

[54] **THREE-DIMENSIONAL BLOCK PUZZLE**

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Related U.S. Application Data

[63] Continuation of Ser. No. 217,532, Jan. 13, 1972, abandoned.

[52] **U.S. Cl.**..... **273/153 S**

[51] **Int. Cl.**..... **A63f 9/08**

[58] **Field of Search**..... **273/153 S, 157 R, 157 A**

[56] **References Cited**

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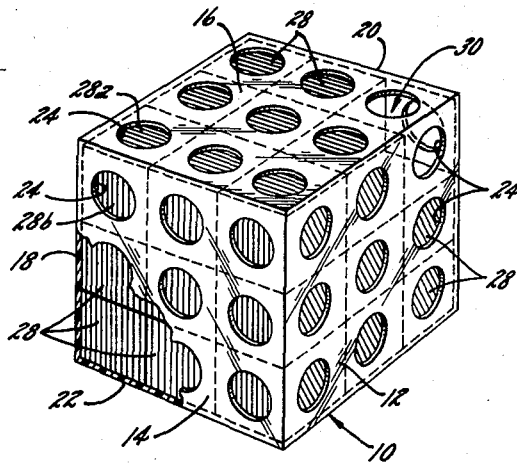
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[57] **ABSTRACT**

A three-dimensional puzzle in which movable blocks are arranged within a substantially closed housing, each of the blocks having the same exterior shape as the housing and the total number of movable blocks being one less than the number required to completely fill the housing so that a void is defined equal in volume to the volume of one of the movable blocks. Each of the blocks has surfaces colored in a predetermined pattern, and each block is movable, by finger pressure exerted through a series of access ports in the outer housing, into various spacial relationships with respect to each other block in solving the puzzle, each spacial relationship resulting in a different color pattern visible through the outer housing.

10 Claims, 4 Drawing Figures



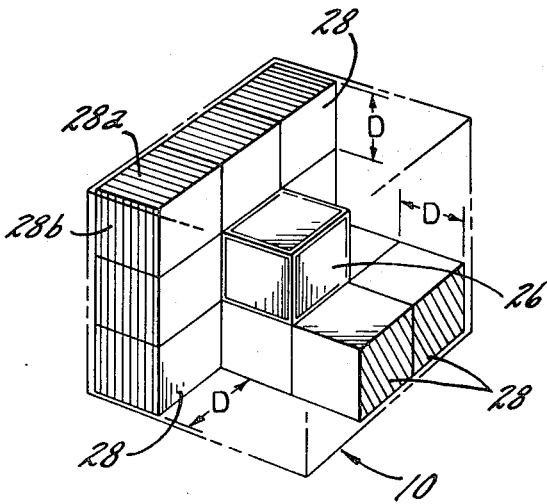
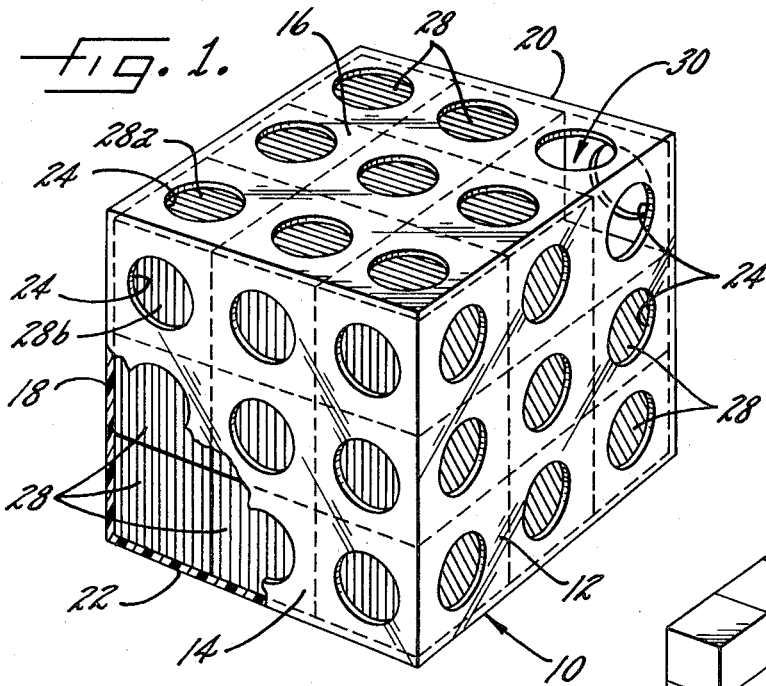


FIG. 2.

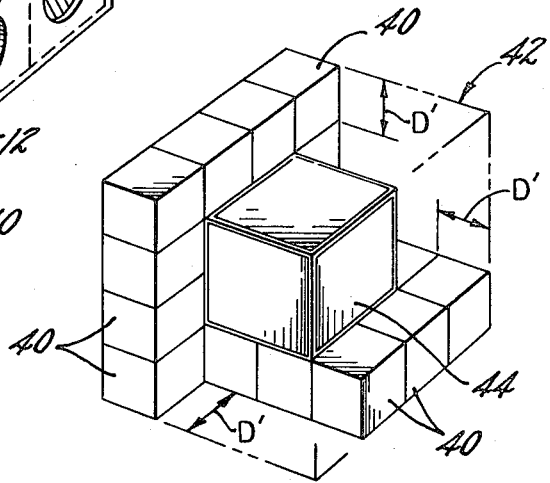


FIG. 3.

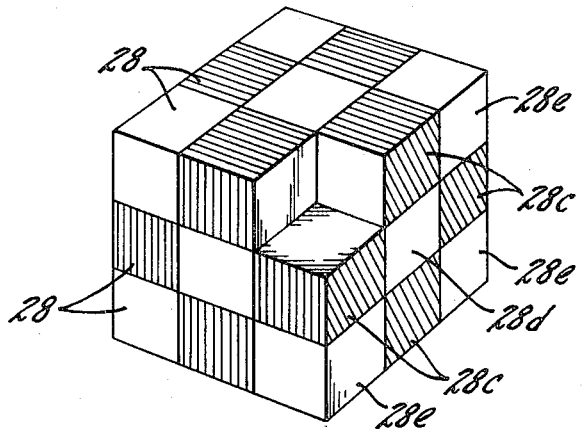


FIG. 4.

THREE-DIMENSIONAL BLOCK PUZZLE

This is a continuation of application Ser. No. 217,532 filed Jan. 13, 1972, and now abandoned.

DESCRIPTION OF THE INVENTION

This invention relates generally to three dimensional puzzles and more particularly concerns a movable block puzzle which can be manipulated to present a variety of visible patterns on its exterior.

There have previously been devised games and puzzles in which pieces of a predetermined shape have been movable in two or even three dimensions within an exterior housing into a variety of spacial relationships with respect to each other. In particular, there have been developed two and three dimensional games in which the number of pieces within the outer housing is one less than the number of pieces required to totally fill the housing so that, by selective displacement with the void defined by the missing piece, the pieces may be moved into various spacial relationships in solving the puzzle. However, the pieces in the known puzzles have had letters and/or numerals impressed on their surfaces in such a manner that only a limited number of possible solutions could be achieved. Furthermore, the geometry of these prior puzzles has placed considerable limitations on the versatility and complexity of these puzzles, these two criterion being of utmost importance in defining a truly challenging puzzle.

It is a principal object of the present invention to provide an improved block puzzle characterized by a degree of versatility and complexity heretofore unknown in the art and further characterized by the use of transparent and colored materials in its construction so as to provide a degree of eye appeal heretofore unavailable in block puzzles.

It is another object of the present invention to provide an improved three dimensional puzzle which requires a high degree of manipulative skill while at the same time providing a changeable decorative appearance.

A more detailed object of the present invention is the provision of a puzzle in which a plurality of many sided blocks of a uniform size and shape are movable within a volume of constant thickness defined within an outer housing of the same shape as the movable blocks.

A further object is the provision of a movable block puzzle as defined above in which the sides of the movable blocks are selectively colored so as to provide a different colored pattern for each solution of the puzzle.

Other objects and advantages of the invention will become apparent upon reading the following detailed description and upon reference to the drawings, in which:

FIG. 1 is a perspective view, partially cut-away, of a cube puzzle embodying the present invention;

FIG. 2 is a perspective view of a portion of the puzzle shown in FIG. 1 and illustrating certain aspects of the internal construction of the puzzle;

FIG. 3 is a perspective view illustrating the internal construction of an alternate embodiment of the puzzle; and

FIG. 4 is a perspective view of the blocks within the puzzle of FIGS. 1 and 2 illustrating a possible solution to the puzzle.

While the invention will be described in connection with certain preferred embodiments, it will be under-

stood that I do not intend to limit the invention to those embodiments. On the contrary, I intend to cover all alternatives, modifications and equivalents as may be included within the spirit and scope of the invention as defined by the appended claims.

Referring now to the drawings, and specifically to FIGS. 1 and 2, there is shown a closed outer housing 10 having six rectangular sides, three of which are visible and designated by the reference numerals 12, 14 and 16. In parallel planes to these surfaces but not entirely visible are corresponding opposite sides designated by the reference numerals 18, 20 and 22, respectively.

To allow for manipulation of the contents of the housing 10 there is provided a plurality of access ports 24 formed in each wall of the outer housing 10, each port being of a size and shape which allows a finger of the user or player to pass through. In the embodiment shown in FIG. 1 each of the sides of the outer housing 10 has nine access ports spaced uniformly across its surface. In carrying out the present invention the sides of the outer housing 10 are constructed of a transparent material, typically plastic, so that the contents of the outer housing 10 are visible not only through the access ports 24 but also through the solid surface material of the housing itself.

In accordance with the present invention, there is provided within the outer housing a central block 26 (FIG. 2) having the same exterior shape as the outer housing 10. The central block 26 is smaller than the housing 10 and so positioned within the housing that a volume of constant depth D is defined around the central block 26 within the housing 10. A plurality of movable blocks, referenced with the numeral 28, are positioned within the volume defined between the central block 26 and the outer housing 10, each of the blocks 28 having the same shape as the outer housing and the total number of the blocks 28 being one less than the number required to completely fill the volume defined between the central block 26 and the housing 10. The remaining space within the housing 10 defines a void 30 equal in volume to the volume of one of the movable blocks. Each of the blocks 28 has side dimensions such that a single block substantially spans the depth D of the defined volume within which the blocks are movable, allowing, of course, a small but finite amount of clearance between the blocks 28 so that the blocks may be moved with a minimum of frictional resistance. As a result of the construction described above, the blocks 28 are capable of being placed in a plurality of spacial relationships with respect to each other by selective displacement of the blocks 28, one by one, with the void 30, the void 30 being successively filled and redefined in the position occupied by the block with which it was last displaced.

In a broad sense, each of the spacial relationships which the blocks 28 might take with respect to each other defines a new solution to the puzzle. However, in order that certain solutions to the puzzle might have special significance from a standpoint of appearance, the sides of the movable blocks 28 are colored so that a different color combination is visible through the transparent outer housing 10 for each of the many spacial relationships which the blocks 28 might assume with respect to each other when selected ones of said blocks are moved.

Therefore, in carrying out the present invention, certain of the surfaces of the blocks 28 are colored, the

colored surfaces of the blocks being so arranged that a plurality of symmetrical or semi-symmetrical visible patterns may be achieved, each representing a different solution to the puzzle. In the specific embodiment represented in FIGS. 1 and 2 each of the movable blocks 28 are provided with one or more colored surfaces arranged in a predetermined relationship with respect to the uncolored surfaces such that first and second primary solutions to the puzzle may be achieved through movement of the blocks 28, these primary solutions resulting in the conditions of, respectively (a) only colored surfaces being adjacent to and visible through the housing 10, and (b) only non-colored surfaces being adjacent to and visible through the housing 10. The first of these solutions is depicted in FIG. 1, in which the surfaces of the movable blocks adjacent to and visible through the side 12 of the housing 10 are green. The surfaces of the movable blocks adjacent to and visible through the side 14 of the housing 10 are red. The surfaces of the movable blocks adjacent to and visible through the side 16 of the housing 10 are blue. The surfaces adjacent opposite sides of the housing 10 are of the same color, e.g., the surfaces of the blocks adjacent to and visible through the side 18 (opposite side 12) are green. It is further contemplated that in the particular solution shown all surfaces of the movable blocks 28 which are not adjacent to the outer walls of the housing 10 are non-colored or white. The central block 26 (FIG. 2) may be transparent or any color which would distinguish it from the movable blocks. The cross hatching shown in FIGS. 1, 2 and 4 illustrates the presence of color on a particular surface; vertical, horizontal and diagonal cross hatching respectively representing the colors red, blue and green. Taking the block in the upper left hand corner of the puzzle in FIG. 1 as an example, this block has a blue surface 28a, a red surface 28b and a green surface (not shown) visible through the wall 18. All other surfaces of this block are non-colored or white. By moving the blocks 28 within the housing 10 by finger pressure through the access ports 24, the second primary solution, in which only noncolored surfaces are adjacent to and visible through the outer walls of the housing 10, can be achieved.

With the blocks 28 selectively colored in the manner defined above, a plurality of secondary solutions may be achieved by movement of the blocks within the housing 10. One of these secondary solutions is illustrated in FIG. 4, in which the blocks 28 of the puzzle have been rearranged so that checker patterns are visible through each side of the housing 10 (shown in FIG. 1). Through the side 12 four green surfaces, each designated by the numeral 28c, are visible and spaced in a symmetric pattern about a non-colored central surface 28d. Non-colored surfaces 28e complete the pattern. Similar patterns of red and blue checks are visible through the housing sides 14 and 16, respectively, and the sides 18, 20 and 22 (not visible) additionally contain checkerboard patterns similar to those occurring on the surfaces shown.

The movable blocks 28 of the embodiment shown in FIGS. 1, 2 and 4 are in a three-by-three-by-three matrix within the housing 10. As such, there are 27 spaces of equal volume and shape within the housing, the central one of which is occupied by the central block 26. Twenty-five blocks are movable within the area between the central block 26 and the outer housing 10 by selective displacement with the void 30. The access

ports 24 are nine in number on each side of the housing 10 and equally spaced across the surface of each side at the possible positions which the blocks 28 might assume adjacent that side.

The invention is not limited to a three-by-three-by-three matrix, but rather includes any enclosed cube or box puzzle in which movable blocks are positioned within a closed housing in a matrix arrangement in which the height width and depth of the matrix, measured in blocks, are identical. For example, the embodiment shown in FIG. 3 includes blocks 40 arranged in a four-by-four-by-four matrix in a volume of constant depth D' defined between an outer housing (represented by the broken line 42) and a central block 44. As in the embodiment of FIG. 1, the central block 44 and each of the movable blocks 40 have the same exterior shape as the outer housing. While the alternate embodiment is only partially shown in FIG. 3, it will be appreciated that the puzzle includes 55 movable blocks, 56 blocks being required to completely fill the volume defined around the central block 44. Naturally, this embodiment of the puzzle, with the surfaces of the blocks 40 selectively colored, presents a much greater number of possible solutions and corresponding visible color patterns than the embodiment previously described. However, the complexity of this puzzle and the time required for its solution are proportionately greater than that of the previous embodiment.

The number N of movable cubes in each of the embodiments illustrated can be determined from the formula

$$N = 6X^2 - 12X + 7,$$

where X = the number of cubes in each dimension of the matrix (e.g., 4 in the embodiment of FIG. 3).

While in the embodiments illustrated the puzzle elements, i.e., the movable blocks, the central block and the outer housing, appear cubicle in shape, it should be appreciated that the defining shape, which is common to all elements, is that of a rectilinear polyhedron or a closed volume defined by six rectangular sides. Also, the puzzle may be fabricated to provide any desired color combination on the surfaces of the movable blocks, it being recognized that one of the principal features of the present invention lies in the capability of obtaining a plurality of color patterns which change as the various alternative solutions to the puzzle are achieved.

I claim as my invention:

1. A puzzle comprising
a closed outer housing having six rectangular sides,

a multi-surfaced central block interior to and having the same exterior shape as said outer housing, said central block being smaller than said housing and so positioned within said housing that each surface of said central block is spaced from the corresponding side of the outer housing by an equal distance to define a volume between said sides and said surfaces,

a plurality of movable blocks within said defined volume, each having the same shape as said outer housing and having one or more surfaces having indicia distinguishable from that of said central block, the number of said blocks being one less than the number required to completely fill said defined volume so that a void is defined equal in vol-

ume to the volume of one of said movable blocks, and

a plurality of access ports in the sides of said outer housing to allow said movable blocks to be moved within said defined volume by selective displacement with said void, whereby said blocks may be placed in a plurality of spacial relationships with respect to each other in solving the puzzle, each solution presenting a different combination of surface indicia visible through the sides of said outer housing.

2. A puzzle according to claim 1 wherein said surfaces of said movable blocks distinguishable from said central block are colored and are arranged with respect to the uncolored surfaces such that first and second color patterns are achieved by movement of said movable blocks, said patterns respectively resulting in (a) only colored surfaces being adjacent said outer housing and (b) only non-colored surfaces being adjacent said outer housing.

3. A puzzle according to claim 2 wherein each of said colored surfaces is a predetermined one of three different colors and wherein achievement of said first color pattern results in the surfaces of said movable blocks adjacent opposite sides of said outer housing being of the same color while the surfaces of said movable blocks adjacent sides of said housing which are perpendicular to each other are of different colors.

4. A puzzle according to claim 1 wherein said rectangular sides of said housing are transparent so that a different combination of surface indicia is visible through said transparent housing for each of said plurality of spacial relationships.

5. A puzzle according to claim 1 wherein said rectangular sides of said housing are square in shape so as to define a cubical housing, each of said movable blocks being cube-shaped and movable with respect to each other in three directions.

6. A puzzle according to claim 1 wherein the total number of said movable blocks is 25 and wherein each of said blocks is movable, by selective interchange with said void, into any position within a three by three by three block matrix inside said housing.

7. A puzzle according to claim 4 wherein said surfaces having surface indicia distinguishable from said central block are of such a number and so arranged on their respective blocks that first and second primary solutions may be achieved through movement of said blocks, said primary solutions resulting in the conditions of, respectively

- a. only surfaces bearing said distinguishable indicia being adjacent to and visible through said transparent housing, and
- b. only surfaces not bearing said distinguishable indicia being adjacent to and visible through said housing.

8. A puzzle according to claim 2 wherein a plurality

of secondary solutions may be achieved by movement of said blocks within said housing in which secondary solutions each side of said housing is abutted by surfaces of differing colors in color patterns which are symmetrical about a center point.

9. A puzzle comprising a substantially closed outer housing of cubical shape, a central cube interior to said outer housing, said central cube being smaller than said housing and so positioned within said housing that each surface of said central cube is spaced from the corresponding side of the outer housing by an equal distance to define a volume between said sides and said surfaces,

a plurality of movable cubes within said defined volume, each of said cubes having surface indicia which is distinguishable from that of said central cube, the length, width and height of each movable cube being equal to said distance and the number N of said movable cubes being determined by the formula

$$N = 6X^2 - 12X + 7,$$

where X is the length of each side of said housing measured in movable cubes, said outer housing being formed with a plurality of holes therein defining access ports for allowing manipulation of said movable cubes within said defined volume into a plurality of spacial relationships with respect to each other in solving the puzzle.

10. A puzzle comprising a closed outer housing having six rectangular sides a central block interior to and having the same exterior shape as said outer housing, said central block being smaller than said housing and so positioned within said housing that each surface of said central block is spaced from the corresponding side of the outer housing by an equal distance to define a volume between said sides and said surfaces, the linear thickness of said central block being at least twice as great as said distance,

a plurality of movable blocks within said defined volume, each having the same shape as said outer housing and a linear thickness substantially equal to said distance, the number of said blocks being one less than the number required to completely fill said defined volume so that a void is defined equal in volume to the volume of one of said movable blocks, and

a plurality of access ports in the sides of said outer housing to allow said movable blocks to be moved within said defined volume by selective displacement with said void, whereby said blocks may be placed in a plurality of spacial relationships with respect to each other in solving the puzzle.

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