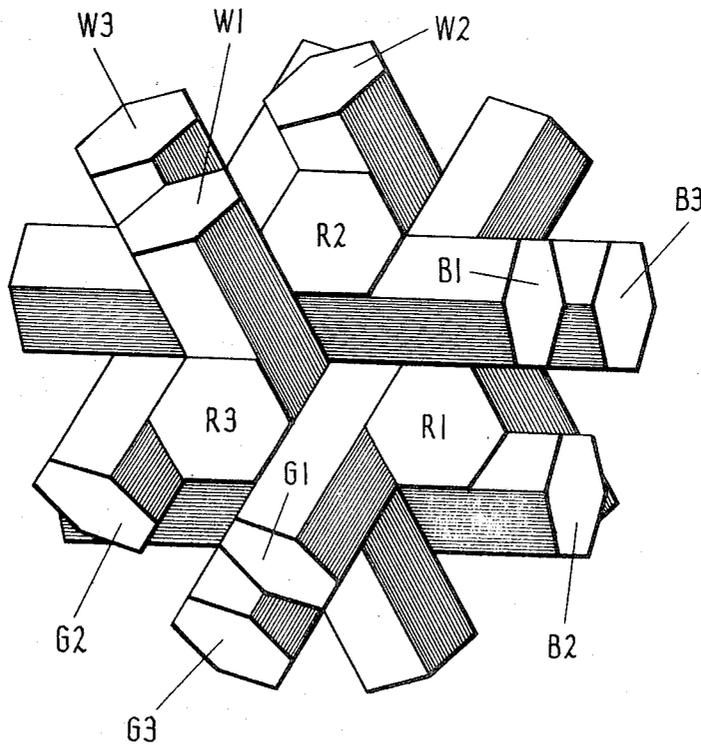
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*Primary Examiner*—Anton O. Oechsle  
*Attorney*—Wolf, Greenfield & Sacks

[57] **ABSTRACT**

A symmetrical assembly puzzle including a total of 12 elongate pieces having notches formed therein to receive other pieces of the puzzle. Nine of the pieces have two notches and the remaining three pieces have an extra, third notch. The pieces may be arranged in three solutions. In each solution, the assembled puzzle includes four groups of pieces, each group including three of the pieces. The pieces in any assembled group are oriented in parallel to each other but at an angle to the pieces in each of the other assembled groups.

**19 Claims, 11 Drawing Figures**





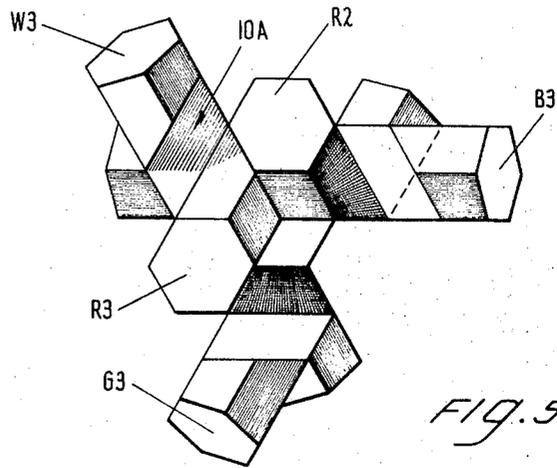


FIG. 5

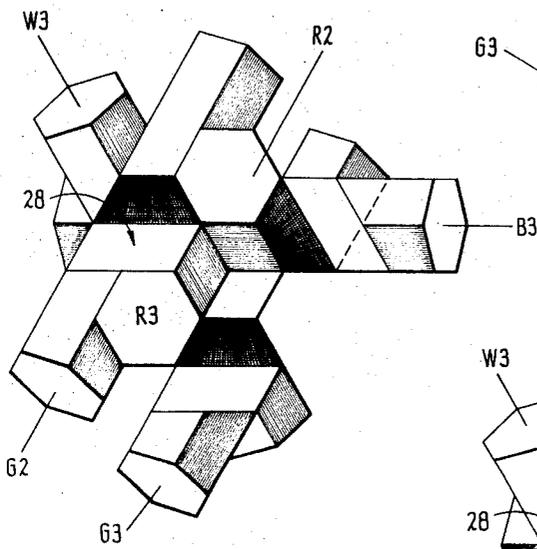


FIG. 6

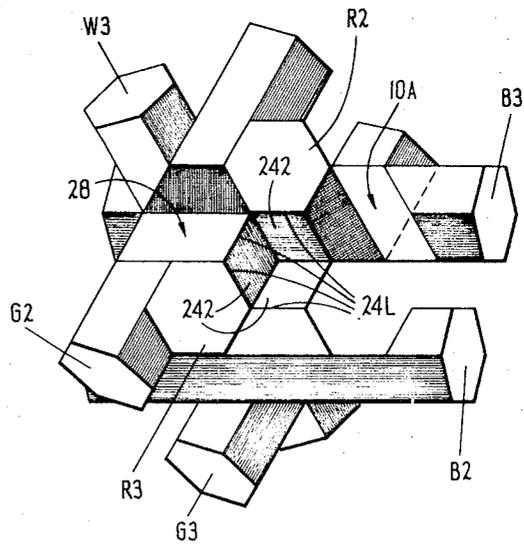


FIG. 7

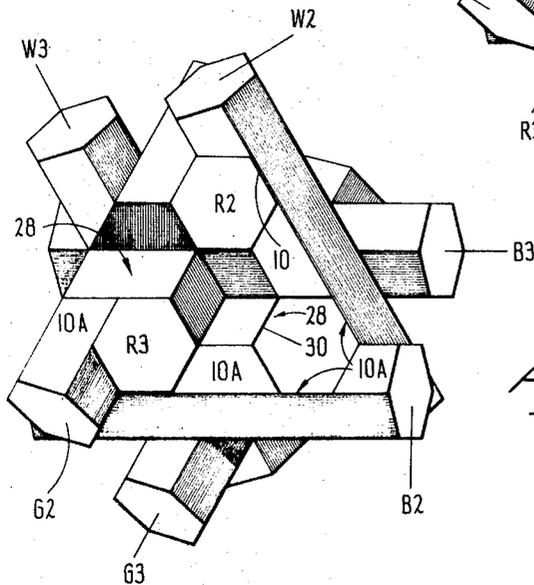


FIG. 8

INVENTOR  
Stewart T. Coffin  
BY  
Wolf, Greenfield, Hixon & Sacks

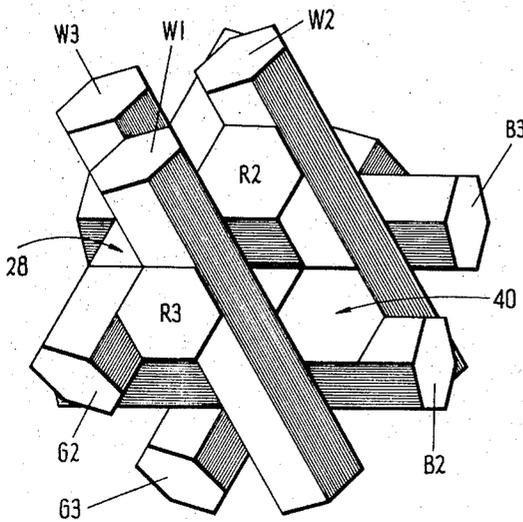


FIG. 9

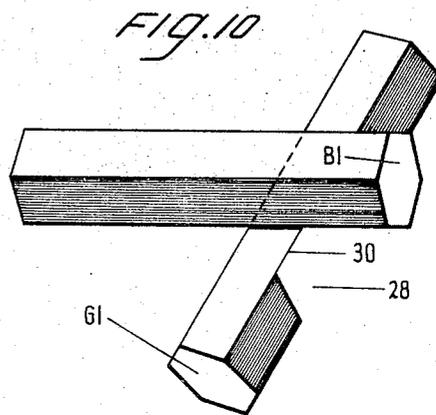


FIG. 10

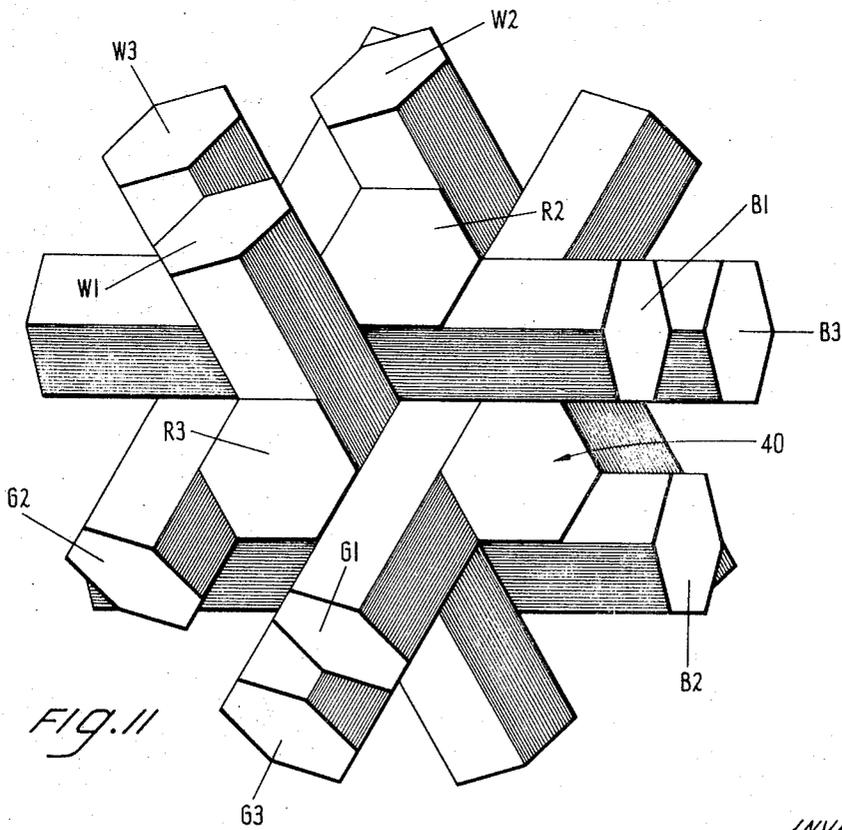


FIG. 11

INVENTOR  
Stewart T. Coffin  
BY  
Wolf, Greenfield, Hilm & Sacks

## ASSEMBLY PUZZLE

## BACKGROUND OF THE INVENTION

This invention relates to puzzles and, more particularly, to assembly puzzles in which a number of identical or similar pieces may be assembled to form a symmetrical structure.

## SUMMARY OF THE INVENTION

In the illustrative embodiment of the invention, the puzzle includes 12 interlocking pieces, each piece having the general shape of a regular hexagonal prism. The object of the puzzle is to assemble the 12 pieces to form a symmetrical solid configuration around a hollow core which has a shape of a rhomb-dodecahedron. Nine of these pieces are referred to herein as "standard pieces," and have two diagonal trapezoidal notches. The remaining three pieces are referred to herein as "odd pieces" each odd piece having a third, diagonal trapezoidal notch near the center of the piece between but at an angle to the first two diagonal notches. Except for the third diagonal notch, the odd pieces are identical in shape to the standard pieces. Each diagonal trapezoidal notch in each piece is formed at an angle of approximately  $70^{\circ}32'$  to the longitudinal axis of its piece. In the assembled puzzle, the 12 pieces are arranged in four groups of three pieces each. The pieces in each group are disposed along parallel axes and the parallel axes of each group are disposed at an angle to the parallel axes of each of the other groups. Additionally, in the preferred embodiment of the invention, the adjacent end surfaces of each piece in a group defines a plane and the planes thus defined by the ends of the pieces in each group define an octohedron.

In each of the 12 puzzle pieces, a rhombic land surface is located between the first two notches. When the puzzle is assembled, each land faces toward the center of the puzzle, and together define a hollow rhomb-dodecahedron space in the center of the assembly.

An object of the invention is to provide an assembly puzzle which tests the user's ingenuity, skill and patience yet which is not overly complex.

Another object of the invention is to provide an assembly puzzle including 12 elongate pieces in which nine of the pieces are identical in shape and have a pair of diagonal notches and in which the remaining three pieces have a third, additional, diagonal notch disposed between and at an angle to the first two notches.

## DESCRIPTION OF THE DRAWINGS

These and other objects and advantages of the invention will be understood more fully from the following detailed description thereof, with reference to the accompanying drawings wherein:

FIG. 1 is a plan view of the assembled puzzle;

FIG. 2 is a perspective view of one of the nine standard pieces;

FIG. 3 is a perspective view of one of the three odd pieces;

FIG. 4 is a plan view of a cradle which is formed by two standard pieces and one odd piece and which is employed to initiate the assembly of the puzzle in the illustrated solution; and

FIGS. 5 through 11 illustrate the sequence of steps in assembling the pieces of the puzzle in one solution thereof.

## DESCRIPTION OF THE PREFERRED EMBODIMENT

Each of the 12 puzzle pieces is in the shape of an elongate regular hexagonal prism having trapezoidal notches formed diagonally therein as shown in FIGS. 2 and 3. FIG. 1 shows, in plan view, the relationship of the various puzzle pieces when assembled. For ease of explanation, each group of three parallel pieces, when in an assembled configuration, will be designated by a different letter with each piece in that group being distinguished from the other pieces by an additional numerical character. Thus, as shown in FIG. 1, one of the groups is designated by W and includes the pieces W1, W2, and W3. The pieces W1, W2, W3 are arranged parallel to each other when assembled in the group configuration shown. The parallel axes of the W group, however, are disposed at an angle to the axes of each of the other groups. Similarly, the R group includes pieces R1, R2, and R3; and the B group includes pieces B1, B2, and B3; and the G group includes pieces G1, G2, and G3. In the following description and claims the term "group" will be employed to designate three of the puzzle pieces arranged in parallel and when in an assembled configuration. FIGS. 5 through 11 illustrate the sequence of steps in assembling the pieces of the puzzle in accordance with one solution thereof. Additionally, although FIG. 1 shows the puzzle in plan as viewed along the axis of the R group, the configuration of the assembled puzzle is identical to that in FIG. 1 when viewed along the axis of any of the other groups.

The 12 pieces of the complete puzzle are divided into a first set of nine standard pieces of identical configuration shown in FIG. 2. The remaining three odd pieces form the second set, one of these pieces being illustrated in FIG. 3. As employed herein, the term "set" refers either to the nine standard pieces or three odd pieces whether or not they are in an assembled configuration.

Each standard piece is in the form of a regular hexagonal prism and has two parallel trapezoidal notches 10, 10a formed therein. Each notch 10, 10a is disposed at an angle of approximately  $70^{\circ}32'$  to the longitudinal axis of the piece. Each notch 10, 10a is formed to a depth so that its associated bottom surface 12, 12a is disposed at the mid-width of the piece and intersects a pair opposed longitudinal edges 14, 16 of the piece. The trapezoidal faces 18, 20 of each notch 10, 10a are disposed at an angle to their associated bottom 12, 12a to receive another piece of the puzzle at an angle of  $70^{\circ}32'$ , with the mated piece being nested in the trapezoidal notch. Thus, each notch in the standard pieces extends and cuts through three adjacent longitudinal faces 22, 24 of the piece. In the preferred embodiment, the end surfaces of the pieces lie in a plane which is perpendicular to the axis of the piece. That portion of the face 24 which is defined between the parallel notches is referred to hereinafter as the intermediate land and is designated by the reference character 24L. In the illustrative embodiment, the intermediate land 24L is of rhombic configuration. When the puzzle is assembled, the intermediate land 24L of each of the pieces faces toward the center of the puzzle and cooperates with the other intermediate lands of the other pieces to define a hollow rhomb-dodecahedron.

FIG. 3 shows, in perspective, the configuration of each of the three odd pieces which make up the second

set. The odd pieces are identical to the standard pieces shown in FIG. 2 except for the inclusion of a third trapezoidal notch indicated generally by reference character 28. The third center notch 28 is similar to the notches 10, 10a and includes a bottom surface 30 and sidewalls 32, 34 which are adapted to receive another puzzle piece at an angle of  $70^{\circ}32'$  to the longitudinal axis of the odd piece. The third notch 28 of the odd piece is located near the mid-portion of the piece but is cut so that it is rotated about the longitudinal axis of the piece and passes through the longitudinal faces 22, 36, and 38 of the piece. The bottom surface 30 of the notch 28 is parallel to the longitudinal face 36 of the piece. The bottom surfaces 12, 12a of the notches 10, 10a lie parallel to the longitudinal face 24 of the piece. Thus, the third notch 28 may be considered as being displaced angularly  $120^{\circ}$  about the longitudinal axis of the piece, relative to the first two notches 10, 10a. The odd piece also includes the land 24L.

The pieces of the puzzle may be assembled in the illustrative solution by initially forming a bottom cradle shown in plan in FIG. 4. The cradle, in this solution, is formed by selecting two standard pieces and one odd piece such as the pieces W3, B3, and G3. The pieces are combined as shown so that their intermediate land surfaces 24L are disposed adjacent each other and with each of the pieces being nested within one of the notches 10 of an adjacent piece to make an angle of  $70^{\circ}32'$  with each of the other pieces. The adjacent middle land 24L surfaces define a portion of the rhombododecahedron at the inner core of the completed puzzle. The odd piece G3 in the bottom cradle is oriented so that its third notch 28 extends in a vertical direction and faces outwardly so that it may receive a later placed, vertically disposed puzzle piece. This cradle is self-supporting and may be placed on a flat surface in this configuration. The notches 10a of the pieces W3, G3, and B3 in the cradle face in a generally upward and inward direction.

A pair of standard pieces such as R2 and R3 then are positioned vertically with the lower notch 10 of each of the vertical pieces R2, R3 being fitted against each of the two standard pieces B3, W3, in the bottom cradle as shown in FIG. 5. An odd piece G2 then is placed in the notch 10a of piece W3 so that the odd piece G2 spans the vertical pieces R1, R3 with the third, center notch 28 of the piece G2 facing upwardly as shown in FIG. 6. Another standard piece, as piece B2, then is manipulated into place into the upwardly facing notch 10a of piece G3, the newly placed piece B2 being located parallel to piece B3 as shown in FIG. 7. Another standard piece, as piece W2, then is manipulated into the upwardly facing notch 10a of the piece B3 so that piece W2 is disposed parallel to piece W3 with the notch 10 of piece W2 engaging the vertical piece R2. The other notch 10a of piece W2 cooperates with the notch 10a of piece B2 and the bottom surface 30 of the third, center notch 28 of piece G3 to define a hexagonal opening which is intended to receive, at a later time, vertical piece R1. (see FIG. 8). The intermediate land surfaces of the puzzle pieces have, at this time, formed a substantial portion of the hollow rhombododecahedron at the core of the structure. It should be noted that the intermediate land of each of the pieces faces inwardly and defines a portion of the hollow rhombododecahedron core of the assembled puzzle.

The next step in assembling the puzzle in the illustrative solution is to select one of the remaining standard pieces, as the piece W1, and to position that piece parallel to pieces W2 and W3 with the upper end of piece W1 extending between the vertical pieces R2 and R3. The lower notch 10 of piece W1 fits over the piece B2 and the piece W1 is received within the upper notch 10a of piece R3 as shown in FIG. 9. The next assembly step is to fit the remaining odd piece G1, separately, to one of the remaining standard pieces B1 as shown in FIG. 10 in plan. The pieces are arranged so that the bottom surface 30 of the intermediate notch 28 of piece G1 is disposed vertically and in registry with the other surfaces defining the hexagonal, vertical opening 40 through which the final piece R1 is to be passed, (see FIG. 9). With the pieces B1 and G1 thus assembled in relation to each other, the piece B1 is inserted axially into and through a hexagonal hole defined by the notches on pieces W1, G2, and R2. As the combined pieces B1 and G1 thus are added to the assembly, the notches 10, 10a of the odd piece G1 mate with pieces W1 and W2. This arrangement is shown in FIG. 11 which illustrates the vertically disposed hexagonal opening 40. The last, remaining, piece which is of standard configuration, is inserted through the remaining hexagonal opening and is retained parallel to the other pieces R2, R3 in that group. The illustrative solution then is complete.

In the preferred embodiment of the invention, each end of each puzzle piece defines a plane at right angles to the longitudinal axis of that piece so that when the puzzle is assembled the adjacent ends of each group will lie in a single plane. Because there are four groups, each having two ends, eight such planes are defined about the outer periphery of the assembled puzzle in an octahedron configuration. Additionally, the hollow interior of the puzzle is in the form of a rhombododecahedron which is defined by the intermediate lands 24L of each of the puzzle pieces. Furthermore, when the puzzle has been assembled, there are no apparent voids between the assembled pieces, the pieces presenting an appearance of complete solidarity and total interlocking relation.

Although the foregoing description has included a sequence of assembly of the pieces leading to one solution, other sequences may be employed to provide other solutions. For example, the starting cradle has been illustrated as being formed from two standard pieces and one odd piece. Other solutions may be obtained by forming the initiating cradle from three standard pieces, one standard piece and two odd pieces, or three odd pieces. The design of the puzzle permits these cradle variations to be formed.

The pieces of the puzzle may be colored variously, may be all the same color or may be colored in a pattern as desired. For example, a specific color may be assigned to each piece in a given group with the colors of the groups being different. For example, group W could be colored white, group B, blue, group R, red, and group G, green. With this arrangement, the foregoing illustrative solution would result in the pieces of like color being arranged in parallel to each other so that a given piece will not lie adjacent to another piece of the same color. With this color configuration, other assembly sequences may result in other color patterns.

The puzzle pieces may be fabricated from any number of convenient materials such as wood, metal or, as preferred, molded plastic.

Having thus described the invention, what I desire to claim and secure by Letters Patent is:

1. An assembly puzzle comprising:

twelve interengageable, elongate puzzle pieces, each of said pieces having a plurality of notches formed therein, said notches extending transversely through said pieces and being contoured to receive a section of another puzzle piece at an angle to said notch puzzle piece;

said puzzle being formed from a first set of puzzle pieces and a second set of puzzle pieces, the pieces in said first set having more notches than the pieces in said second set; and

said puzzle pieces being arrangeable in an interlocking, self-supporting configuration which defines a plurality of groups of said puzzle pieces, the pieces within each group being oriented in parallel to each other but at an angle to each piece in each of said other groups, said configuration of said twelve pieces being defined by four groups of three pieces each.

2. An assembly puzzle comprising:

twelve interengageable, elongate puzzle pieces, each of said pieces having a plurality of notches formed therein, said notches extending transversely through said pieces and being contoured to receive a section of another puzzle piece at an angle to said notch puzzle piece;

said puzzle being formed from a first set of puzzle pieces and a second set of puzzle pieces, the pieces in said first set having more notches than the pieces in said second set, said pieces of said first set including a total of three of said puzzle pieces and said second set including the remaining nine puzzle pieces; and

said puzzle pieces being arrangeable in an interlocking, self-supporting configuration which defines a plurality of groups of said puzzle pieces, the pieces within each group being oriented and parallel to each other but at an angle to each piece in each of said other groups.

3. A puzzle as defined in claim 2 wherein said three pieces in said first set each have three notches and wherein said pieces in said second set each have two notches.

4. A puzzle as defined in claim 3 wherein each piece in said second set has two notches formed on the same side of said piece, said notches being spaced lengthwise along said piece and extending in parallel directions, said direction being oriented at an angle to the longitudinal axis of said piece, the region between said paralleling slots defining an intermediate land surface.

5. A puzzle as defined in claim 4 wherein said pieces of said first set include the same two notches and intermediate land as the pieces in said second set, each of said pieces in said first set having a third notch disposed between the two paralleling notches thereof, said third notch being displaced angularly about the longitudinal axis of said piece and extending in a different direction than that of said first two notches.

6. A puzzle as defined in claim 5 wherein each of said puzzle pieces is of hexagonal prismatic shape, said

notches being of trapezoidal configuration to receive three longitudinal faces of the other of said pieces.

7. A puzzle as defined in claim 6 wherein the notches formed in each of said members are oriented in a direction making an angle of approximately  $70^{\circ}32'$  with the longitudinal axis of their associated piece.

8. A puzzle defined in claim 7 wherein the direction of the third notch of each of said pieces in said first set is displaced about the longitudinal axis of said puzzle piece approximately  $120^{\circ}$  to the direction of the first two notches thereof.

9. A puzzle as defined in claim 7 wherein the land of each piece defined between said first group faces inwardly toward the center of said assembled puzzle, each of said lands cooperating with the other lands of said other pieces to define a hollow space of dodecahedron configuration.

10. A puzzle as defined in claim 9 wherein each of said lands is of substantially rhombid configuration.

11. An assembly puzzle comprising:

a plurality of interengageable, elongate puzzle pieces, each of said pieces being of hexagonal prismatic shape, each of said pieces having a plurality of notches, each of said notches being of trapezoidal configuration, each of said notches being disposed at an angle of approximately  $70^{\circ}32'$  to the longitudinal axis of its associated piece, said notches being contoured to receive a section of another puzzle piece at said angle to said notch puzzle piece;

said puzzle being formed from a first set of puzzle pieces and a second set of puzzle pieces, the pieces in said first set having more notches than the pieces in said second set; and

said puzzle pieces being arrangeable in an interlocking self-supporting configuration which defines a plurality of groups of said puzzle pieces, the pieces within each group being oriented in parallel to each other but at an angle to each piece in each of said other groups.

12. An assembly comprising:

a plurality of interengageable, elongate puzzle pieces, each of said pieces having a plurality of notches of substantially identical configuration formed therein, said notches extending transversely through said pieces and being contoured to receive a section of another puzzle piece at an angle to said notched puzzle piece, each of said puzzle pieces having at least two paralleling notches spaced lengthwise along said piece and defining a land therebetween;

said puzzle being formed from a first set of puzzle pieces and a second set of puzzle pieces, the pieces in said first set having more notches than the pieces in said second set; and

said puzzle pieces being arrangeable in an interlocking self-supporting configuration which defines a plurality of groups of said puzzle pieces, the pieces within each group being oriented in parallel to each other but at an angle to each piece in each of said other groups, said lands of each of said pieces facing inwardly towards the center of said assembled puzzle, each of said lands cooperating with the other of said lands to define a hollow dodecahedron at the center of said puzzle.

13. A puzzle as defined in claim 12 wherein three pieces of said puzzle are interengageable to define a self-supporting cradle in which each piece in said cradle is disposed at an angle to each of the other pieces in said cradle.

14. A puzzle as defined in claim 13 wherein the lands of each piece within said cradle are of rhomboid configuration and are disposed adjacent each other at the center of said cradle, said lands defining a portion of a hollow rhomb-dodecahedron.

15. A puzzle as defined in claim 13 wherein said three pieces defining said cradle comprise all the pieces of said first set of puzzle pieces.

16. A puzzle as defined in claim 13 wherein said three pieces defining said cradle comprise two pieces

from said first set and one piece from said second set of puzzle pieces.

17. A puzzle as defined in claim 13 wherein said three pieces defining said cradle comprise one piece from said first set and two pieces from said second set of puzzle pieces.

18. A puzzle as defined in claim 13 wherein said three pieces defining said cradle comprise three pieces from said second set of puzzle pieces.

19. A puzzle as defined in claim 1 in which the pieces in each group are of identical color, the colors of each group being different from the color of each of the other groups.

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