# United States Patent [19]

**Neale et al.**

[11] **3,811,682**

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[54] **FOLDING PUZZLE**


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[52] **U.S. Cl.** ..... **273/155**, 46/1 L, 273/DIG. 4, 273/DIG. 5, 273/DIG. 12

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

[58] **Field of Search** ..... 273/155; 46/1 L, 157



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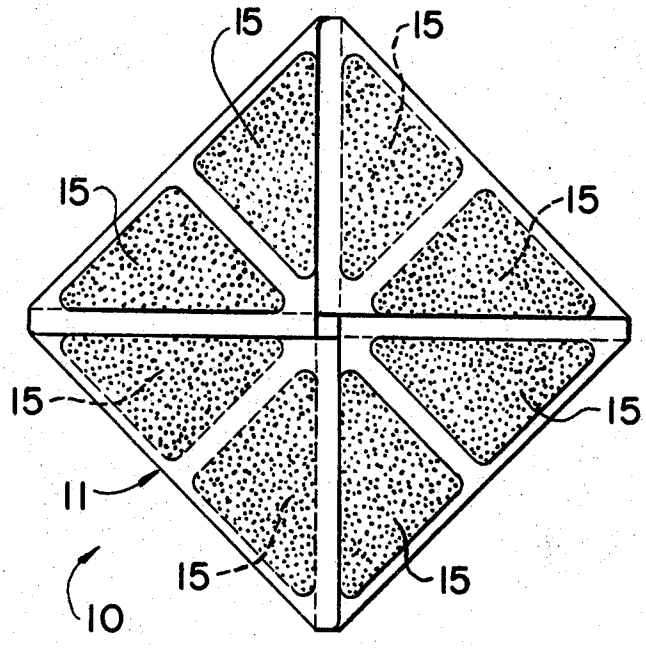
*Attorney, Agent, or Firm*—Philips, Moore, Weissenberger Lempio & Strabala



[57] **ABSTRACT**

An interlocking folding puzzle is formed from an elongated rectangular web having a plurality of triangular stiffening panels arranged thereon in spaced apart sets of four to form four repeating spaced apart edge aligned squares. Each of the squares is folded along one of its diagonals and the ends of the web are connected together such that each square forms one quarter of a composite interfolded square. Those portions of the web between the stiffening panels constitute hinges which enable the stiffening panels to assume various relationships relative to each other. The web is formed of polyethylene, polypropylene or polyvinylchloride to provide long life, non-memory hinges.


**4 Claims, 7 Drawing Figures**



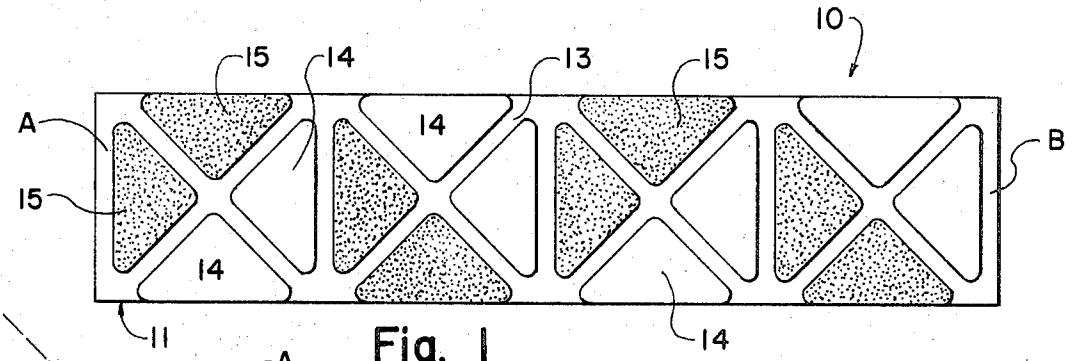



Fig. 1

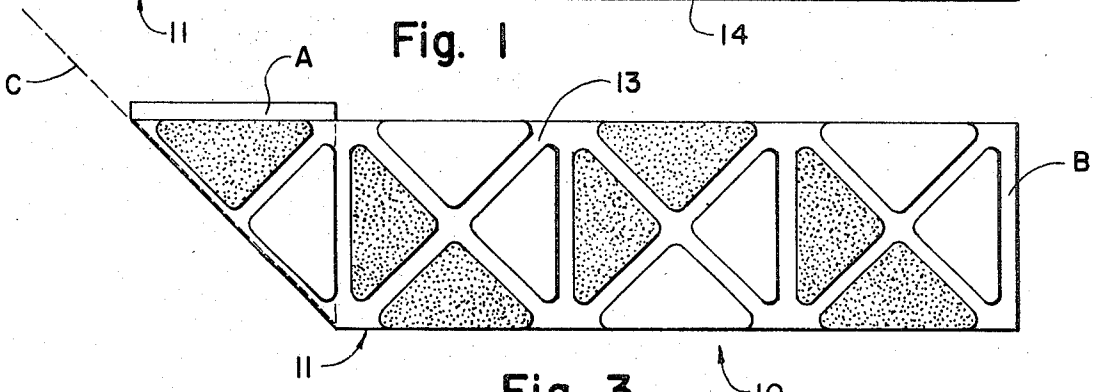



Fig. 3

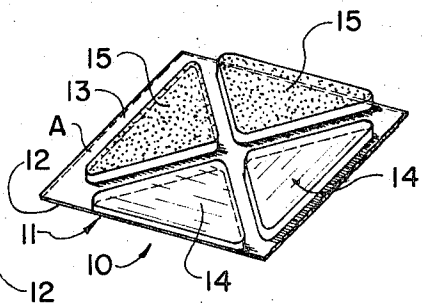



Fig. 2




Fig. 4

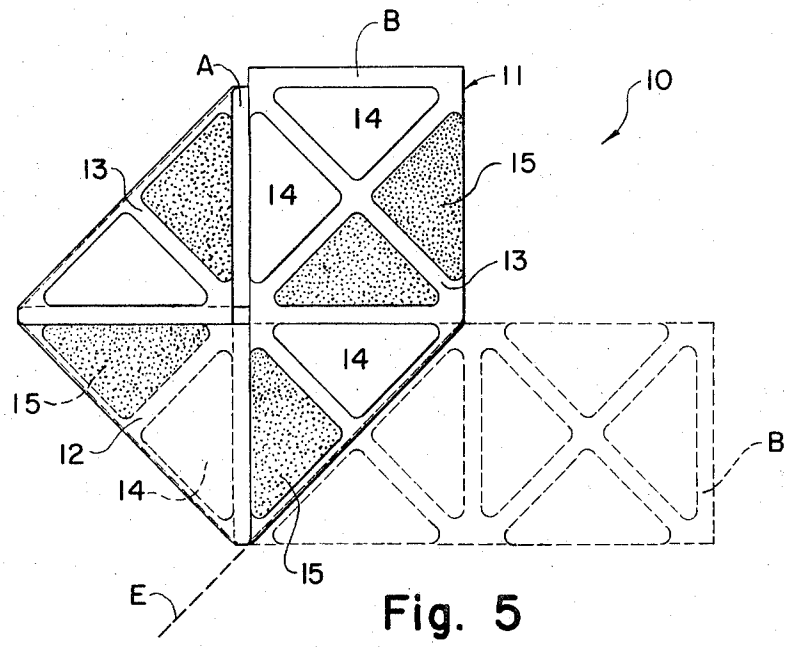



Fig. 5

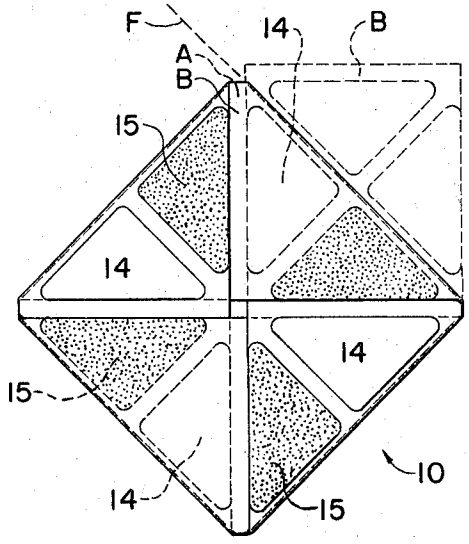



Fig. 6

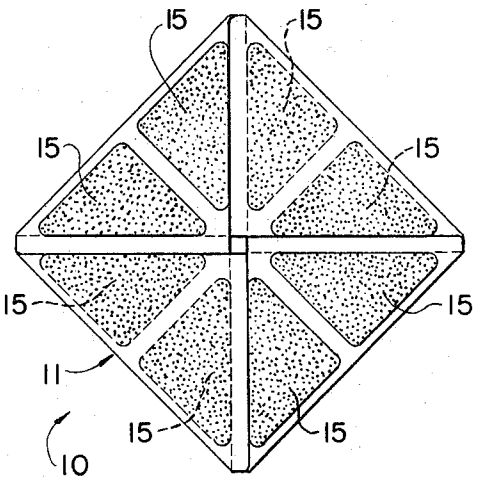



Fig. 7

# FOLDING PUZZLE

## BACKGROUND OF THE INVENTION

Numerous paper puzzles made by folding paper have intrigued persons of all ages for years, and in particular, professionals in the scientific fields, such as mathematics. Mathematical problems or games, such as the number of different ways to fold a rectangular map which is creased lengthwise and widthwise to form a matrix of identical rectangles, is an example of a problem which can be attacked by folding a piece of paper. Since the actual physical permutation of folding operations experienced with paper puzzles or models are fascinating of themselves, especially when combined with a search for a solution to an underlying problem, these puzzles are both entertaining and educational. Further, these operations can be repeated by others for both purposes. Indeed some of the paper puzzles themselves are unique in their arrangement and structure, apart from any underlying theory, being a puzzle in a more general sense, as contrasted to a tool or physical model. For example, see "Folding Money" Volume II edited by Randlett (Magic Inc. 1968) demonstrating some of the latter situations. More generally paper folding is also an Oriental art known as origami, having many advocates, demonstrating the interest in this area.

Because these paper puzzles involve a series of paper panels hinged together, with a fold line, their service life is limited. Also the folding may produce a "memory" in the puzzle making its solution too simple for a subsequent user. Further, the mechanical strength of such hinges may be inadequate for a puzzle designed for repeated use. Special hinges used between the panels tend to be prohibitively expensive and do not provide the necessary flexibility often required.

Thus, it is an object to provide a plastic web and panel design for such puzzles which are both durable and inexpensive, as well as a unique puzzle having such a format.

## SUMMARY OF THE INVENTION

A folding puzzle having excellent durability can be formed with an elastomer mat or web having spaced thereon a plurality of stiffening panels whereby the web will provide a hinging function between the several panels, as the latter are articulated relative to one another. The stiffening panels may have a variety of shapes, but in a preferred embodiment they are triangular, with sets of four such panels assembled in closely spaced relationship on the web to approximate a square, with four such squares arranged in an edgewise linear sequence on the rectangular web. With designs added to half of each such assembled "sets," such as coloration, the web may be folded in a lapping relationship, forming a larger interlocked square by joining the opposite ends of the rectangular web of the linear sequence of smaller squares. If the designs on the panels are properly arranged, the final interlocked square can be manipulated to obtain a mixed design on opposite sides of the interlocked square or a uniform design on both sides.

## BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be better understood by referring to the drawings wherein:



FIG. 1 illustrates a plan of the puzzle format employing a rectangular elastomer web or sheet with a plurality of spaced-apart stiffening panels disposed on the surface thereof;

FIG. 2 is a perspective of one end of the puzzle format showing the relationship of the web and the individual panels;

FIGS. 3, 4, 5 and 6 are successive plan views of the puzzle format, with FIG. 3 illustrating the first folding operation, FIG. 4 illustrating the second folding operation, FIG. 5 showing the third folding operation and FIG. 6 illustrating the final folding operation to form the larger interlocked square; and

FIG. 7 illustrates the completed puzzle in plan showing the panels in an alternate configuration, with the colored panels all arranged to be viewed from one side of the puzzle as opposed to the mixed configuration shown in FIG. 6.

## DESCRIPTION OF AN EMBODIMENT

Referring to FIG. 1, the puzzle format 10 is illustrated in an unfolded condition and by considering FIGS. 1 and 2, it can be seen the puzzle format employs an elastomer mat or web 11 with a plurality of panels disposed thereon in a spaced-apart relationship, the pattern having a repeating sequence. The web is rectangular in shape and can be selected from various elastomers, such as polyethylene, polypropylene or polyvinylchloride. Polypropylene is somewhat preferred because of its superior flexing characteristics in hinging applications. Also, these materials, in the thin webs employed, (3 to 10 mil), are translucent or clear which will allow the coloration (designs) in some of the panels to be seen from both sides of the web. For example, this is illustrated in FIG. 4, wherein the bottom surface 12 of the web is shown along with the top surface 13 of the web in the same figure as a result of a fold, and the coloration of all the colored panels is seen, even though some are viewed from the bottom side of the web.

More particularly, the panels 14 and 15, disposed on the top surface 13 of the mat or web 11, are identical except for coloration. Obviously designs may be employed on the surfaces of these panels in place of the coloration, which has been indicated by shading. The panels themselves are triangular, actually isosceles right triangles, and forming stiffening members on the web, thereby allowing the web portions between the stiffening members (panels) to function as hinges. The panels are preferably formed integrally with the web, but may be welded thereto ultrasonically or with solvents, when separately formed. Also, the panels may be actually disposed in the web, when integrally formed therewith, so a raised portion thereof occurs on both the top and bottom surfaces of the web, as opposed to being primarily associated with one surface, as shown in drawings herein.

Panels 14 and 15 are associated with the web or mat 11 in a pattern which includes "sets" of four panels slightly spaced-apart to form squares, as shown in FIG. 2, and four of these "sets" are arranged in a linear sequence, as can best be seen in FIG. 1. In this figure, it can also be seen that tabs A and B are employed at the opposite ends of the rectangular mat or web which tabs have a width equal to the space between the "set" and individual panels referred to above. Ultimately the tabs will be fused together to join these ends in the puzzle.

To form the puzzle from the puzzle format illustrated in FIG. **1**, the end thereof having tab A, is folded under along folding axis C (shown in FIG. **3**) and thereafter the end having tab B folded over along folding axis D (shown in FIG. **4**) to form half of the enlarged interlocked square. The remaining half is formed by folding the end with tab B along folding axis E over the previously folded part so the top surface **13** of the puzzle format is on top (shown in FIG. **5**) whereafter the end with tab B is subsequently folded over this portion along folding axis F to bring tabs A and B together. These tabs are welded to complete the puzzle and can be formed with a thickness one half the thickness of the web so a double thickness is avoided when they are joined. Also during the folding operations the top surface is folded so its panels are contiguous to one another and the bottom surface is folded to be contiguous to itself, as review of the drawings will demonstrate.

As a result of the described folding operations an enlarged interlocked square is formed, as can best be seen in FIGS. **6** and **7**. The object of the completed puzzle is to convert from the configuration illustrated in FIG. **6** to that shown in FIG. **7** and back again by folding permulations.

This is accomplished by folding the enlarged interlocked square along its diagonal to form a triangle, opening the triangle like a hat in the middle of its hypotenuse to form a smaller square, which is then opened to a rectangle. This rectangle may be opened to a cube tube and then collapsed to rearrange the relationship of the panels. Thereafter, the sequence is reversed and the result is the configuration shown in FIG. **7**, if the original folding operations were commenced with the configuration shown in FIG. **6**.

What is claimed is:

**1.** An interlocking folding puzzle comprising:

an elongated rectangular flexible elastomer web having opposite ends; and

a plurality of triangular stiffening panels disposed on the surface of said web and fixedly attached thereto, said panels arranged in spaced apart relationship in sets of four to form four repeating spaced apart edge aligned squares, each of said squares being foldable along either diagonal wherein portions of said plastic web between said panels and said squares form non-memory hinges, said squares each being folded along one diagonal into a planar lapping relationship to form one quarter of a composite square, the ends of the thus interfolded web being connected together to form an endless loop, each of said quarter squares including two of said triangular stiffening panels whereby the relative arrangement of said panels can be interchanged through folding permutations of said endless loop along said non-memory hinges without distorting said stiffening panels.

**2.** The puzzle defined in claim **1** wherein the elastomer is a plastic selected from the group consisting of polyethylene, polypropylene and polyvinylchloride.

**3.** The puzzle defined in claim **1** wherein the stiffening panels are formed integrally with the web.

**4.** The puzzle defined in claim **1** wherein said stiffening panels have at least two different indicia thereon distinguishing some of said panels from other of said panels.

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