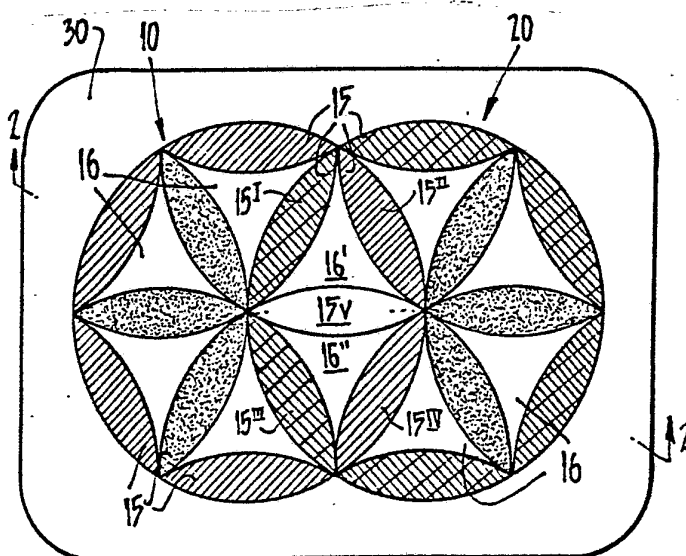




## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(54) Title: PUZZLE



(57) Abstract

A two-dimensional puzzle having at least two overlapping circles (10, 20) of equal radius, each of which is defined by a number of petals (15) and a number of triangles (16), each petal being formed of two arcs each having a radius equal to the circle radius and a chord equal in length to such radius, each face of each triangle being an arc complementary to the arc of the petals, adjacent circles (10, 20) having common components (15<sup>I</sup>-15<sup>V</sup>, 16<sup>I</sup>, 16<sup>II</sup>) so arranged that each circle can be rotated relative to each other circle thereby causing spatial displacement of the common components. The various components (15, 16) can interlock with each other or can be held onto a surface, such as by magnetism.

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PUZZLE

This invention relates to an improved puzzle and, particularly, to a puzzle which is basically two dimensional in form, as far as a user is concerned.

Over the last two to three years there has been a great resurgence in interest in puzzles and the phenomenal acceptance of the puzzle known as Rubik's cube is a good indication of this.

Whilst three dimensional puzzles certainly have a great attraction and interest, I believe that they suffer from certain disadvantages in that, unless a user has a highly developed spatial sense, it is often difficult to appreciate what the effects of certain changes in orientation of the faces will be.

For this reason, I believe that a puzzle which is basically two dimensional, that is one where the user can, at all times, see all the components of the puzzle, would be of great interest and it is to produce a puzzle of this type the object of the present invention lies.

The invention, in its broadest sense, comprises a puzzle having at least two overlapping circles, each circle being defined by a number of petals and a number of triangles, each petal being formed of two arcs which are portions of a circle of the same circumference as the circle of the puzzle and having a chord equal to the radius of the circle, each triangle having faces each being an arc complementary to the arc of the petals, the arrangement being such that adjacent circles have common components which, by selective rotation of either or any of the circles, can cause spatial displacement of the common components.

In one specific form of the invention, the petals and triangles have complementary tongues and grooves and the circles comprising the puzzle are located in a base which has a peripheral tongue or groove complementary to that of the adjacent petals, whereby the components of the circles are constrained but without limitation to the rotational movement between circles having common components.

In a preferred form of the invention I may provide the components of a synthetic plastics material and a body member which may be separable so that, on assembly, there is provided a hand held puzzle, the upper face of

which demonstrates the features of the puzzle, and which can be readily manipulated by a user's hands.

In order that the invention may be more readily understood, I shall describe the invention in relation to the accompanying drawings; in which:-

5            Fig. 1    is a top plan view of an assembled puzzle consisting of two inter-locking circles;

            Fig. 2    is a section along line 2-2 of Fig. 1 showing the overall construction of the base and the petals and triangles;

            Fig. 3    is an underneath view of the puzzle with the base removed;

10           Fig. 4    is a plan view of the base of the puzzle with the upper portion removed;

            Fig. 5    is an underneath perspective view of a petal;

            Fig. 6    is a similar underneath perspective view of a triangle; and

15           Figs. 7, 8 and 9 are schematic views showing how the concept of the invention can extend to a number of inter-locking circles which, themselves, can be in an arrangement which is aesthetically pleasing and which is adapted for use in a number of different applications.

20           I shall refer firstly to the embodiment of Figs. 1 to 6 and, more specifically, to the general concept of the invention which is best illustrated in Fig. 1.

It can be seen that there are, effectively, two overlapping circles 10 and 20, each of which can be considered as having six peripheral petals, petals generally being indicated at 15, and six radial petals, the petals of each circle enclosing six triangles, indicated generally at 16.

25           It will be noted that five petals  $15^i$  to  $15^v$  and two triangles  $16^i$  and  $16^{ii}$  are common to the two circles, the petals  $15^{ii}$  and  $15^{iv}$  being peripheral petals of

the left circle and the other three being radial petals and petals 15<sup>i</sup> and 15<sup>iii</sup> being peripheral petals of the right circle and the other three being radial petals.

5 As can readily be visualised, provided each of the components are capable of movement, one relative to the other, it would be readily possible to rotate, as a whole, one or other of the circles which rotation will cause the displacement of the common components so that they will be partially or completely removed from the common position and if then the same circle or, more particularly, the other circle is then partially rotated, so there can readily be  
10 a random mixing of the various components.

Provided then the original selection of colours of the various components is such as to provide an organised pattern, the puzzle provides the possibility of disturbing this organisation, which is simply done by random movement of the two circles, and then permits an attempt to reconstruct the original  
15 organisation or, alternatively, the possibility of starting from an initial, organised, situation and to transpose various parts of the organisation.

For example, as illustrated in Fig. 1, schematically I have shown the peripheral petals of the two circles as being of one colour, the radial petals, which are not common petals, as being of a second colour, although it may be  
20 preferred that the three such radial petals of one circle are all of a different colour to the equivalent petals of the other circle and the central common petal, petal 15<sup>iv</sup>, may be of a different colour or a neutral colour. Similarly, whilst the various triangles 16 are shown as being uncoloured, it would be possible for the uncommon triangles, that is the four triangles outwardly of  
25 the common petals, in each case, to be of the same or two different colours and of a colour or colours different to the common petals and it would be possible to effect transposition of these.

In this specification it is not proposed to provide specific instructions for any transposition of components or a general principle to return the components  
30 to the original organised position.

Referring now to Figs. 1 to 6 as they specifically illustrate one practical form of the invention, the invention can be considered to be illustrated as,

effectively, full size in Fig. 1, although this is only exemplary, and is made from a face component 30, a base 31, nineteen petals 15 and ten triangles 16.

The various components may be moulded from a synthetic thermoplastics material and, preferably, a material which has good dimensional stability, as  
5 accuracy of formation is critical, and, also, which shows low friction properties where two components are in abutment or, alternatively, which is capable of being lubricated to give such properties.

I have found one suitable material for this to be high impact polystyrene and, if required, to aid the required frictional properties, the moulding powder may  
10 have incorporated a percentage of talc or of silicone.

The properties of various thermoplastics and methods of handling these are known in the art and will not be discussed further herein.

The face 30 is provided with a peripheral tongue 32 which extends fully around an aperture formed therein and which is spaced below the upper surface of the  
15 face by a distance equal to the thickness of the face member 33 of a petal 15.

Each petal has, below its face member 33, a groove 34 which is defined, on its lower edge, by a lower member 35, the arrangement being such that, when a petal is engaged with the peripheral tongue 32, the upper surface of the face 33 is at the same level as the upper surface of the face 30, the tongue 32  
20 enters the groove 34 and transverse outward movement is restricted by the lower member 35.

Each triangle 16 is formed with a peripheral tongue 40 which is spaced below the triangle's face 41 by a distance equal to the thickness of the face member 33 of the petal so that, on interengagement of the triangle with the petal, so  
25 the upper surfaces of their face members lie in the same plane. Thus, when the total required number of petals and triangles are assembled into the aperture of a face member 30, the upper surface of the assembled body is effectively co-planer, as can be seen from the upper surface of Fig. 2, and the outer appearance is then, of course, as illustrated in Fig. 1.

30 It will be seen that the lower member 35 of each petal is smaller than the

face member 33 so that this does not, in any way, obstruct movement of the petal vis-a-vis the triangles and it will also be seen that each triangle has a lower portion 42 which is also smaller than the main body of the triangle so as not, in any way, to obstruct movement of the triangle.

- 5 The downward extension 43 of the portion 32 is such that its underside contacts ridges 50 in the base which extend upwardly therefrom and thus maintain the overall upper surface of the puzzle.

Also, in this way, because the area in contact is relatively restricted, there is a minimisation of friction between the components.

- 10 Each triangle has a downwardly extending stem 43 which extends below the surface of the portion 42 and which abuts the outer edge of the ridge 50 and, thus, movement of the triangles is constrained by the location of these ridges and the relative orientation of the various components are also restrained.

- 15 Each petal is also provided with a pair of extensions 36, one of which abuts the outer surface of ridges 51 in the base to help to guide the petals in their movement and thus, again, to restrain these to move in the required manner.

- 20 Fig. 4 shows the orientation of the stems 43 and 36 in the base. Certain of the petals 15 and a triangle 16 are shown in this figure in chain dash lines to show the orientation of the components and the effective guiding by ridges 50 and 51.

Two arcuate grooves 52 are shown through the ridges 50, 51 and the external ridge in the base, which grooves permit the mounting of the peripheral petals in the common area. This can well be seen from examination of Fig. 4.

- 25 When the various components are assembled into the face member 30, the face member is located over the base 31 and the two members are held together either by gluing, ultrasonic welding or by any known method of connecting plastics components.

Although not illustrated, register springs may be provided to co-operate with the petals so that, on relative rotation of the two circular components on each

required degree of rotation, that is after every  $60^{\circ}$  of rotation, the components will be positively located and the required orientation maintained.

5 Thus, if a user is to alternately rotate one circle to a stop and then the other similarly so the components will be in the correct orientation on each movement.

10 The embodiments of Figs. 7 to 9 show that the invention can be readily applied to a large variety of different combinations of circles and, reference to Figs. 7 and 8 specifically, will show the two ways in which three circles can be combined, Fig. 7 being where the centres of all three circles lie in a straight line and Fig. 8 shows an arrangement where such centres lie at the corners of an equilateral triangle.

15 Fig. 9 shows an arrangement of four circles where the centres are at the corners of a diamond having its shorter axis one radius of the circle and its longer axis the length of a chord having an arc comprised of the arcs of two petals.

It will be seen that by increasing the number of circles, so the orientation and complexity of the puzzle of the invention can be widely varied.

20 It will also be appreciated that, whilst the embodiment of Figs. 1 to 6 shows a particular constructional arrangement which is suitable for a hand held puzzle, there can be wide variation in the construction without departing from the concept of the invention.

25 For example, and exemplary only, there could be a surface which has a peripheral wall which defines the shape of the required puzzle and which is magnetic and each of the pieces of the puzzle could include a magnet of opposite polarity downwardly directed so that the whole assembly remains coherent but, yet, it being readily possible to effect rotation of the circles comprising the puzzle.



## CLAIMS:

1. A puzzle having at least two overlapping circles, each circle being defined by a number of petals and a number of triangles, each petal being formed of two arcs which are portions of a circle of the same circumference as the circle of the puzzle and having a chord equal to the radius of the circle, each triangle having faces each being an arc complementary to the arc of the petals, the arrangement being such that adjacent circles have common components which, by selective rotation of either or any of the circles, can cause spatial displacement of the common components.
2. A puzzle as claimed in claim 1 wherein the petals and triangles have complementary tongues and grooves and the circles comprising the puzzle are located in a base which has a peripheral tongue or groove complementary to that of the adjacent petals, whereby the components of the circles are constrained but without limitation to the rotational movement between circles having common components.
3. A puzzle as claimed in claim 2 wherein the petals and triangles are of a synthetic plastics material and the base comprises two members which may be separable, the peripheral tongue or groove being in the upper member, so that, on assembly, there is provided a hand held puzzle, the upper face of which demonstrates the features of the puzzle and which can be readily manipulated by a user's hands.
4. A puzzle as claim in claim 3 wherein the lower base member has at least one upwardly directed partial annular ridge associated with each circle and each triangle has a downwardly depending extension adapted to be guided by one side of the ridge over a substantial part of its rotation.
5. A puzzle as claimed in claim 3 or claim 4 wherein the lower base member has at least one upwardly directed annular partial ridge associated with each circle and each petal has a downwardly depending extension adapted to be guided by one side of the ridge over a substantial part of its rotation.
6. A puzzle as claimed in claim 3 wherein each petal has two downwardly depending extensions, symmetrically located thereon, the spacing between

the extensions being equivalent to the spacing between the associated upwardly directed annular ridges of the adjacent circles.

7. A puzzle as claimed in claim 1 wherein each petal and triangle is adapted to be located in a cut-out having the shape of overlapping circles and having means whereby they can be held therewithin.
8. A puzzle as claimed in claim 7 wherein each petal and triangle has a magnet associated therewith, and having a base on or in which the petals and triangles are adapted to be received.

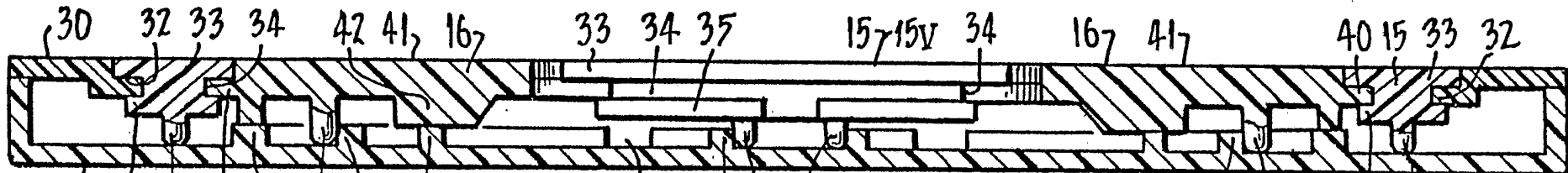


FIG. 2.

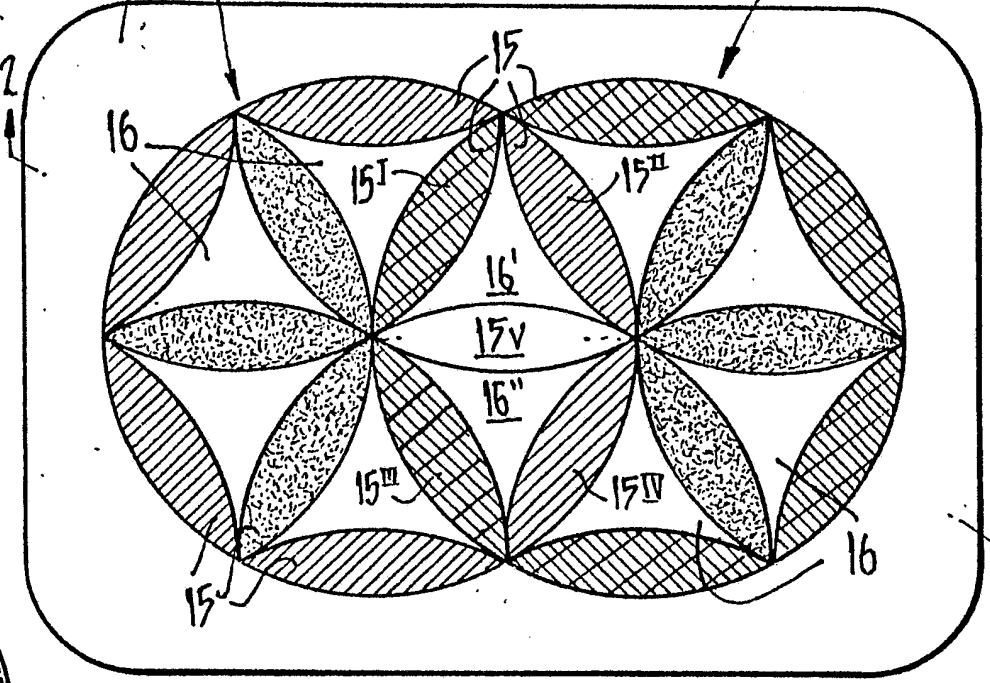


FIG. 1.

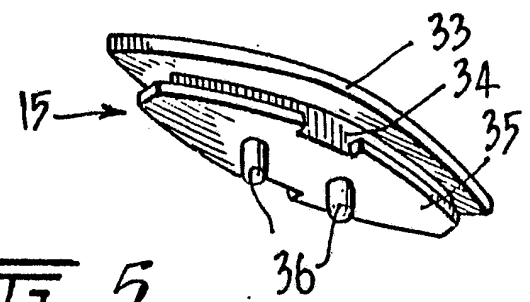


FIG. 5.

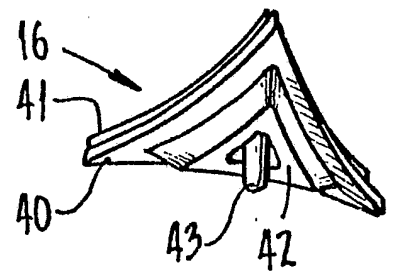
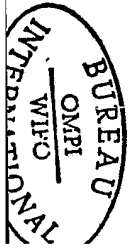


FIG. 6.



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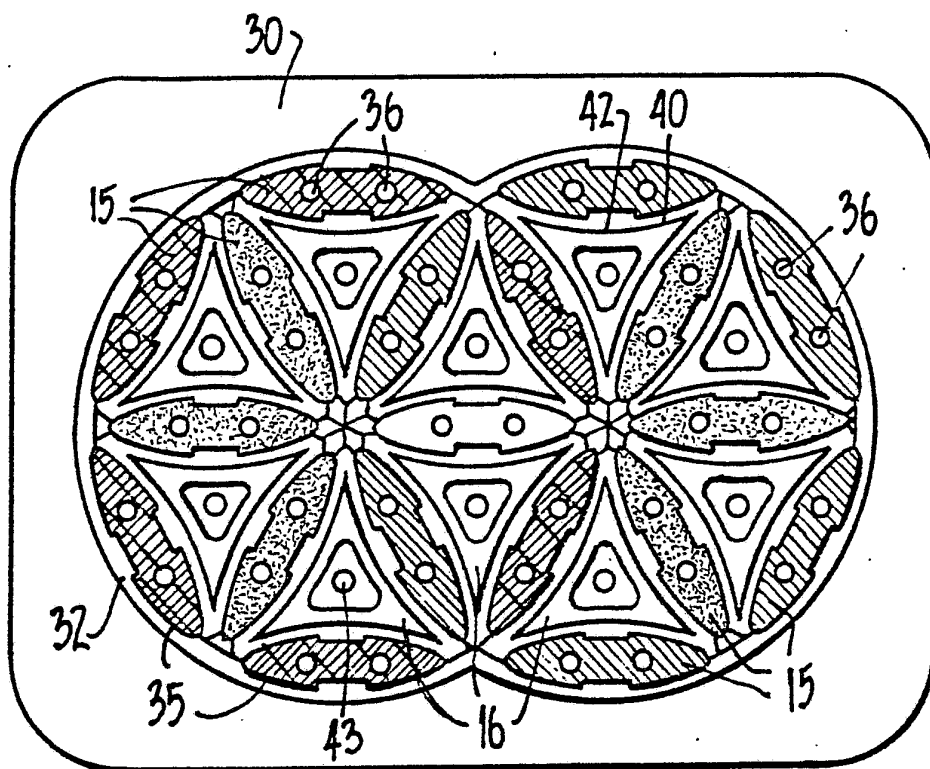


FIG. 3.

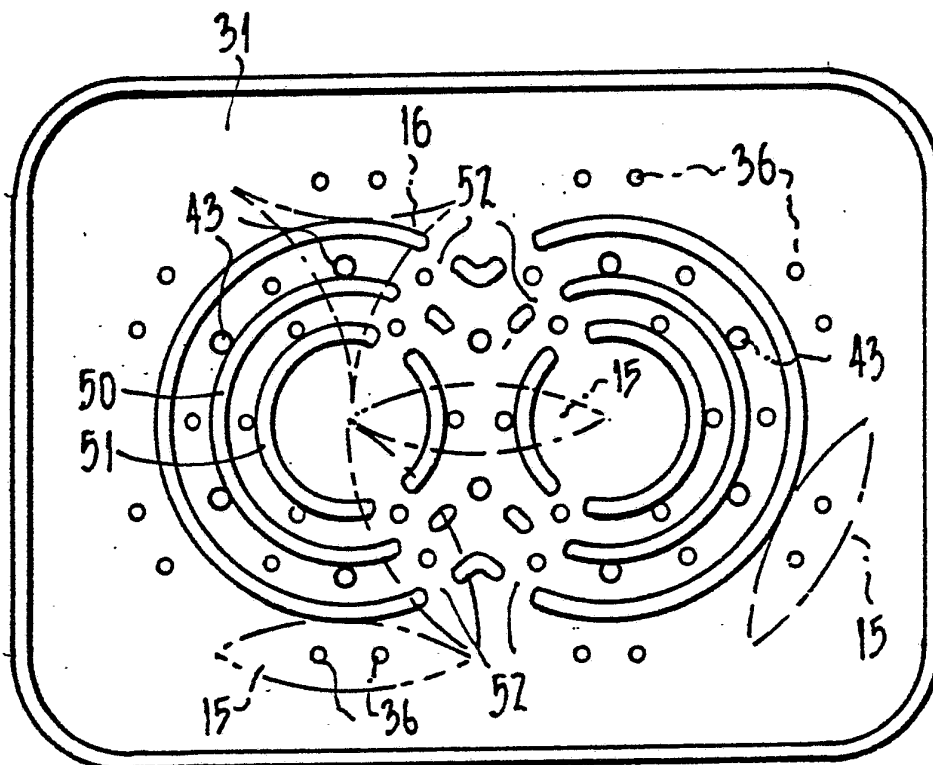
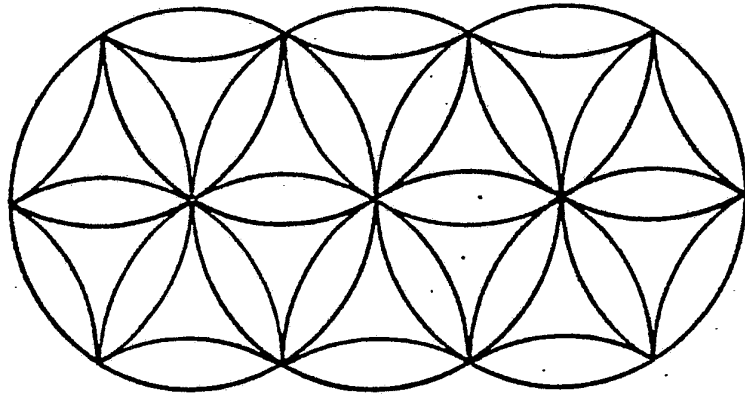
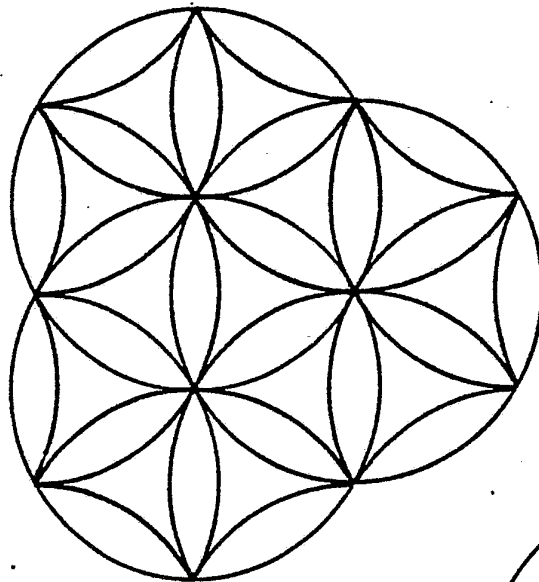


FIG. 4.

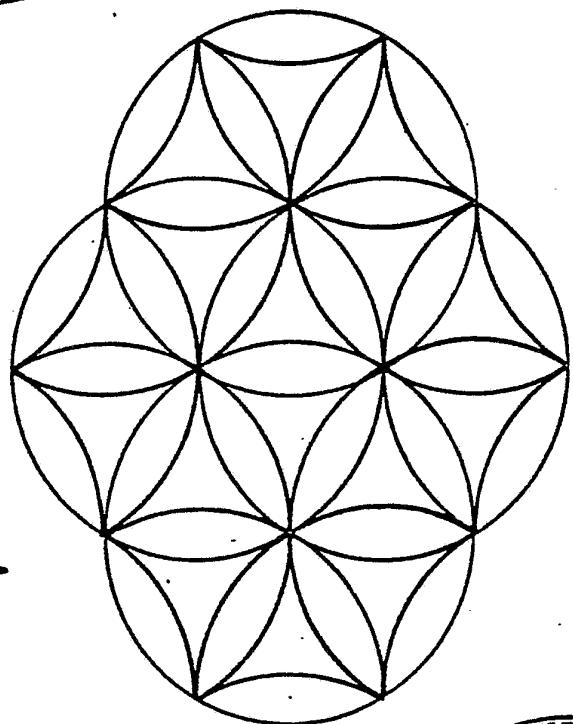
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III. 7.



III. 8.



III. 9.

# INTERNATIONAL SEARCH REPORT

International Application No PCT/AU 82/00208

<b>I. CLASSIFICATION OF SUBJECT MATTER</b> (If several classification symbols apply, indicate all) <sup>3</sup>		
According to International Patent Classification (IPC) or to both National Classification and IPC		
Int. C1 <sup>3</sup> A63F 9/08, 9/10		
<b>II. FIELDS SEARCHED</b>		
Minimum Documentation Searched <sup>4</sup>		
<b>Classification System</b>	<b>Classification Symbols</b>	
IPC	A63F 9/08, 9/10	
Documentation Searched other than Minimum Documentation to the extent that such Documents are Included in the Fields Searched <sup>5</sup>		
AU : IPC as above.		
<b>III. DOCUMENTS CONSIDERED TO BE RELEVANT</b> <sup>14</sup>		
<b>Category *</b>	<b>Citation of Document, <sup>16</sup> with indication, where appropriate, of the relevant passages <sup>17</sup></b>	<b>Relevant to Claim No. <sup>18</sup></b>
X	GB,A, 133556 (SKAIFE) 16 October 1919 (16.10.19) see page 3, lines 1-6	1
A	FR,A, 2405077 (HENRIQUES RABA) 4 May 1979 (04.05.79) see page 1, lines 18-34	1
<p>* Special categories of cited documents: <sup>15</sup></p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&amp;" document member of the same patent family</p>		
<b>IV. CERTIFICATION</b>		
Date of the Actual Completion of the International Search <sup>3</sup>	Date of Mailing of this International Search Report <sup>3</sup>	
9 March 1983 (09.03.83)	14 March 1983 (14-03-83)	
International Searching Authority <sup>1</sup>	Signature of Authorized Officer <sup>20</sup>	
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