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(54) Puzzle comprising rotatable pieces

(57) The puzzle comprises a frame (1) in which are mounted thirteen rotatable carriers (3, 3') each carrying four movable portions (4). The movable portions carry markings and must be placed in order to form a pattern. By rotating a carrier, a movable portion shared by that and another carrier can be transferred so as to be shared with a third carrier. The puzzle may be two sided with a different pattern on each side arranged such that when one side is in order, the other is not. The carriers and frame may have tongues (6) and the movable portions have grooves (7) which engage the tongues.

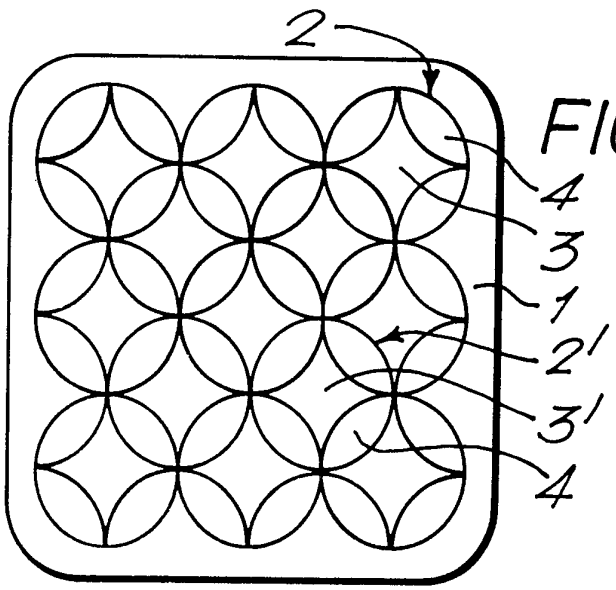
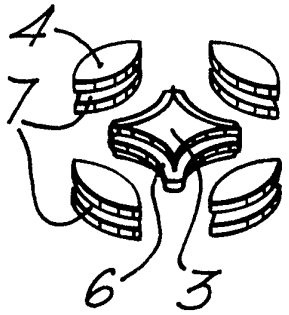


FIG.1.

FIG.4.



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The drawings originally filed were informal and the print here reproduced is taken from a later filed formal copy.

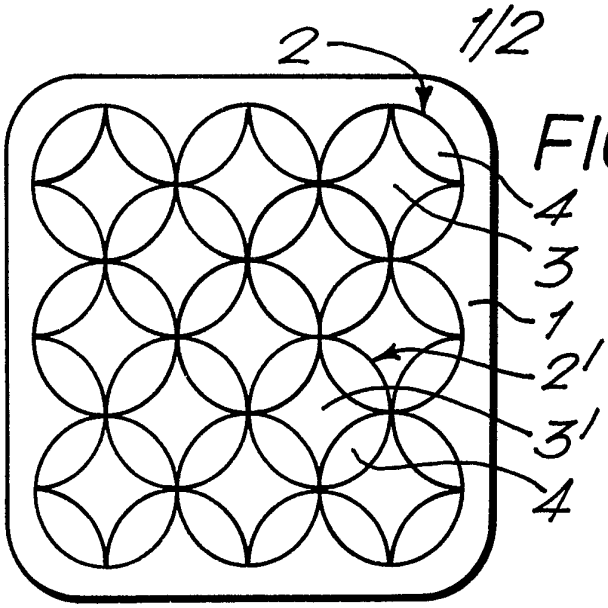


FIG.1.

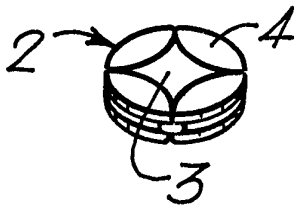


FIG.3.

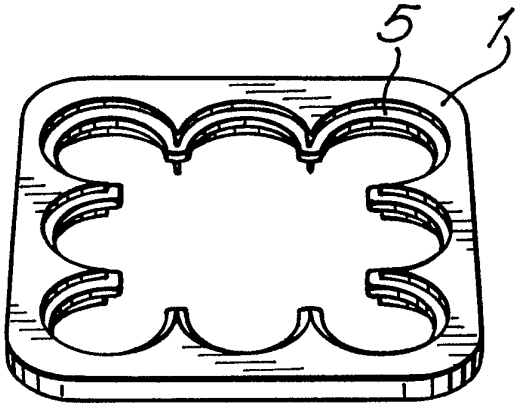


FIG.2.

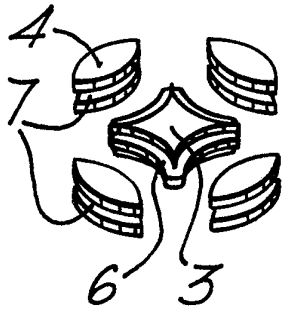


FIG.4.

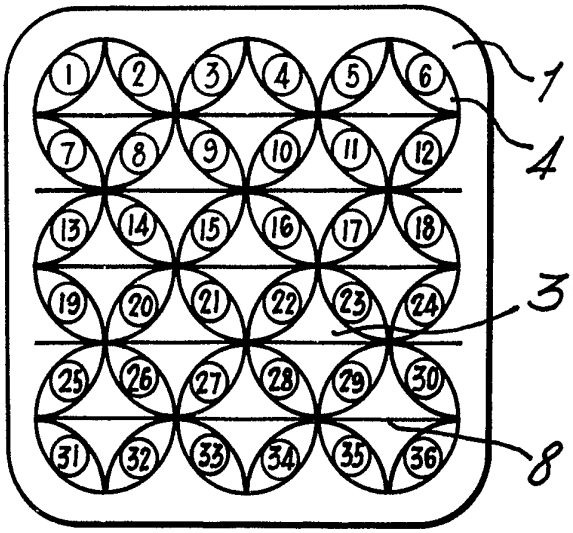


FIG.5.

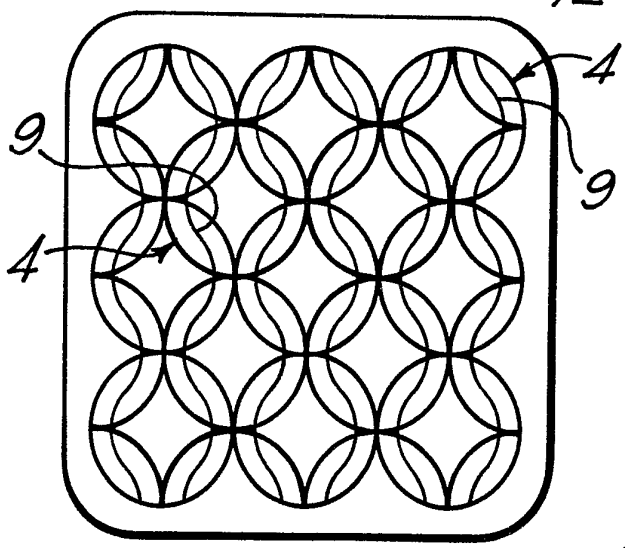


FIG.6.

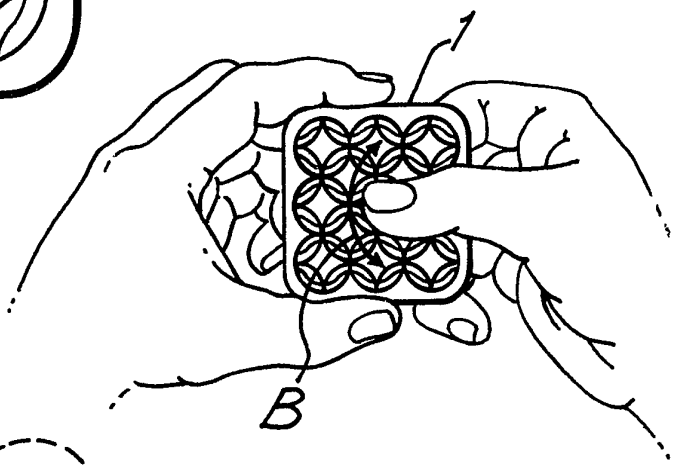
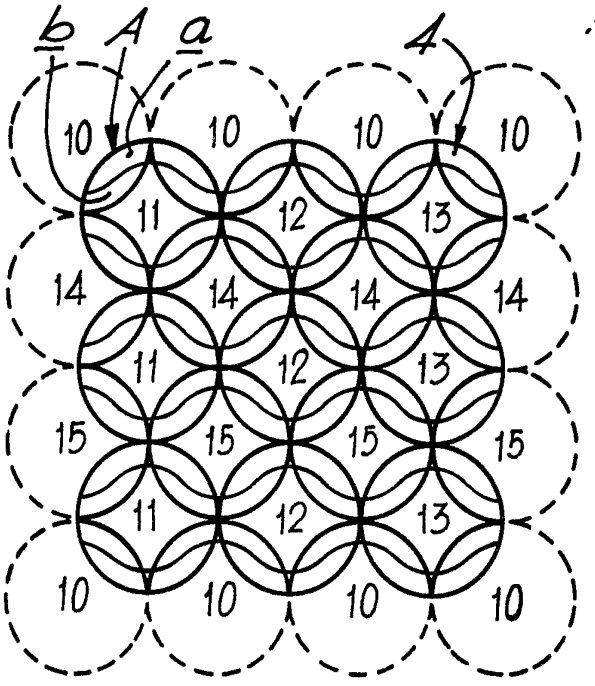


FIG.8.

FIG.7.



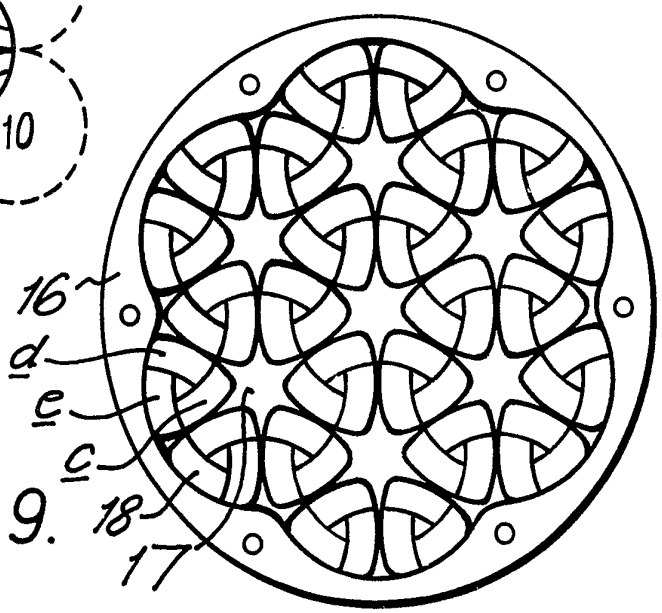


FIG.9.

SPECIFICATION

Puzzle

This invention relates to a puzzle and in particular to a puzzle for amusement and/or educational purposes in which movable components are restrained as regards their degrees of freedom but must be manipulated into a predetermined pattern.

One well known puzzle of this type involves a grid of, for example, sixteen squares in which are positioned fifteen square components. These components bear markings and must be shunted into predetermined positions in the grid. The components can be moved only in directions parallel to the sides of the squares.

A more recent and successful puzzle is the cube arrangement invented by Rubik. In this, twenty seven components are movably linked together to form a cube with a different predetermined pattern, usually simply a chosen colour, on each of its six faces. The six components at the centre of each face do not alter their positions but the other components can move by rotation of "slices", i.e. eight components around a central component, about a respective axis through such central component.

A problem with the simpler types of shunting puzzles is that the moves become fairly simple to predict and put into effect. The cube puzzle is more complex but is necessarily bulky if the components are to be readily manipulated. An object of this invention, therefore is to provide a novel puzzle which at least in certain preferred embodiments, is not bulky in nature.

Thus, according to the present invention there is provided a puzzle in which movable portions are to be arranged in a predetermined manner, comprising a plurality of overlapping rotary systems, rotatable about parallel axes, the movable portions being defined at least in part by the overlap between any two systems, and the arrangement being such that rotation of a first rotary system can cause a movable portion to move from a position in which it is common to the first rotary system and a second rotary system, to a position in which it is common to the first rotary system and a third rotary system.

Thus, the movable portions, which carry e.g. pattern markings, letters, numbers or otherwise be identified relative to the predetermined arrangement, can be moved from a disordered state into a predetermined order by a series of steps comprising selective rotation of the rotary systems.

In a preferred embodiment, the rotary systems have the form of overlapping circles. Whilst many arrangements are possible, in a preferred embodiment the circles are arranged on a regular matrix with circles in the heart of the matrix each overlapping four others. This gives a particularly neat geometrical arrangement which may be particularly easy to accommodate in a physical form.

One particulary advantageous arrangement involves, from a geometrical point of view, nine equal radius circles arranged on a regular square matrix so as to touch at their circumferences and four further identical circles centred on the interstices thus giving thirteen rotary systems. Each circle is divided around its circumference into four portions, each being the shape defined by the intersection of an interstitial circle with one of the other circles. It can be seen that this will give thirty six movable portions, with portions around the edge of the matrix each being in one rotary system only, and those in the heart of the matrix being common to two systems.

It will be appreciated that many variations as to the number of circles, their geometrical arrangement, the number of overlaps and so forth are possible. Systems with three or six overlaps per circle could be devised and with a six circle overlap for example, movable portions could be defined by the overlap of three circles. The puzzle could be represented on a display, e.g. a television screen, by means such as a suitably programmed microprocessor. Rotation of the approximately displayed rotary systems would be by suitable remote control means such as a grid of push buttoms. In such an arrangement the invention can be considered as apparatus programmed or controlled to give the visual representation of the puzzle components, together with means for manipulating the components as they appear in the visual representation.

It would also be possible to have a mechanical arrangement, with e.g. electrical drives for the rotary systems and suitable control switches.

In the preferred embodiment, however, the puzzle is in the form of a hand held unit with the rotary systems being manipulable directly by the fingers. In such an embodiment, the puzzle can comprises a support frame with the rotary systems each comprising a rotatable carrier mounted within the frame and carrying respective movable portions. Preferably, all the components interlock, whilst providing for the relative movements necessary, and it is particularly advantageous if the components are mutually supporting. Suitably designed tongue and groove arrangements could be provided to interlock the components with each other and the frame.

In one preferred arrangement the frame is open on both sides with the movable portions being visible from, and bearing markings on, both sides. By suitably arranging the markings on the movable portions it can be provided that when the portions are arranged to give the correct pattern on one side, they do not do so on the other. Thus, there will always be a puzzle to solve, and this avoids the necessity of a user deliberately jumbling a puzzle once it has been solved, before he or she can attempt to solve it again. The predetermined design on the two sides can be completely different, and even on one side it can be arranged that several alternative solutions are possible.

The puzzle, when in a purely physical form, can have its components made of any suitable material such as wood or plastics although the latter will generally be preferable.

It will also be noted that the puzzle could take a more three dimensional form. Thus, for example, six separate faces could be arranged in a cube. Whilst it might be that the movements on one face would not cause movements on another, the predetermined patterns could be such that each face would need to

be solved so as to have a predetermined relationship to its four adjacent faces. Indeed it many well be that the complete independence of the faces in terms of movement could, with suitable choices of patterns, make this a lengthy and difficult exercise.

An embodiment of the invention will be described by way of example and with reference to the accompanying drawings. in which:-

Figure 1 is a plan view of a puzzle in accordance with the invention, without the pattern markings being shown;

Figure 2 is a perspective view of the frame used in constructing the puzzle;

Figure 3 is a perspective view on one rotary system used in the puzzle;

Figure 4 is an exploded view of Figure 3, showing the components of the rotary system.

Figure 5 is a view corresponding to Figure 1, showing a simple numerical pattern;

Figure 6 is a view corresponding to Figure 1, showing a pattern of coloured links;

Figure 7 is a diagram showing the colours used in the pattern of Figure 6;

Figure 8 is a view showing how the puzzle is manipulated in use; and

Figure 9 is a diagrammatic view of a second embodiment.

Referring now to Figures 1 to 4, there is shown a hand held puzzle, of e.g. injection moulded plastics. The puzzle comprises a thin, square frame 1 of approximately size 68 × 68 × 3mm, shaped to receive nine primary circular rotary systems 2, of 20mm diameter on a 3×3 regular formation with their centres 20mm apart. Each primary rotary system comprises a central carrier or spur 3 supporting four movable portions 4. The frame and the spurs are provided with 2mm deep by 1mm thick tongues 5 and 6 respectively around their edges which engage in corresponding grooves 7 in the edges of the portions 4. Each portion 4 is symmetrical with its plan shape defined by two arcs each equal to one quarter of the circumference of the circles. A further four spurs 3', identical to spurs 3, are positioned in the interstices between the primary systems 2 to form four secondary rotary systems 2', thus giving a total of thirteen rotary systems each with a spur at its centre and four portions 4.

The interlocking between the spurs, movable portions, and frame is such that the components are securely located in the frame, whilst the spurs can be rotated with ease to transfer the movable portions from one rotary system to another so as to arrange them in a predetermined pattern.

The frame is open on both sides and the spurs and movable portions are correspondingly two sided. A predetermined pattern is printed, moulded or otherwise formed on both sides of the puzzle with the arrangement being such that when the puzzle on one side is solved, the positions of the movable portions on the other side are incorrect for the pattern on that side.

As shown in Figure 5, one possible pattern to be formed is a simple numerical array. Each portion 4 carries a number 1 to 36 and the pattern is correct when these appear sequentially as shown. Each spur 3,3', carries a diametrical line 8, and a further complication in the puzzle is that these lines must be aligned horizontally as shown. One alternative solution to the same puzzle, by way of example, would be to have the same sequence of numbers but with the lines arranged vertically on spurs 3 but horizontally on interstitial spurs 3'.

Another pattern, which could be on the reverse side to the numbers pattern, is shown in Figure 6. Each movable portion 4 is split into two colours by a doubly curved line 9 following respective arcs over each half of its length. The colours are chosen such that when the portions are in their correct positions there is given the impression of links of different colours which visually link together in a pattern resembling chain mail.

The colour arrangement for the links can be explained by reference to Figure 7. In this, additional circles have been superimposed on the basic diagram so that each portion 4 can be seen to have two parts each defined by a circle. There are twenty five circles in all, split into six colour designations identified by the numbers 10, 11, 12, 13, 14 and 15. Thus for any portion 4, its colour combination depends on the colour designations of the two circles in which it falls. By way of example, therefore, the portion 4 which is particularly identified by the letter A has two coloured parts *a* and *b*. Part *a* is of colour 10, whereas part *b* is of colour 11.

With the colours chosen as in Figure 7, the effect will be of series of links. With the identical colour schemes for the portions 4, however, other solutions are possible. Indeed, there is a total of thirty six solutions giving the appearance of links, and the portions 4 can have their positions altered from those shown in Figure 7, to give these alternative solutions as desired.

Suitable colours could be e.g. blue, yellow, red, green, orange and violet for the numbers 10 to 15. Each colour will appear twelve times, four times with each of three of the other colours, and the six colours are divided into two sets of three for this purpose.

In use, the puzzle is held as shown in Figure 8, and the spurs 3,3' rotated selectively as indicated by the arrow B to move the portions 4 from one position to another and eventually into the correct arrangement. The spurs can be gripped between the thumb and index finger, on opposite sides of the frame. As a spur is rotated it will alter the arrangement about other spurs and relative to the frame, so that all moves are inter-related.

There is thus provided an intriguing and versatile puzzle which in a preferred embodiment can be wafer thin, light and small, and which can provide a continual challenge. By randomly moving the pieces between printing a pattern on one side, and then printing another on the other side, it may be possible to manufacture puzzles which have differing solutions in terms of starting from one side being solved. This will make it difficult for users to develop predetermined moves to solve any puzzle automatically, and coupled with the thirty six solutions to the link pattern, will give greater challenges.

An alternative arrangement is shown in Figure 9. Thus a frame 16 contains seven rotatable carriers 17,

which between them support twenty four movable portions 18. The shape of the portions is defined by three equal length arcs of three overlapping circles, and in the pattern shown, each portion bears three bands of colour, *c*, *d* and *e*. In this arrangement each portion can be comon to three rotary systems, which will add to the complexity even though there are fewer rotary systems than in the first embodiment. The geometrical arrangement is that of a circle overlapped equally by six surrounding circles of equal radius. In construction, the same principles can be used as for the first embodiment.

Finally, it has been found that even a simple system, with four rotary systems arranged at the corners of a square and one interstitial system overlapping each of the others - there being sixteen movable portions in all - presents a reasonable challenge and may be of interest to e.g. younger or inexperienced users.

CLAIMS

1. A puzzle in which movable portions are to be arranged in a predetermined manner, comprising a plurality of overlapping rotary systems, rotatable about parallel axes, the movable portions being defined at least in part by the overlap between any two systems, and the arrangement being such that rotation of a first rotary system can cause a movable portion to move from a position in which it is common to the first rotary system and a second rotary system, to a position in which it is common to the first rotary system and a third rotary system.

2. A puzzle as claimed in claim 1 wherein the rotary systems have the geometrical form of overlapping circles.

3. A puzzle as claimed in claim 2 wherein the movable portions are defined by equal length arcs of overlapping circles of equal radius.

4. A puzzle as claimed in claim 3 wherein at least one circle overlaps four others by equal amounts.

5. A puzzle as claimed in claim 4 wherein the rotary systems have the geometrical form of firstly a plurality of equal radius circles arranged on a regular matrix with their centres spaced apart by a diameter so as to form a plurality of interstices and secondly a plurality of likewise equal radius circles centred on the interstices, and intersecting the first circles, each circle have four movable portions defined therein.

6. A puzzle as claimed in claim 5, comprising nine circles arranged on the regular matrix, four interstitial circles, and thirty six movable portions.

7. A puzzle as claimed in any preceding claim wherein each rotary system comprises a rotatable carrier carrying respective movable portions.

8. A puzzle as claimed in claim 7 wherein the rotatable carriers and movable portions and mounted in an interlocking manner in a frame.

9. A puzzle as claimed in claim 7 wherein the frame is open on both sides so as to provide visual access to the movable portions.

10. A puzzle as claimed in claim 9 wherein the predetermined arrangement of the movable portions, viewed from one side of the frame, differs from that viewed from the other side of the frame.

11. A puzzle as claimed in claim 10 wherein the visual appearances from the respective sides of the frame, when the movable portions are in their respective predetermined arrangements, are different.

12. A puzzle, substantially as hereinbefore described with reference to Figures 1 to 4 and 8 of the accompanying drawings.

13. A puzzle as claimed in claim 12 having markings thereon substantially as hereinbefore described with reference to Figure 5 of the accompanying drawings.

14. A puzzle as claimed in claim 12 or 13 having markings thereon substantially as hereinbefore described with reference to Figures 6 and 7 of the accompanying drawings.

15. A puzzle substantially as hereinbefore described with reference to Figure 9 of the accompanying drawings.

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