March 12, 1968 R. E. SANSON 3,372,936

INTERLOCKING BAR PUZZLE COMPRISING HELICALLY NOTCHED BARS

Filed Aug. 27, 1965

2 Sheets-Sheet 1

FIG. 1

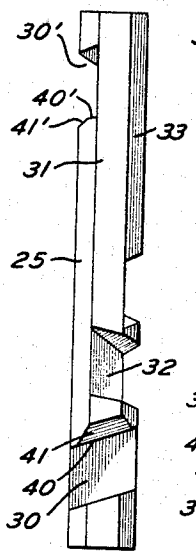


FIG. 4

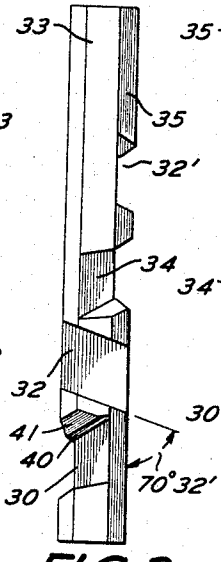


FIG. 5

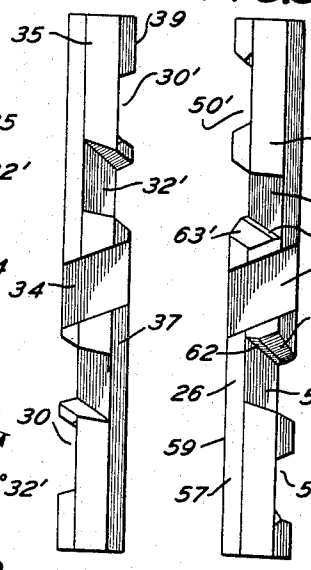


FIG. 8

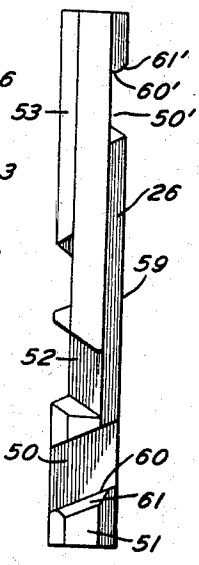


FIG. 7

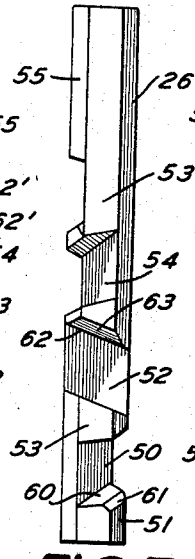


FIG. 3

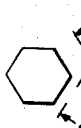


FIG. 2

FIG. 6

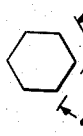


FIG. 9

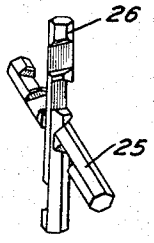


FIG. 10

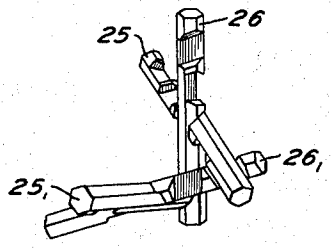


FIG. 11

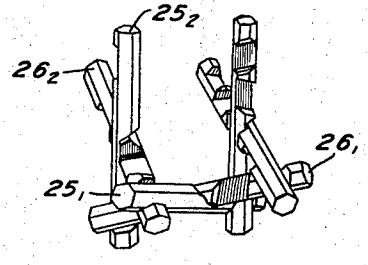
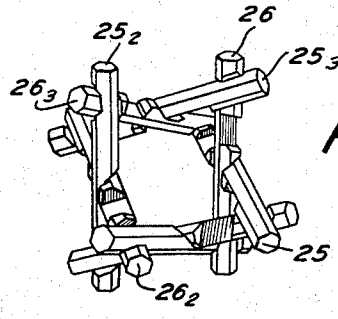


FIG. 12



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FIG. 13

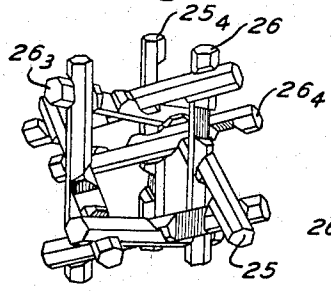


FIG. 14

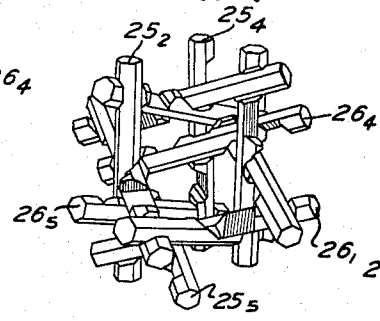


FIG. 15

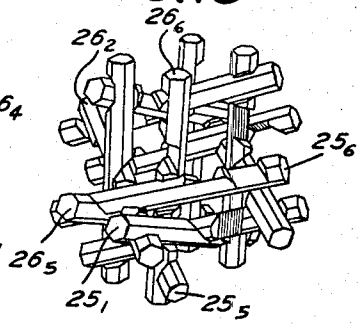


FIG. 16

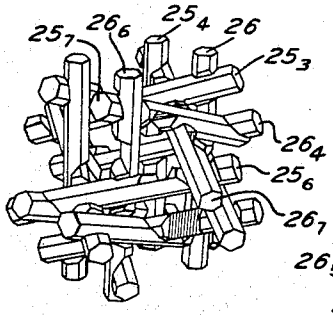


FIG. 17

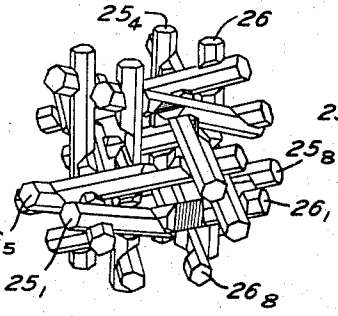


FIG. 18

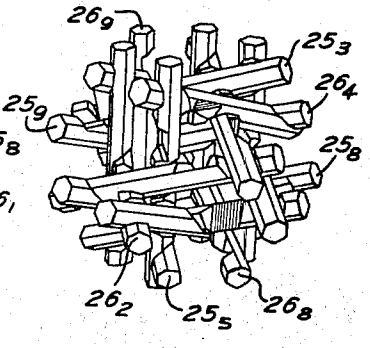


FIG. 19

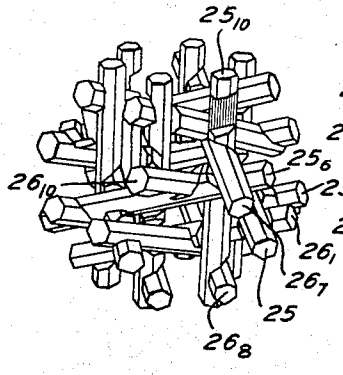


FIG. 20

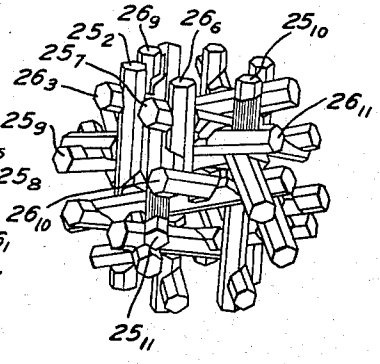
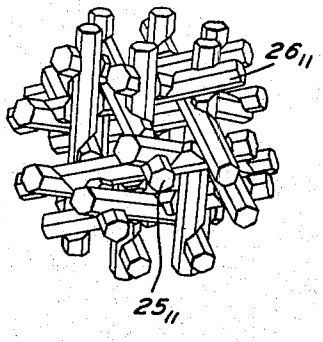


FIG. 21



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INTERLOCKING BAR PUZZLE COMPRISING HELICALLY NOTCHED BARS

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Filed Aug. 27, 1965, Ser. No. 483,165
7 Claims. (Cl. 273—160)

This invention relates to puzzles, and more particularly, to a puzzle in which a plurality of interlocking bars may be assembled into a symmetrical block structure.

A primary object of the invention is to provide for amusement and pastime a novel and interesting block puzzle of seemingly extraordinary complexity in which with the exercise of patience and skill, a plurality of bars may be assembled into a single composite locked structure.

Another object is to provide a plurality of interengageable helically notched bars capable of being assembled into a symmetrical interlocked ornamental structure.

A further object is to provide a block puzzle comprising twenty-four interengageable bars of the same length composed of two respective sets of twelve identical notched bars.

A further object of the invention is to provide a block puzzle composed of interengageable reversible notched bars of regular hexagonal cross section.

With these and other objects in view which will become apparent from the ensuing description and claims, the following sets forth the details of construction and combination of parts of a specific embodiment of my invention which will be best understood when read in conjunction with the accompanying drawing, in which:

FIG. 1 is a front elevation of one of a first set of identical hexagonal notched bars of which the puzzle is composed; FIG. 2 is a bottom plan view of the bar of FIG. 1; FIG. 3 is an elevation on the line 3—3 of FIG. 2; FIG. 4 is an elevation on the line 4—4 of FIG. 2; FIG. 5 is a front elevation of one of a second set of identical hexagonal bars notched differently than the bar of FIG. 1; FIG. 6 is a bottom plan view of the bar of FIG. 5; FIG. 7 is an elevation on the line 7—7 of FIG. 6; FIG. 8 is an elevation on the line 8—8 of FIG. 6; FIG. 9 is a perspective view of the first step in assembling the puzzle illustrating a bar of FIG. 1 interengaged with a bar of FIG. 5 forming a basic construction unit; FIG. 10 is a perspective view showing the second step in the solution of the puzzle in which two of the basic units of FIG. 9 are interengaged; FIGS. 10 to 20 are perspective views showing successive steps in assembling the puzzle, in which basic units of FIG. 9 are successively interengaged; and FIG. 21 is a perspective view showing all of the parts properly assembled.

The puzzle comprises two sets of 12 identical elongated-notched bars of regular hexagonal cross-section, the bars of the two sets differing only in the notching. The bars of each set have five longitudinally-spaced diagonal notches disposed helically around the bar in successively adjacent flat longitudinal faces. The sequential notches are flat bottomed, extend to a depth half way through the bar, have a width slightly greater than the distance between opposite vertices of the hexagon of the bar in transverse section and have their sides all inclined at an angle of about 70° and 32′ to the longitudinal axis of the bar, alternate notches in the helix having their sides inclined at this angle in opposite sense.

Referring now to FIGS. 1 to 4, the bar **25**, characteristic of the first set, has in its front face **31** as represented in FIG. 1, an end notch **30** inclined upwardly to the right. The adjacent notch **32** is in the face **33** next right of the face **31**, is disposed higher on the bar **25** and is inclined upwardly to the left as shown in full face in FIG. 3. The next sequential notch **34** is medial of the bar length, is in the face **35** next right of the face **33** and is inclined to the longitudinal axis in the same sense as the notch **30**. The next sequential notch **32′** is in the adjacent face **37** to the right of the face **35** and is identical with and inclined with respect to the longitudinal axis in the same direction as the notch **32**. The final sequential notch **30′** is in the face **39** to the right of the face **37** and is identical with and inclined with respect to the longitudinal axis in the same direction as the notch **30**. The end notches **30** and **30′** are disposed at the same distances from the respective opposite ends of the bar, the intermediate notch **32** is disposed longitudinally midway between the end notch **30** and the medial notch **34**, and the intermediate notch **32′** is disposed longitudinally midway between the end notch **30′** and the medial notch **34**. The bar **25** is reversible in the sense that when reversed end for end by rotation on a transverse horizontal axis and then rotated 60° clockwise about the longitudinal axis it will appear identical. For example, if the bar **25**, as shown in FIG. 1, is rotated 180° on a transverse horizontal axis in the plane of the drawing and is then rotated 60° clockwise as viewed from below, it will appear exactly as in FIG. 1, with the notch **30′** being adjacent to the bottom of the bar and the notch **30** adjacent to the top of the bar.

The bottoms of the notches are planes which include the longitudinal axis of the bar and are parallel to the face from which the respective notch extends. The sides of each notch are respectively perpendicular to its bottom, except in the case of the notches **30** and **30′** which have their sides **40** and **40′**, remote from the respective adjacent ends of the bar, identically beveled at **41** and **41′** to somewhat more than half the depth of the respective notch.

FIGS. 5 to 8 show one of the bars **26** of the second set, which is similar to the bars of the first set but has the notches arranged in a left-hand-thread helix around the bar instead of the right-hand-thread helix of the bar **25**. As shown in FIG. 8, the bar has in its front face **51**, adjacent the lower end, a notch **50** inclined upwardly to the right. The adjacent notch of the helix is the intermediate notch **52** in the face **53** next left of the face **51**, the sequential medial notch **54** is in the face **55** next left of the face **53**, the sequential intermediate notch **52′** is in the face **57** next left of the face **55** and the end notch **50′** is in the face **59** next left of the face **57**. The inclinations of the end and medial notches with respect to the longitudinal axis are the same as for the corresponding end and medial notches of the bar **25**, and the intermediate notches are of opposite inclination, also similarly as in the bar **25**. The notches in the bar **26** are longitudinally disposed identically with the corresponding notches of the bar **25**.

The notches in the bar **26** have flat bottoms and perpendicular sides, similar to the notches in the bar **25**, but differ with respect to beveling of some of the sides. In the notches **50** and **50′**, the sides **60** and **60′**, toward the respective adjacent end of the bar, are identically beveled at **61** and **61′** to about half the depth of the notches. In the notches **52** and **52′**, the sides **62** and **62′**, toward the medial notch **54**, are identically beveled at **63** and **63′** to somewhat more than half the depth of the notches, similarly to the bevels **41** and **41′**.

One example of the assembling or interengaging of the bars to complete or solve the puzzle will now be described, successive bars in a set being identified by consecutive subscripts. Referring to FIG. 9, the bars **25** and **26** are interengaged at their respective medial notches **34** and **54**, forming a basic construction unit. The puzzle is further assembled by successive one-at-a-time additions

of identical basic units formed by medial interengagement of a bar of the first set with a bar of the second set.

In FIG. 10 a second unit, composed of medially interengaged bars 25_1 and 26_1, is shown engaged with the first unit, the notch 30 of the bar 25 being interengaged with the notch 50 of the bar 26_1 and the notch 50 of the bar 26 being interengaged with the notch 30 of the bar 25_1. In FIG. 11 a third unit composed of medially interengaged bars 25_2 and 26_2 is shown added to the assembly of FIG. 10, the notch 30' of the bar 25_1 being interengaged with the notch 50 of the bar 26_2 and the notch 50' of the bar 26_1 being interengaged with the notch 30 of the bar 25_2. In FIG. 12 a fourth unit composed of medially interengaged bars 25_3 and 26_3 is shown added to the assembly of FIG. 11, the notch 50 of the bar 26_3 being interengaged with the notch 30' of the bar 25_2 and the notch 50' of the bar 26_3 being interengaged with the notch 30' of the bar 25, and the notches 30 and 30' of the bar 25_3 being interengaged with the notches 50' of the respective bars 26_2 and 26.

The structure of FIG. 12 is a symmetrical self-supporting subassembly and is one of three identical subassemblies which when properly interfitted constitute the completed puzzle. It is evident that this subassembly could have been constructed by combining the basic units in any selected order rather than in the clockwise order indicated in the foregoing.

In FIG. 13 a fifth unit composed of medially interengaged bars 25_4 and 26_4 is shown added to the subassembly of FIG. 12. The bar 25_4 is disposed parallel to and behind and to the left of the bar 26 in such position that its notch 32' interengages the notch 52' of the bar 26_3 and the notch 52' of the bar 26_4 interengages the notch 32' of the bar 25. In FIG. 14 a sixth unit composed of medially interengaged bars 25_5 and 26_5 is shown added to the structure of FIG. 13, wherein the notches 50 and 52' of the bar 26_5 are interengaged respectively with the notch 30 of the bar 25_4 and the notch 32 of the bar 25_2, and the notches 30 and 32' of the bar 25_5 are interengaged respectively with the notch 50 of the bar 26_4 and the notch 52' of the bar 26_1. In FIG. 15 a seventh unit composed of medially interengaged bars 25_6 and 26_6 is shown added to the structure of FIG. 14, in which the notches 30 and 32 of the bar 25_6 are interengaged respectively with notch 50' of the bar 26_5 and the notch 52 of the bar 26_2, and the notches 50 and 52 of the bar 26_6 are interengaged respectively with the notch 30' of the bar 25_5 and the notch 32' of the bar 25_1.

In FIG. 16 an eighth unit composed of medially interengaged bars 25_7 and 26_7 is shown added to the structure of FIG. 15, in which the notches 30, 30' and 32' of the bar 25_7 are interengaged respectively with the notch 50' of the bar 26_6, the notch 50' of the bar 26_4 and the notch 52' of the bar 26, and the notches 50, 50' and 52' of the bar 26_7 are interengaged respectively with the notch 30' of the bar 25_6, the notch 30' of the bar 25_4 and the notch 32' of the bar 25_3. At this stage the structure has a second complete four-unit subassembly interlocked with the first subassembly illustrated in FIG. 12.

In FIG. 17 a ninth unit composed of medially interengaged bars 25_8 and 26_8 is shown added to the assembly of FIG. 16. The bar 25_8 is disposed parallel to and behind the bar 26_1 in such position that its notches 32 and 32' respectively interengage the notch 52 of the bar 26_5 and the notch 52 of the bar 26, while the notches 52 and 52' of the bar 26_8 respectively interengage the notches 32 of the bars 25_1 and 25_4.

In FIG. 18 a tenth unit composed of medially interengaged bars 25_9 and 26_9 is shown added to the structure of FIG. 17, wherein the notches 50, 52 and 52' of the bar 26_9 respectively interengage the notch 30 of the bar 25_8, the notch 32 of the bar 25_5 and the notch 32 of the bar 25_3, and the notches 30, 32 and 32' of the bar 25_9 respectively interengage the notch 50' of the bar 26_8, the notch 52 of the bar 26_4 and the notch 52' of the bar 26_2.

In FIG. 19 an eleventh unit composed of medially interengaged bars 25_{10} and 26_{10} is shown added to the assembly of FIG. 18, in which the notches 50, 52 and 52' of the bar 26_{10} respectively interengage the notch 30' of the bar 25_8, the notch 32 of the bar 25 and the notch 32' of the bar 25_6, and the notches 30, 32 and 32' of the bar 25_{10} respectively interengage the notch 50 of the bar 26_3, the notch 52 of the bar 26_1 and the notch 52 of the bar 26_7.

In FIG. 20 a twelfth unit composed of medially interengaged bars 25_{11} and 26_{11} is shown inserted into the structure of FIG. 19, the bar 26_{11} being in juxtaposition but not interengaged with the bars 25_{10}, 25_7, 25_2 and 25_9, and the bar 25_{11} being in juxtaposition but not interengaged with the bars 26_{10}, 26_6, 26_3 and 26_9, preparatory to interlocking the complete puzzle.

FIG. 21 shows the complete puzzle, in which the medially interengaged bars 25_{11} and 26_{11} have been lockingly integrated into the assembly of FIG. 19, by a twisting manipulation which snaps the twelfth unit into final position wherein the notches 30, 32, 32' and 30' of the bar 25_{11} respectively interengage the notch 50' of the bar 26_{10}, the notch 52' of the bar 26_6 the notch 52 of the bar 25_3 and the notch 50' of the bar 26_9, and the notches 50, 52, 52' and 50' of the bar 26_{11} respectively interengage the notch 30' of the bar 25_{10} the notch 32 of the bar 25_7, the notch 32' of the bar 25_2 and the notch 30' of the bar 25_9. The interengagement of the respective bars is facilitated by the bevels 41, 41', 61, 61', 63 and 63', particularly in the case of the insertion and manipulation of the twelfth basic unit into final locking position. Although there is very little clearance for accomplishing the insertion and manipulation into place of the final unit, this procedure is made readily feasible by the flexibility of the previously assembled structure due to the deliberate inclusion of suitable lost motion in the interengagements of the preceding units.

In the foregoing, for purposes of illustration, I have demonstrated the solving of the puzzle in a specific sequence of assembly of the several basic units, but it is evident that the units may be properly assembled in many other sequences. Since the puzzle can thus be assembled in many different ways, its fascination is greatly enhanced over block puzzles which can only be assembled in one way and thus tend to become monotonous.

In the above preferred modification I have shown the puzzle as being composed of bars whose cross-sections are regular hexagons, but it is obvious that the cross-sections may equally be circles or regular polygons in which the number of sides is evenly divisible by six, for example, such as a dodecagon. In any case, it is essential only that in advancing along the helix of notches from one end of a bar, the flat bottoms of successive notches be sequentially radially angularly displaced sixty degrees from the respective preceding notch.

The bars of the puzzle may be molded, cut from rod stock, or otherwise fabricated from any suitable material and may be of any desired color or decoratively variegated. For example, the bars may be composed of rigid plastic material with one set of the bars of one color and the other set of another color.

Although my invention has been described in considerable detail, such description is intended as illustrative rather than limiting, as other embodiments will be evident to those skilled in the art, as well as obvious modifications in construction and arrangements of parts, without departing from the spirit of the invention.

I claim:

1. A puzzle comprising twenty-four bars of equal length and cross-section arranged in two respective sets of twelve identically-notched reversible bars, said notches being disposed helically around the bars, the notches of the bars in one set being respectively interengageable with the notches of the bars of the other set to form a symmetrical self-sustaining structure.

2. A puzzle of claim 1 in which each bar has five longitudinally-spaced helically-disposed notches, the notches of each bar of one set being arranged in a right-hand-thread helix around the bar and the notches of each bar of the other set being arranged in a left-hand-thread helix around the bar.

3. A puzzle of claim 2 in which said notches extend to a depth half way through the bar and have flat bottoms and parallel sides perpendicular thereto, the bottom of each helically sequential notch being radially angularly displaced 60° from the preceding notch of the helix, and all said sides being inclined at an angle of approximately 70° to the axis of the bar, with the sides of successive helically-adjacent notches being inclined to said axis alternately in opposite sense.

4. A puzzle of claim 1 in which the transverse sectional shape of said bars is a regular hexagon and said notches extend inwardly from respective flat surfaces of the bars.

5. A puzzle of claim 1 in which said bars are cylindrical.

6. A puzzle of claim 1 in which the bars are fabricated of rigid plastic material.

7. A block puzzle comprising twenty-four bars of equal length and cross-section, each of said bars having a medial notch, a notch adjacent each end and a respective notch intermediate the medial notch and each end notch, said

notches being disposed helically around the bar each successively at a 60° radial angle from the next preceding notch, said notches extending to a depth of half the bar thickness and having flat bottoms and parallel sides inclined at an angle of approximately 70° to the axis of the bar with the sides of successive adjacent notches along the helix being alternately inclined at said angle to the axis in opposite sense, said bars being arranged in two sets of twelve bars in which the helices, of the notches of the two sets are respectively of opposite hand, one of said sets having bevels on the respective sides of the end notches of its bars which are adjacent to the intermediate notches thereof, and the other set having bevels on the respective sides of the end notches of its bars which are adjacent to the ends thereof and bevels on the respective sides of the intermediate notches of its bars which are adjacent to the medial notches thereof.

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ANTON O. OECHSLE, *Primary Examiner.*