



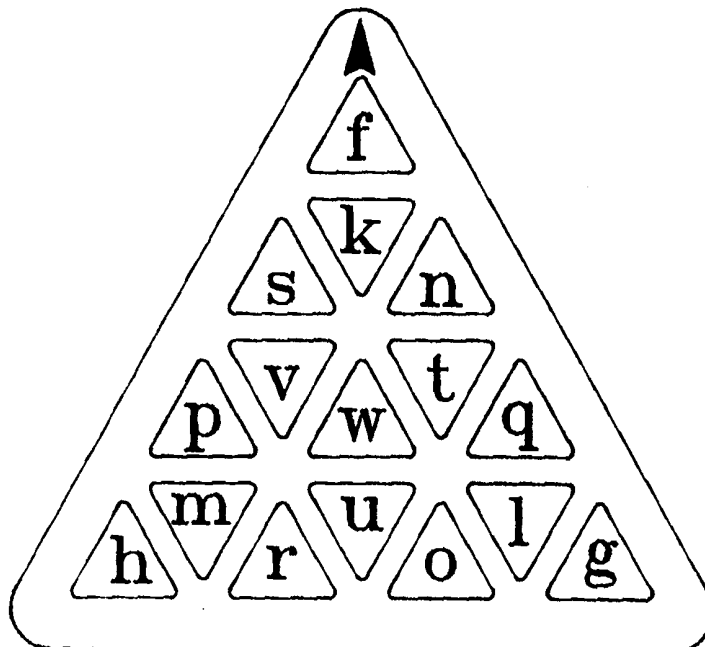
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<p>(21) International Application Number: PCT/GB98/02875 (22) International Filing Date: 23 September 1998 (23.09.98) (30) Priority Data: 9720262.6 25 September 1997 (25.09.97) GB (71)(72) Applicant and Inventor: WEINREB, Chaim, Raphael [IL/GB]; 37 Woodberry Grove, Finchley, London N12 0DN (GB). (74) Agent: HUGHES, Brian, P.; Brian Hughes &amp; Co., Letterbox Cottage, Friezley Lane, Cranbrook, Kent TN17 2LL (GB).</p>	<p>(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).</p> <p><b>Published</b> <i>With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i></p>	

(54) Title: PUZZLE

(57) Abstract

A puzzle comprises a number of elements, preferably between four and twelve, which are capable of being placed in a stack in any order, each member having several segments in locations which overlie the segments of the other element or elements when the elements are in a stack, some of the segments being open and some being closed, and the closed segments having colours or parts of pictures or designs, whereby when the elements are stacked in a proper order only a single pattern or design is visible from one end of the stack.



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## PUZZLE

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This invention is concerned with a puzzle capable of amusing children and adults over a wide range of ages.

10 The present invention provides a puzzle comprising a plurality of elements capable of being placed in a stack in any order, each element having several segments in locations which overlie the segments of the other element or elements when the elements are in a stack, some of the segments being open and some  
15 being closed, and the closed segments having thereon colours or parts of pictures or designs, whereby when the elements are stacked in a proper order only a single pattern or design is visible from each end of the stack.

20 Preferably, the segments are of at least two types and, when the stack is in a proper order only closed segments of one type are visible from each end of the stack.

Preferably the closed segments visible from each end are of  
25 a different type.

Preferably, each element has two faces and can be stacked in either of two attitudes each having a different face uppermost.

30

Preferably, each element can have at least two orientations relative to an adjacent element in a stack of elements.

The types of closed segment may be distinguished by  
35 different pictures, designs or colours.

Preferably the closed segments have different colours on their different faces, and when the elements are in a proper stack, i.e. the elements having a proper attitude, order and orientation, the stack shows only one colour when viewed from an end.

Preferably, the number of orientations of each element is between three and six.

The number of elements may be between two and ten.

Preferably four colours are provided on closed segments.

In a preferred embodiment seven planar triangular elements are provided, each element having sixteen segments, and four colours are used to distinguish the closed segments.

There may be more than one solution or proper stack for a given set of elements, each solution showing a different colour design or picture when the proper stack is viewed from one end.

An embodiment of a puzzle according to the present invention will now be described, by way of example, with reference to the accompanying drawings, in which:-

Fig.1 is a schematic grid used in planning one embodiment of the present invention;

Figs.2 and 3 illustrate two faces of an element of the embodiment of Fig.1;

Figs 4 and 5 together show a complete set of seven elements of one embodiment of a puzzle according to the present invention; and

Fig.6 shows an element of a further embodiment of the present invention.

Puzzles according to embodiments of the present invention come in many different shapes and sizes but all involve stacking  
5 a number of thin elements in a correct order, attitude and orientation, the elements all having areas known as segments which match the segments of other elements in all relative orientations. The segments may be open, i.e. they can be seen  
10 through, or closed. The elements have two faces and the closed segments, on both faces of the elements, are coloured or carry a part of a design or picture, the puzzle being solved when the correct colours, designs or pictures are seen from both ends of a stack of elements.

15 To grasp fully the way in which a puzzle is designed it is first desirable to construct a grid in the shape of an element of the puzzle and having identified areas in positions corresponding to the positions of the segments in the elements of the puzzle. Fig.1 shows such a grid for a triangular element,  
20 but it should be understood that the grid is used only when the puzzle is being planned and has no use or function beyond that stage.

The grid of Fig.1 has sixteen segments and Figs.2 and 3 show  
25 two sides of an element of the puzzle, the sixteen segments in Figs. 2 and 3 having the same reference letters but in lower case for a first face and in upper case for the second face. Also shown in Figs.2 and 3 are an arrow marked to show the orientation of the element. The three possible orientations are with the  
30 arrow pointing up (T), to the left (L) or to the right (R). As the puzzle involves a number of elements, in this embodiment seven, we can refer to different elements in different attitudes and orientations as, for example,

35 5:2 T meaning the fifth element, face 2 with the arrow on top, or

1:1 L meaning the first element, face 1 with the arrow to the left.

If we compare the element side 1 (Fig.2) with the schematic grid of Fig.1 with the arrow on corner X, we find segment f on location A1 while segment m is on location B3. We also see that segment g is on A2 and segment h is on A3. If we now rotate the element by 120° clockwise placing the arrow now on angle Y, we shall find that segment f has now moved to location A2 while segment m has moved to location B1. A further rotation of 120° will bring segment f to location A3 and a further rotation back to A1. Segment m has also moved now back to location B1. It is clear that segment f is limited in its movements to only three locations A1, A2, and A3, and it shares these locations with segments g and h.

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If we turn over the element (Fig.3) to put the other face uppermost we find that the same limitations apply; segments F,G and H are limited to the same locations. The only difference is that when the indicating arrow is pointing to angle X and segment F is on location A1, it is segment H that is on A2 rather than segment h and vice versa. As the segments f, g and h are limited to a set number of locations, the A locations, we can consider them as a group which we will call a homogeneous group. The characteristic of such a group is that its segments all lie on one and only one line of symmetry of the element.

25

In exactly the same way the segments k, l and m are limited to the B locations and the segments t, u and v are limited to the D locations and these are two further homogeneous groups.

30

If, however, we examine segments n and q we find a different state of affairs. When we place the element on the schematic grid and rotate it as before we find that segment n is limited to the Ca locations while segment q is limited to the Cb locations. Upon turning the element over the opposite is true, i.e. segment N is limited to the Cb locations while segment Q is limited to the Ca locations. Thus the segments (n,o,p,q,r and s) in the C

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locations, sub-groups Ca and Cb, form another and different group which we call a heterogeneous group whose characteristic is that  
5 its members do not lie on any axis of symmetry of the element.

One important characteristic of a heterogeneous group of segments is that in adjacent elements segments from one sub-group can be placed over segments of the other sub-group if one of the  
10 elements is turned over.

The segment E stands by itself as it does not change its position with rotation or turning over of the element and is a single segment group, the hermit group; the segment of this group  
15 lies on all the axes of symmetry of the element at the centre of the element.

These considerations are important in designing the shape and locations of the segments. If we consider, for example, Fig  
20 6 we can see that we are dealing with irregular shapes, the fish and the sea horse. The fish is, however, a symmetrical shape and if, as is the case, all the fish lie on one of the four axes of symmetry of the element then there is no problem. The fish are all members of the homogeneous groups A or B. The sea horses do  
25 not lie on any axis of symmetry and therefore form a heterogeneous group C. If the sea horses are to match sea horses in adjacent groups it is important that the sea horses are located in pairs which are reflections of each other about a line of symmetry.

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We shall now consider the more detailed compilation of a puzzle based on the grid of Fig.1 and illustrated in detail in Figs 4 and 5. The puzzle consists of seven elements both faces of the first four of which are shown in Fig.4, and both faces of  
35 the last three of which are shown in Fig.5. In the Figs. face 1 of each element is shown on the left and face 2 is shown on the right. Four colours are used on the closed segments, namely red,

yellow, green and blue. The puzzle has two solutions, one in which the stack is red at one end and blue at the other, and one  
5 in which the stack is green at one end and yellow at the other. In the Figs. the colour of the segments is indicated by the letters R,B,G and Y, and where no letter is shown the segment is an open segment.

10 In compiling a puzzle like this it is important to start with the end elements of the stack and work in through the inner elements. It is also obvious that the exposed face of an end element of a proper stack, in this embodiment, can have closed  
15 segments only of the colour that is to be seen at that end as, by definition, all of its closed segments will be visible. Each solution of the puzzle requires two end faces, one for side A at the top of the stack and one for side b at the bottom. Thus, in this particular embodiment there are four end faces, two for each of the two possible solutions.

20

As the end faces are obvious it is desirable to keep low the number of closed segments on the end elements and to have the end faces paired and backing onto each other in the two outer elements. So one outer element has the red end face on one side  
25 and the yellow end face on its other side, while the other end element has the blue and green end faces.

Thus, one end element is shown in Fig.4 as the first element in the stack having the red and yellow end faces and the other  
30 end element is shown in Fig.4 as the second element having the blue and green end faces.

The first element has five closed segments and comparing them with the grid of Fig.1 it can be seen that one is in the homogeneous group A, one is in the homogeneous group B, one is  
35 in the homogeneous group D and two are in the heterogeneous subgroup Cb.



The second end element, the second element in Fig.4, has six closed segments, one in the homogeneous group A, one in the homogeneous group B, one in the homogeneous group D, one in the heterogeneous sub-group Ca and two in the heterogeneous sub-group Cb.

It is desirable in compiling a puzzle to be economical with the use of segments in the heterogeneous sub-groups as this makes the compilation of the puzzle easier and its solution more difficult.

The third element shown in Fig.4 is a decoy element in that it can be placed under the two end elements to show at the end element only one colour but cannot lead to a correct solution of the problem. The correct second element for the red/blue puzzle is the fourth element of Fig 4, face 2 with the arrow at the top, and for the green/yellow puzzle the fourth element, face 1 with the arrow to the right. The important difference between the true and false elements is, in this embodiment, the presence of an open segment in the false element where the correct element has a closed segment.

The correct sequence of elements for the two solutions of the puzzle are:-

	Red on top Blue on bottom	Green on top Yellow on bottom
30	1:1 T	2:2 T
	4:2 T	4:1 R
	7:2 R	6:2 T
	5:2 L	3:1 R
	3:1 T	7:1 T
35	6:2 R	5:2 R
	2:2 T	1:1 T

The false trails laid by the decoy elements are:-

5		True	False
	Red	1:1 T	1:1 T
		4:2 T	3:1 T
	Blue	2:1 T	2:1 T
10		6:1 L	3:2 T
	Green	2:2 T	2:2 T
		4:1 R	3:1 R
15	Yellow	1:2 T	1:2 T
		5:1 L	3:2 L

Correct solutions of the puzzle may be defined in a number of different ways, such as colour, design, or a picture. In colour puzzles the best solution is a uniform colour when viewed from either end of the stack, and a minimum of two colours is then required or, if there are two alternative solutions as in the embodiment described, the minimum number of colours is four. Similar considerations apply for design and picture puzzles in which the closed segments carry portions of different overall designs or pictures, and the different colours or portions of the different designs or pictures differentiating different types of closed segment,

The number of elements in a puzzle is one factor determining the degree of difficulty of the puzzle, and it is preferred to have between two and ten elements. Two element puzzles are sufficiently difficult for young children, and with more than ten elements a puzzle tends to become excessively difficult.

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Each element of the embodiment described has three orientations, but with more orientations the puzzle becomes more

difficult. It is preferred to have between three and eight orientations for each element. The orientations may be defined  
5 by the shape of the element, e.g. a triangle pentagon or hexagon, or by projections or indentations at the side of, for example, circular elements, by finger holes or by other indexing means.

Generally, as with the embodiment described, the end faces  
10 have only one type of closed segment. The puzzle can, however, also show a maze in which the closed segments carry portions of paths which link with paths printed between the segments on the elements to join, when in a proper stack start and finish marks. In this form of the puzzle the end faces are not apparent by  
15 inspection alone.

The elements of the puzzle are made of any suitable material such as stiff paper or thin plastics sheet.

20 The segments of the elements are normally separate areas, but some segments could be borders surrounding other segments. In embodiments of this character it is desirable that the surfaces of the elements that are not part of segments be coloured or patterned to blend in with the colour, design or  
25 picture of the solution(s). In this case it is desirable that the elements be printed on transparent plastics with open windows unprinted and unperforated. The blending of the "background" surfaces of the elements with the pattern or design of the closed segments also applies to other embodiments of the puzzle.

30

In a further embodiment of the invention different puzzles in a set of puzzles can include a key element having a closed segment on which is a portion of a picture or design that is unrelated to the rest of the puzzle and is not visible when the  
35 puzzle is solved, the key elements from the set of puzzles together forming another puzzle whose solution is the picture or design. For example, at the time of a major sporting event such

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as the world cup the set of puzzles can have solutions showing famous players and key elements having segments showing part of  
5 a picture of the world cup, the key elements combining to form a separate puzzle the solution to which is the picture of the world cup.

10 In a further embodiment the puzzle is adapted for use on a computer, the elements of the puzzle then being images generated by the computer and manipulated by the player using a mouse, joystick or similar control device.

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## CLAIMS

- 5 1. A puzzle comprising a plurality of elements capable of being placed in a stack in any order, each element having several segments in locations which overlie the segments of the other element or elements when the elements are in a stack, some of the segments being open and some being closed, and the closed  
10 segments having thereon colours or parts of pictures or designs, whereby when the elements are stacked in a proper order only a single pattern or design is visible from each end of the stack.
2. A puzzle as claimed in claim 1, in which each element has  
15 two faces and can be stacked in either of two attitudes each of which has a different face uppermost.
3. A puzzle as claimed in claim 1 or claim 2, in which the elements are triangular, circular or octagonal.  
20
4. A puzzle as claimed in any preceding claim, in which the segments are of at least two types and, when the stack is in a proper order only closed segments of one type are visible from each end of the stack.  
25
5. A puzzle as claimed in any preceding claim, in which the types of closed segment are distinguished by different pictures or designs.
- 30 6. A puzzle as claimed in any of claims 1 to 4, in which the types of closed segment are distinguished by colour.
7. A puzzle as claimed in claim 6, in which the closed segments have different colours or pictures or designs on their different  
35 faces, and when the elements are in a proper stack, i.e. the elements having a proper order, attitude and orientation, the stack shows only one colour or picture or design when viewed from an end.

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8. A puzzle as claimed in claim 1 or claim 2, or any of claims 4 to 7 when independent of claim 3, in which each element has at least two orientations relative to an adjacent element in a stack of members.
9. A puzzle as claimed in claim 8, in which the number of orientations of each element is between three and eight.
10. A puzzle as claimed in any preceding claim, in which the number of elements is between two and ten.
11. A puzzle as claimed in any preceding claim, in which four colours are provided on closed segments.
12. A puzzle as claimed in any preceding claim, in which there are seven planar triangular elements, each element having sixteen segments, and four colours are used to distinguish the closed segments.
13. A puzzle as claimed in any preceding claim, in which there is more than one solution or proper stack for a given set of elements, each solution showing a different colour or picture when the proper stack is viewed from one end.
14. A puzzle as claimed in any of claims 1 to 3, in which the puzzle is a maze, the closed segments showing paths across the segment and the areas of the elements surrounding the segments showing paths between the segments.
15. A puzzle as claimed in any preceding claim, in which each element has a first group of segments lying on a line of symmetry of the element and a second group of elements which do not lie on a line of symmetry.

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16. A puzzle as claimed in claim 15, in which the segments of the second group are provided in pairs which are reflections of each other about a line of symmetry.

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17. A puzzle as claimed in any preceding claim, in which the elements of the puzzle comprise elements from a plurality of different puzzles each as claimed in any preceding claim.

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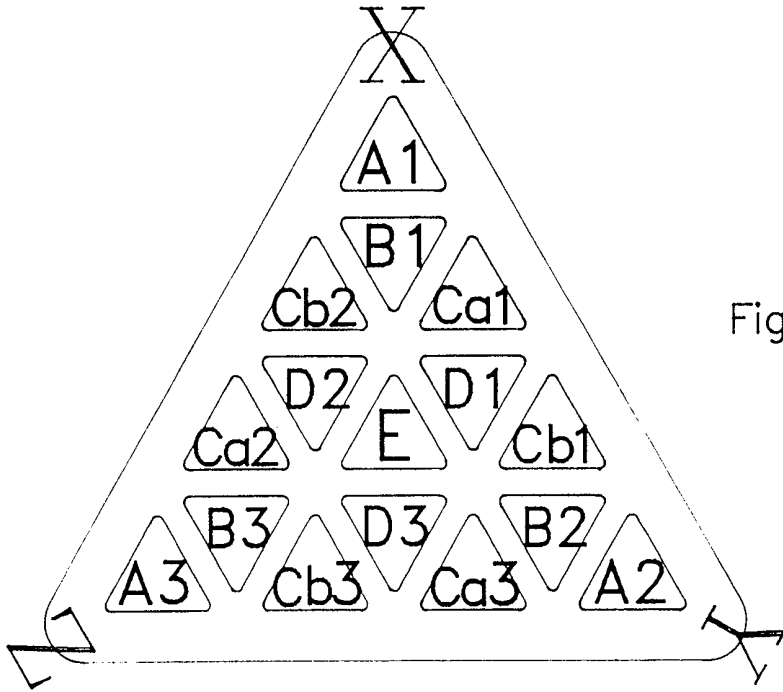


Fig.1

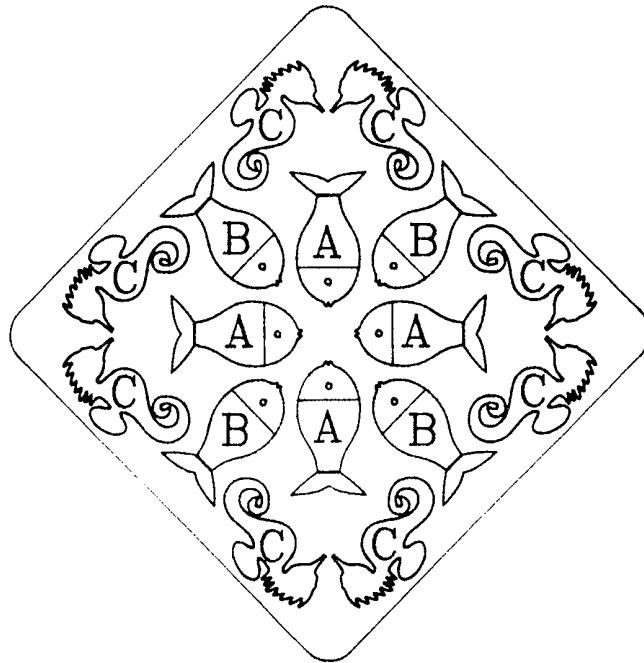


Fig.6



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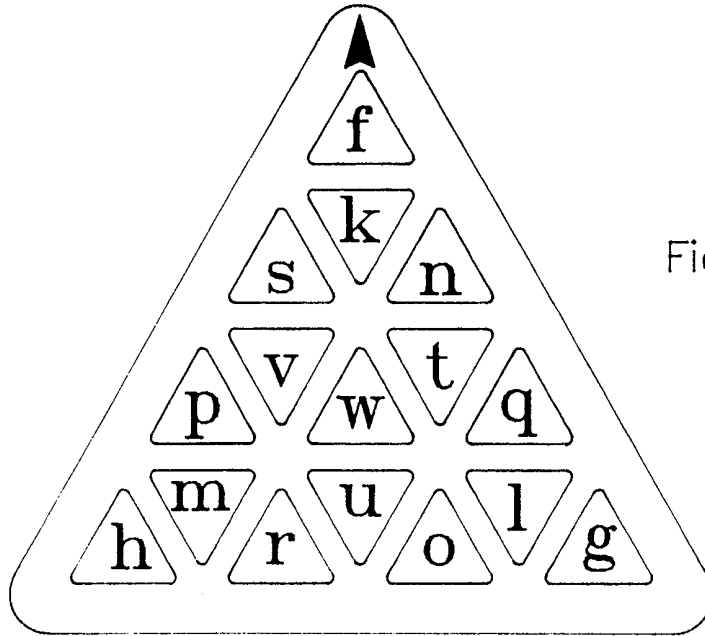


Fig.2

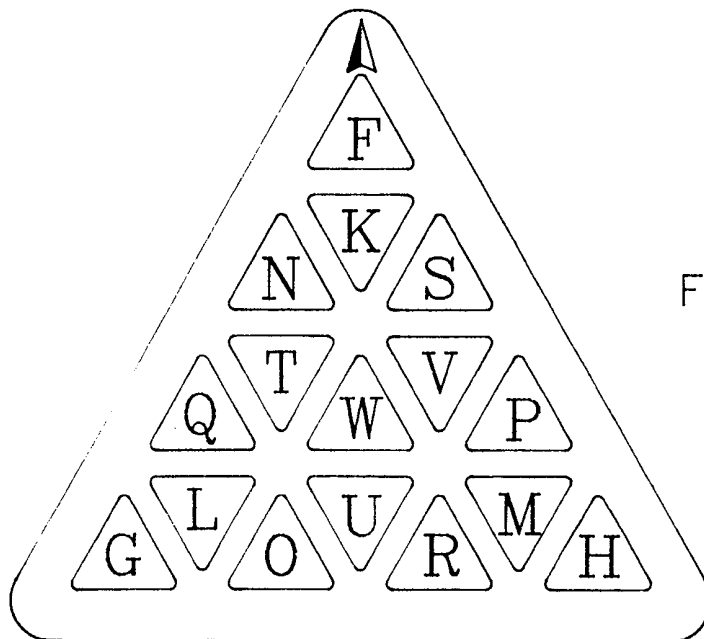


Fig.3

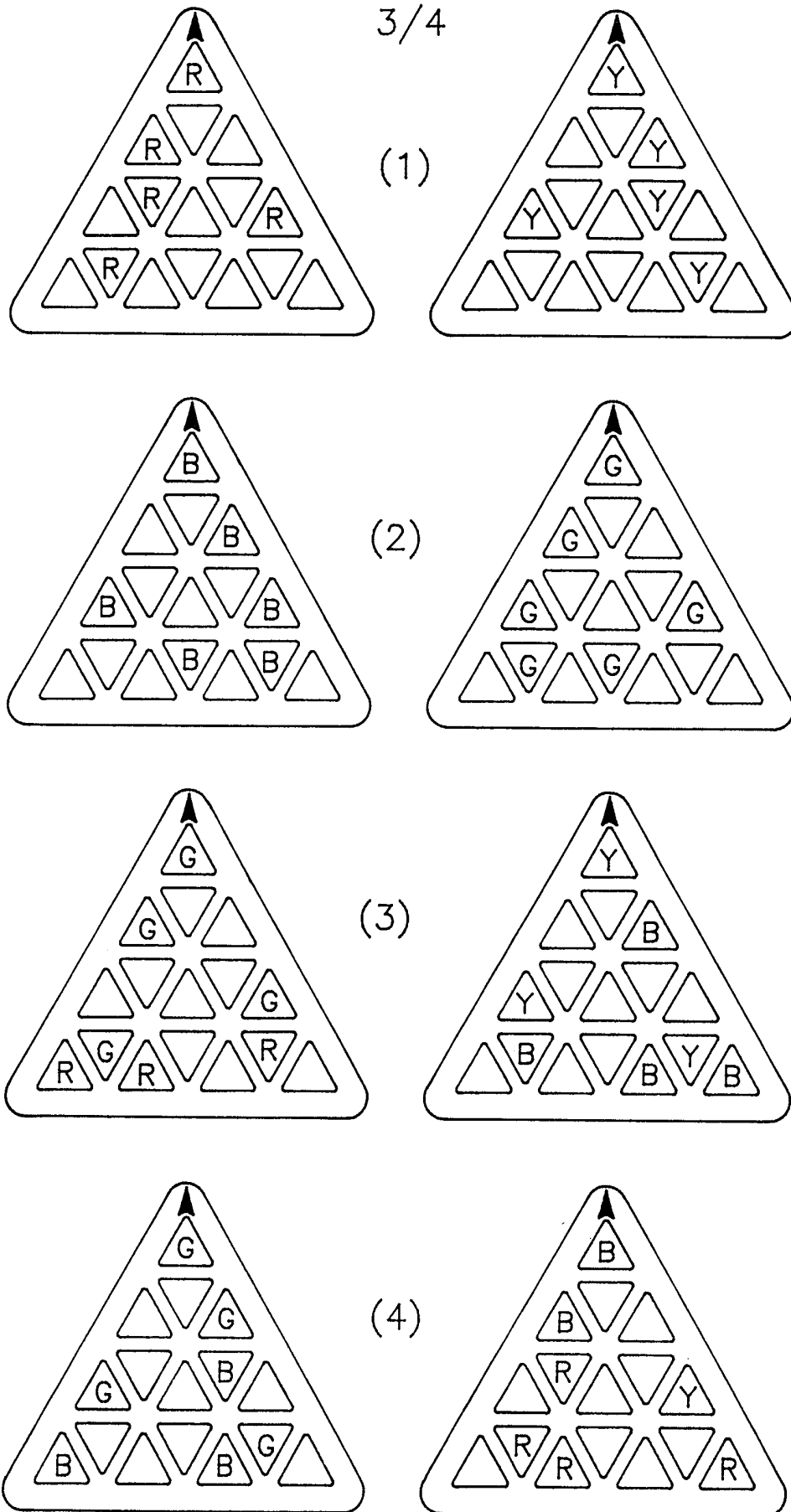


Fig.4

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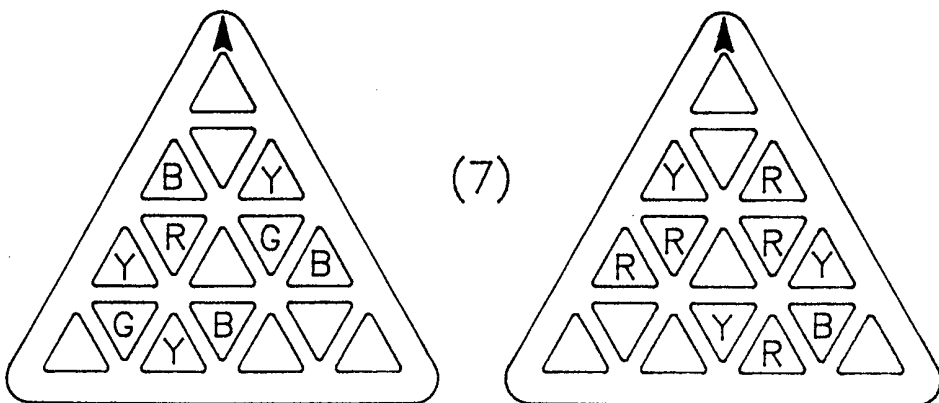
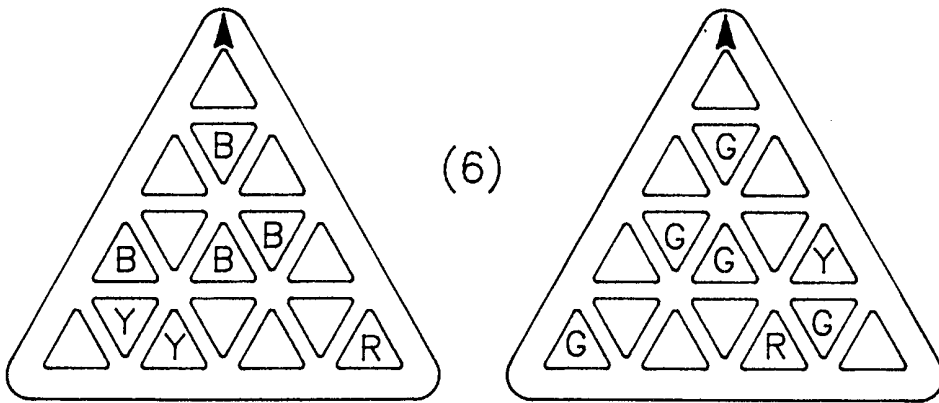
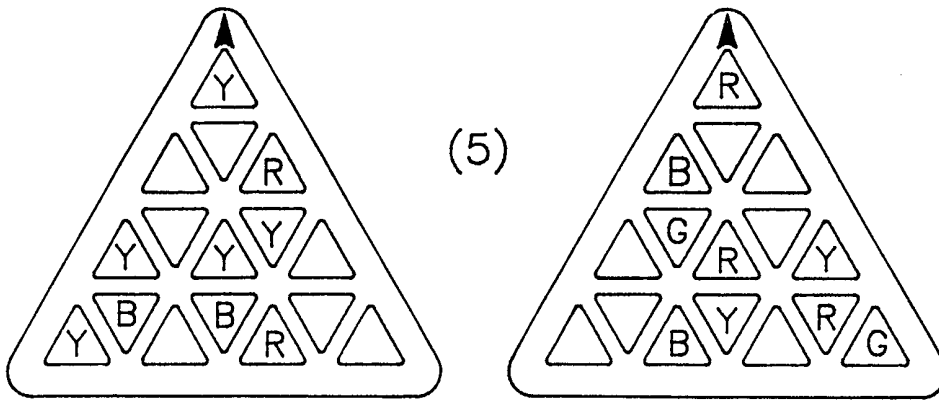


Fig.5

## INTERNATIONAL SEARCH REPORT

Int. national application No.

PCT/GB 98/02875

A. CLASSIFICATION OF SUBJECT MATTER		
IPC6: A63F 9/12 According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols)		
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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
EPODOC, WPI		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 9100758 A1 (ALLAN, RALPH, WYLIE), 24 January 1991 (24.01.91), page 2, line 3 - line 29; page 3, line 21 - line 39; page 4, line 18 - line 33, page 9, line 2 - page 27, line 27 figures 1,3,9 claims 1-17 abstract --	1-17
X	US 5299805 A (GREEN), 5 April 1994 (05.04.94), column 1, line 28 - column 2, line 5, figures 1,3, 7,8, claims 1-7, abstract --	1-17
A	US 4815742 A (AUGUSTINE), 28 March 1989 (28.03.89), column 1, line 30 - line 65, claim 1, abstract --	1,4,5,10
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.		
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Date of the actual completion of the international search		Date of mailing of the international search report
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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4362301 A (DUVEYOUNG), 7 December 1982 (07.12.82), abstract  --	1-17
A	US 4781381 A (HEIN), 1 November 1988 (01.11.88), figures 2,3, abstract  -- -----	1-17

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S<sup>n</sup> 208285

Information on patent family members

01/12/98

International application No.

PCT/GB 98/02875

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WO 9100758 A1	24/01/91	NONE	
US 5299805 A	05/04/94	IL 97029 A	07/10/94
US 4815742 A	28/03/89	NONE	
US 4362301 A	07/12/82	NONE	
US 4781381 A	01/11/88	NONE	