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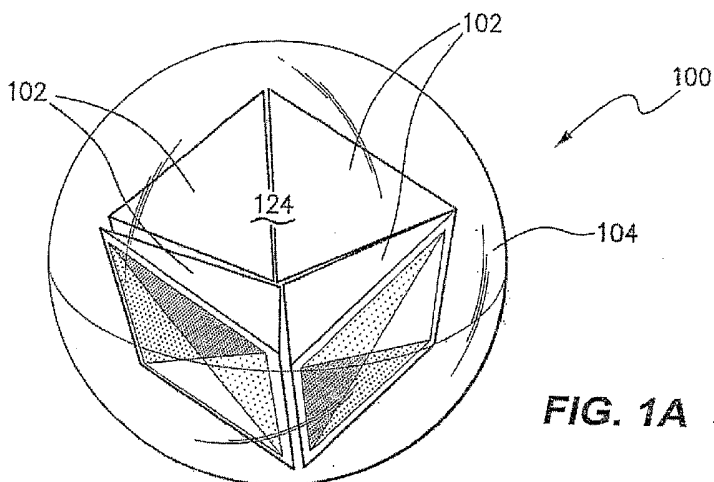
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(54) **Title:** GAME APPARATUS



**FIG. 1A**

(57) **Abstract:** Game apparatus is disclosed herein. In a preferred embodiment, the game apparatus is in the form of a spatial puzzle apparatus (100) which comprises a plurality of puzzle blocks (102) which has a general pyramid shape, and a (void 124) which is configured to receive one of the plurality of puzzle blocks (102). A spherical housing (104) is used to house the plurality of puzzle blocks (102) and the void (124). The spherical housing (104) is configured to circumscribe the plurality of puzzle blocks (102) so that the plurality of puzzle blocks (102) and the void (124) define and retain the shape of a cube (106) as the plurality of puzzle blocks (102) are caused to rotate about a common axis to change positions via the void (124) to solve the puzzle. A virtual or electronic form of the spatial puzzle apparatus is also disclosed.



## GAME APPARATUS

### Background and Field of the Invention

This invention relates to game apparatus, particularly but not exclusively to a spatial puzzle apparatus.

Puzzles are known for generations and they are popular with adults and kids alike because they stimulate creative thinking and provide an intellectual challenge to the player. Rubik's Cube™ is an example of a successful and popular spatial puzzle.

It is an object of the present invention to provide game apparatus which provides the public with a useful choice.

### Summary of the Invention

In a first aspect of the invention, there is provided game apparatus comprising: a plurality of game blocks and a void which is configured to receive one of the plurality of game blocks; a housing arranged to enclose the plurality of game blocks and the void, the housing being configured to circumscribe the plurality of game blocks so that the plurality of game blocks define and retain a predetermined shape as the plurality of game blocks are caused to rotate about a common axis to change positions via the void.

To play the game apparatus, a user holds the apparatus in his hand and manipulates the game apparatus, for example by directional shaking, to cause the game blocks to change positions making use of the void. With this arrangement, a simple and yet challenging puzzle may be created, for example if the faces of the blocks are configured to carry a certain image and a user rotates the game blocks to form a predetermined larger image to solve the puzzle. Through playing the puzzle, a player can explore the relationship between three-dimensional space and two-dimensional planar structures, the interrelation of inner and outer space characteristics, their specific features and regularities. Such a puzzle also has considerably wide range of choices between possible step variations so that the player can entertain himself while the puzzle maintains his attention and improves his mechanical aptitude simultaneously. The players' hand and eye coordination skills can be improved and supports kinaesthetic learning process. As a result, such a puzzle is not only educational but also fun.

It can also be appreciated that in the course of playing, the solution of the puzzle is altered by rearranging, through any sequence of steps, the puzzle blocks within the spherical housing. Following this, the goal of the game may lie in arriving at the initial regular specific pattern of the puzzle blocks, possibly and preferably within the shortest period of time, i.e. by performing, out of a large number of variations, the shortest sequence of steps through which all puzzle blocks are moved back into their initial position. Arriving at a pre-determined specific pattern of the puzzle blocks may prove to be a hard task despite the

fact that handling the puzzle seems, at least at first instance, to be very easy, resulting in a challenging puzzle.

While handling the game apparatus with an aim of solving the puzzle, the player is confronted with questions regarding the relationship between a three-dimensional space and planer structures contained and moved therein. Problems of interrelating the senses of rotation, the reversibility of coordinate systems, and the terms of "outside" and "inside" will gradually become more and more apparent to regular and enthusiastic users of the puzzle.

Preferably, the plurality of game blocks comprises pyramid-shaped game blocks with the apex of each pyramid-shaped game block configured to meet at the common axis. The pyramid-shaped game blocks may be substantially identical and each of the pyramid-shaped game blocks may have a regular, irregular or different polygon base. Preferably, the game blocks rotate and slide at the same time to change positions.

In the alternative, the pyramid-shaped game blocks may comprise two different types and may comprise two different polygon-shaped bases.

Preferably, each game block comprises a base that carries a visual representation, such that when the game blocks are properly arranged, the combination of the visual representations of each of the bases provides a distinct representation which represents a solution to a puzzle. In this way,

the game apparatus may be adapted to be a puzzle. The visual representation carried by each base may be identical. The visual representation may comprise colours or a combination of different colours to form a pattern.

It is also envisaged that the visual representation may comprise characters.

The plurality of game blocks may be made of the same or different types of material, such as wood, clear plastic or ferromagnetic material. Inside of the entire piece being made of ferromagnetic material, it is envisaged that at least one side of the plurality of game blocks may comprise a ferromagnetic material layer. The ferromagnetic layer thus enables a user to use magnetic force to manipulate/rotate the game blocks. Each or at least one of the plurality of game blocks may comprise different colours, characteristics or images. For example, the surface of each or at least one of the game blocks may have different textures or characteristics.

The housing may comprise a finger hole to allow a user's finger to rotate the game blocks using a finger. The housing may be hermetically sealed, and may comprise a retaining mechanism arranged to releasably hold the position of one of the plurality of game blocks.

Preferably, the housing has a sphere shape.

The plurality of game blocks may be arranged to define the general shape of a Platonic or Archimedean solid. It is preferred to arrange the plurality

of game blocks such that they are arranged to rotate about a common point to change positions.

The plurality of game blocks may be edible, and may be made of chocolate.

Instead of a physical device, it is also envisaged that the game apparatus may be implemented virtually or electronically such as for an electronic game, and this forms a second aspect of the invention which provides a virtual game apparatus comprising: a plurality of virtual game blocks and a virtual void which  
1) is configured to receive one of the plurality of virtual game blocks; a virtual housing arranged to enclose the plurality of virtual game blocks and the virtual void, the virtual housing being configured to circumscribe the plurality of virtual game blocks so that the plurality of virtual game blocks define and retain a predetermined shape as the plurality of virtual game blocks are caused to rotate  
5 about a common virtual axis to change positions via the virtual void.

The virtual game apparatus may be implemented on an interactive electronic game which may include a finger or hand controller to control the movement of the virtual housing, thereby causing the virtual game blocks  
0 to rotate about the common axis. The interactive electronic game may be implemented online and may be also programmed as a multi-player game so that players compete against one another to solve the puzzle within the shortest period of time. The virtual game apparatus may also be implemented in a hand-held electronic gaming device.

It is further envisaged that the game apparatus, as a physical device, may be adapted as a "construction" game apparatus such that all the game blocks which made up a predetermined shaped are included and a user is required to remove one (or more) game blocks to form a game or puzzle. This forms a third aspect of the present invention in which there is provided game apparatus comprising: a plurality of game blocks; a housing arranged to enclose the plurality of game blocks, at least one of the game blocks being removable from the housing to create a void, wherein the housing is configured to circumscribe the remaining of the plurality of game blocks so that the remaining of the plurality of game blocks define and retain a predetermined shape as the remaining of the plurality of game blocks are caused to rotate about a common axis to change positions via the void to be created.

The "extra" game block which is removed may be reinserted when the user completes playing the game to prevent rotation of the game blocks. This is useful to enable the user to restart the game again at a stage which he stopped previously, or if the game apparatus is adapted as a puzzle, the game block may be inserted when the user has completed the puzzle, thus, allowing him to maintain the game blocks in completed positions. Of course, instead of using the "extra" game block, it is envisaged that other suitable means may be used, for example, using a pin which is insertable through the common axis to prevent the game blocks from rotating about the common the axis. Such means is also applicable for the first aspect in which the game apparatus is configured with the void from the onset, and likewise the third aspect may be configured with all

the preferred features of the first aspect and/or what is described in the described embodiment.

#### Brief Description of the Drawings

An embodiment of the invention will now be described, by way of example, with reference to the accompanying drawings in which,

Figure 1A is a pictorial representation of a game apparatus in the form of a spatial puzzle apparatus comprising a plurality of puzzle blocks according to a preferred embodiment of the present invention;

Figure 1B is an enlarged schematic two-dimensional view of the spatial puzzle apparatus of Figure 1A;

Figure 2 is a schematic view of a hexahedron which is a Platonic solid on which the spatial puzzle apparatus of Figure 1 is based upon;

Figure 3 illustrates how the hexahedron of Figure 2 is sub-divided into six identical pyramids;

Figure 4 is an example of visual representations of the base of the plurality of puzzle blocks of Figure 1 when shown in 2-dimensions;

Figure 5 illustrates the visual representations of Figure 4 when the plurality of puzzle blocks are re-arranged to solve the puzzle;

Figure 6 is a schematic view of a tetrahedron which is another example of a Platonic solid;

Figure 7 is a schematic view of an octahedron which is another example of a Platonic solid;



Figure 8 is a schematic view of a dodecahedron which is another example of a Platonic solid;

Figure 9 is a schematic view of an icosahedron which is another example of a Platonic solid;

Figure 10 are examples of Archimedean solids that may be used as basis to create further spatial puzzle apparatus;

Figure 11 are examples of "inspheres";

Figure 12 shows schematic representations of the dodecahedron of Figure 8, without showing a housing; and

Figure 13 shows how a pyramid block is arranged within a truncated octahedron, which is another example of an Archimedean solid, without shown a housing.

#### Detailed Description of the Preferred Embodiment

Figure 1 is a pictorial representation of a game apparatus and in this embodiment, this is in the form of a spatial puzzle apparatus 100. The spatial puzzle apparatus 100 comprises a plurality of game or puzzle blocks 102 housed within a spherical housing 104 which defines a game space for the puzzle blocks to move. Each of the puzzle blocks 102 is made of light plastic and is of a pyramid shape as will be further explained below. The spherical housing 104 is made of clear plastics and comprises two equal hemispheric portions sealed hermetically together, so that dusts and dirt, etc. from the outside is prevented from access to the game space. Figure 1B shows the positional relationships between the puzzle blocks 102 more clearly.

The concept of the spatial puzzle apparatus 100 of this embodiment is based on a hexahedron 106 which is one of the Platonic solids, and the hexahedron 106 is commonly called a cube. As shown in Figure 1B, the cube 106 has six square bases 108,110,112,114,116,118 and therefore, the cube 106 is formed by six identical pyramids 120 as shown in Figure 3. Figure 2 shows how one of the pyramids 120 looks like more clearly. The arrangement of each of the six pyramid's apex 122 meets at a common axis 103 about the centre of the spherical housing 104 (shown in 2-dimensions in Figure 1B). The spatial puzzle apparatus 100 is formed by removing one pyramid from the six pyramids to create a void 124 (see Figure 1) which enables one of the pyramids to rotate into the void 124 thereby creating a further void (left by the pyramid that moved into the void 124) for another pyramid. In other words, the remaining five pyramids 120 form the puzzle blocks 102 of the spatial puzzle apparatus 100, as shown in Figure 1.

The spherical housing 104 is arranged to circumscribe the puzzle blocks 102 so that the vertices of the puzzle blocks are releasably engaged with the interior of the spherical housing 104 so as to retain the shape of the Platonic solid, in this case the general shape of a cube 106, but still allowing the puzzle blocks 102 to move freely within the spherical housing 104, albeit with certain movement of the spherical housing 104. It should be mentioned that depending on the arrangement of the spherical housing 104 and the puzzle blocks 102, the puzzle blocks 102 may be arranged to just rotate or rotate and slide to change positions.

Each of the square bases 108,110,112,114,116, of the puzzle blocks 102 are provided with distinct visual representations which provide a visual indicator of the progress of the player's effort to solve puzzle. The distinct visual representation may be symbols, colour combinations, graphic pictures which, when the game pieces are arranged properly, show a specific, pre-determined characteristic pattern. To assist with the explanation of how the spatial puzzle apparatus works and for ease of explanation, each of the five square bases 108,110,112,114,116 of the puzzle blocks 102 are shown in two-dimensions in Figure 4. Each square base 108,110,112,114,116 is divided into four equal portions 108a,108b,108c,108d (using the square base 108 as an example) with the letters A, B, C and D respectively. For a greater aesthetic appeal, these four equal portions may contain different colour combinations.

The rest of the square bases 110,112,114,116 are similarly divided as shown in Figure 4.

As it can be appreciated, in Figure 4, the portion 108a bearing the letter A is aligned with the portion 110b bearing the letter B of the adjacent puzzle block 110. The portion 110c bearing the letter C is immediately adjacent to portion 116a bearing the letter A of the adjacent block 116 (when arranged in three dimensional as shown in Figure 1). Likewise, the portion 114c bearing the letter C of puzzle block 114 is adjacent to portion 112b bearing the letter B of puzzle block 112.

An object of the puzzle is to rearrange the puzzle blocks 102 so that the adjacent portions of each block have the same letter, as shown in Figure 5. This means that starting from the puzzle positions that provide the visual representations of Figure 4, a player needs to hold the spatial puzzle apparatus 100 in a hand, and tilt, shake or rotate the spatial puzzle apparatus 100 to urge a desired puzzle block 102 to move about 90° or rotate about the common axis 103 into the void 124. This thus creates a further void left by the puzzle block 102 that moved into the void 124 and allows another puzzle block to move there. The player thus manipulates the puzzle apparatus 100 in order to shift or rearrange the positions of the puzzle blocks 102 one at a time making use of the empty space defined by the void and the player solves the puzzle when the arrangement of the puzzle blocks 102 provides the visual representation shown in Figure 5 (i.e. when the letters on adjacent portions are the same, although the direction of the letters have been re-arranged for easy reading and may not be what is actually the case if the puzzle is solved by playing the spatial puzzle apparatus 100).

The possible movements of the puzzle blocks 102 are determined by general rules of space geometry defined by the space within the spherical housing 104 and the puzzle blocks 102, and by the specific geometric dimension of the spherical housing 104.

During the movement, it can be appreciated that the spherical housing 104 enables the puzzle blocks 102 to retain the general shape of the cube 106. As it

can be appreciated, all five pyramid-like puzzle blocks 102 may change and rotate to create a challenging puzzle which requires a sequential solution.

As it can be appreciated from the above, removing a pyramid to create a void from a Platonic solid (in this case a cube) provides sufficient space to enable another puzzle block to move into the void by shaking the puzzle apparatus 100. The spherical housing 104 functions as a circumscribed sphere or circumsphere which is arranged to retain the general shape of the cubic shape and yet allowing movement of the puzzle blocks into the void.

The temporary positional relationship between one of the puzzle blocks 102 and the spherical housing 104 to which the puzzle block may be overcome by exercising directional dynamic impacts to the puzzle block, for example, by shaking the spatial puzzle apparatus 100 in a particular direction with a certain skill that can be learned by experience and frequent playing of the puzzle apparatus 100. By such dynamic impacts of proper force and direction, the puzzle block is forced to separate from the respective lateral face of the spherical housing 104 simply under its own weight and inertia.

The spherical housing 104 improves the handling characteristics of the puzzle apparatus 100. Such a shape, besides being more suitable for manual handling, is less dangerous to children. Furthermore, the spherical shape, may improve the freedom of movement of the pyramid puzzle blocks in the game space defined by the interior of the spherical housing 104.

It is envisaged that suitable means be used to prevent or obstruct the puzzle blocks 102 from rotating. In this way, the user may use the means to "freeze" the positions of the puzzle blocks 102, for example, when he wishes to stop playing, and allows him to restart again at a stage in which he stopped playing. Also, if the user solves the puzzle, he may use the means to stop rotation of the puzzle blocks 102 so that he can maintain the puzzle blocks 102 in a solved state. The means may be in the form of a cylindrical rod which is inserted through an aperture formed in the housing 104 which passes through the common axis 103 to prevent the puzzle blocks 102 from rotating about the common axis. Also, if the housing is formed of two halves which is detachable from each other, an extra puzzle block 102 may be inserted to fill up the void 124 and the two halves re-attached to prevent the puzzle blocks 102 from rotating. Indeed, the provision of an extra puzzle block 102 to fill up the void forms a variation to the described embodiment.

In this variation, it is envisaged that the puzzle apparatus 100 includes all the six puzzle blocks 102 (i.e. pyramids) to form the cube 106 enclosed within the housing 104 formed of two halves which is detachable. This may be called a "construction puzzle". To begin playing, a user simply detaches the two halves of the housing and removes a puzzle block 102 from the housing to create the void 124 therein. Of course, more than one puzzle blocks 102 may be removed depending on the type of solid on which the puzzle is based on. In this way, a puzzle apparatus 100 is formed which allows the puzzle blocks 102 to rotate about the common axis 103. As explained earlier, the removed puzzle block

102 may be added back to fill up the void to prevent rotation of the puzzle blocks 102.

The described embodiment should not be construed as limitative. For example, instead of a puzzle, the apparatus may be configured as a toy or generally a game apparatus. For example, there is nothing to solve but a user simply rotates the game or puzzle blocks for fun or amusement, or to look at different representations carried by the faces of the puzzle blocks. The described embodiment uses a cube as a Platonic solid but other Platonic solids may be used such as Tetrahedron, Octahedron, Dodecahedron, and Icosahedron.

(a) A Tetrahedron 150 has four triangular sides as shown in Figure 6.

Therefore, it may be divided into four identical pyramids (one of which 152 is shown in Figure 6), such that, each pyramid has a triangular base.

(b) An Octahedron 160 has eight triangular sides as shown in Figure 7.

Therefore, it may be divided into eight identical pyramids (one of which 162 is shown in Figure 7), such that, each pyramid has a triangular base.

(d) A Dodecahedron 170 has twelve pentagonal sides as shown in Figure 8.

Therefore, it may be divided into twelve identical pyramids (one of which 172 is shown in Figure 8), such that, each pyramid has a pentagonal base.

(e) An Icosahedron 180 has twenty triangular sides as shown in Figure 9.

Therefore, it may be divided into twenty identical pyramids (one of which 182 is shown in Figure 9), such that, each pyramid has a triangular base.

Similar to a cube, one of the pyramids in each of these Platonic solids may be removed to create a spatial puzzle or game. Indeed, more pyramids may be removed for the more complex Platonic solids such as a Dodecahedron and Icosahedron. Indeed, for a spatial puzzle that is based on the Dodecahedron, it is preferred to remove two pyramids forming the Dodecahedron shape to facilitate movement of the puzzle blocks, although the puzzle would still work with one pyramid removed and the puzzle blocks are loosely circumscribed to the housing.

Note that in all cases, the peak of all pyramids is around the centre of each Platonic solid so that the pyramids rotate and slide about this centre. This point is also the centre of the corresponding circumscribed spherical housing 200 (shown in 2-dimensions in Figures 6 to 9) which retains the general shape of the Platonic solids as the pyramids are urged to move around the housing to solve the puzzle. Figure 12 shows schematic representations of the dodecahedron of Figure 8, without showing the housing 200, and illustrating an imaginary point 171 where the peaks of all the pyramid blocks 172 meet. As shown in Figure 12, this point 171 is also the centre of the Platonic solid. The base of each Platonic solid may bear distinct visual representations that are used as an indication to solve the puzzle.



The angle of movement or rotation of a puzzle block to take up the position of a void may differ for different Platonic geometric solids, as can be appreciated from the above.

In the described embodiment of the cube, letters are used for simplicity but the surfaces of the polygon-shaped pyramids of the puzzle blocks may be marked with aesthetically more appealing representations, for example, symbols, sections or parts of graphic pictures which, when the game pieces are arranged properly, show a specific, pre-determined characteristic pattern. One such specific pattern could be seen, for example, in one particular arrangement on the resulting outer surfaces of the five puzzle blocks, and in another particular arrangement on the resulting inner surfaces 102a of puzzle blocks (see Figure 1B). To solve such a puzzle, the user may need to rely on his memory to solve the puzzle. This is because when the user causes a puzzle block 102 to rotate to fill up the void 124, the inner surface 102a of this block 102 becomes hidden from view and thus, the user may need to rely on memory in order to know which other puzzle blocks 102 to move to solve the puzzle as determined by a predetermined pattern on the inner surfaces 102a.

Further, in the described embodiment, the spherical housing 104 is arranged to enclose the puzzle blocks and the movement or rotation of puzzle blocks in the game space is created by directional shaking, for example, aided by gravity. However, it is envisaged that magnetic force may be used and in this case, the puzzle blocks 102 are preferably made of ferromagnetic material. As an

alternative, the puzzle block may be made of insulative material but at least one side of the puzzle block comprises a layer of ferromagnetic material (for example, attached using adhesive). This type of puzzle that uses magnetic force thus provides another form of challenge to users. It is also envisaged that the housing 104 may be filled at least partially with a suitable medium, such as liquid or other types of fluids (e.g. compressible or incompressible fluids, Newtonian or non-Newtonian fluids), instead of air, as long as it enables the puzzle blocks to rotate or move within the housing. The puzzle blocks may be made lighter (in terms of density) from the filling medium and the apparatus may be manipulated in different orientations (e.g. upside down or sideways). Also, some puzzle blocks may be lighter whereas some puzzle blocks heavier in density compared to the filling medium to achieve an even more mind boggling game apparatus.

The housing or the puzzle blocks of the puzzle apparatus may be illuminated for example, by including a battery to power lights. The lights may be visible to the human eye so that it enhances the playing experience at night. Also, it is envisaged that the lights may be invisible to the human eye, such as infra-red, which may be observed through night vision devices. The puzzle blocks 102 may be made of fluorescent materials which emit light, in the visible or invisible range (for the latter, special equipment like the night vision device might be needed). Further, one of the puzzle blocks 102 may comprise electrical contacts which corresponds to electrical contacts on another puzzle block 102 such that when the corresponding electrical contacts made contact, a specific visual image or representation is displayed at the base of the respective puzzle

blocks, for example, to signify to the user that adjacent puzzle blocks are of a correct match (or not).

Instead of light plastic, each puzzle block 102 may be made of wood. Each puzzle block may also be hollow or without a base (for example, when the puzzle uses the inner surfaces 102a as a guide to solve the puzzle as explained above instead of the base). The corners of each puzzle block 102 may also be rounded or truncated to apply less pressure/force to the inner walls of the spherical housing 104. Further, weights may be added to the bases 108,110,112,114,116,118 to create more robust movement of the puzzle blocks 102. It is also envisaged that the puzzle blocks 102 of a puzzle apparatus 100 may be made of different materials so that at least one or some of the puzzle blocks have a different weight or mass compared to the rest. This creates an imbalance gravitational force which creates a more challenging game or puzzle apparatus.

It is also envisaged that each puzzle block may be made of something edible such as chocolate, cheese, biscuits or some type of sweet. The puzzle may thus be marketed as a "puzzle-snack", perhaps encouraging the user to solve the puzzle before consuming the snack. Of course, this would mean that the housing 104 may be opened by the user.

Also, instead of hermetically sealing the spherical housing, a finger hole may be formed on the spherical housing to allow finger-tip handling of the puzzle

blocks. Instead, or in addition, retaining means in the form of at least one surface area of increased mechanical friction or adherence may be used.

A further variation for handling the puzzle apparatus 100 may involve each of the surfaces of the puzzle blocks to be provided with actuating means for releasing the gripping force by which a puzzle block 102 is temporarily and releasably held to the spherical housing. In an example, the spherical housing may be provided with actuating means such as a sensor or push button for indirect holding of the game pieces of the puzzle. This is preferred over the earlier variation of having a finger hole since the spherical housing 104 may still be sealed hermetically, so that dust and dirt, etc. from the outside is prevented from entering the game space. All kinds of such actuating means for indirect handling perform, independently from their actual design, the act of pushing away the puzzle block from the lateral face to which it is held by a certain predetermined initial distance, whereby the gripping force maintained by magnetic pull or friction, for example, is ceased, and free movement of the game piece concerned is allowed.

In certain embodiments of the invention, the retaining means may simultaneously serve as a symbol, i.e., as means of making the puzzle blocks, for example, by coloring or otherwise, so that they will become distinguishable from each other. When designed so, the function of retaining is, at least to a certain extent, substantially hidden or even disguised, so that such embodiments of the invention are made even more "puzzling".

In the described embodiment, Platonic solids are used as examples and thus, it is preferred to use a spherical housing 104 to define the game space and to create the circumsphere. However, it is envisaged that the present invention may be extended to other solids such as Archimedean solids as shown in Figure 10. Figure 10 shows (from top row left to right followed by second row) truncated tetrahedron, cuboctahedron, truncated hexahedron, truncated octahedron, Rhombi cub octahedron, truncated cuboctahedron, snub hexahedron, icosidodecahedron, truncated dodecahedron, truncated icosahedron, rhombicosidodecahedron, truncated icosidodecahedron, snub dodecahedron. Similarly to the Platonic solids, each of those solids are divided into at least two and at most three types of pyramids (since they have two or more types of polygons meeting in identical vertices), to be circumscribed inside a spherical housing. For example, a truncated tetrahedron may comprise four triangular base pyramids and four hexagonal base pyramids. Figure 13 shows how a pyramid block 190 is arranged within a truncated octahedron 192, which is another example of an Archimedean solid, without shown a housing. Similar to the Platonic solids, for example the dodecahedron 170 illustrated in Figure 12, the vertices of the pyramid blocks 190 (only one shown) meet at an imaginary point 191, which is the centre of the truncated octahedron 192.

The housing in the described embodiment and for Platonic solids is a spherical shape. However, other shapes of housing are envisaged that can retain the configuration of the Platonic solid. Also, in the described embodiment, the spherical housing 104 comprises two hemispheric portions and sealed

hermetically together but this may not be so. Both hemispheric portions may be detachable from each other, as explained in the "construction puzzle" variation with all the puzzle blocks included and at least one removed to create a void on the housing for the rest of the puzzle blocks to rotate about a common axis. Also, it is envisaged that the housing is adapted so that a part of the housing forms an inwardly projecting puzzle block which means that it takes fewer movable puzzle blocks to form a puzzle. Of course, the position of the inwardly projecting puzzle block is fixed.

For example, the same concept may be used with inspheres, where the pyramids have a "pillowed" shape. To illustrate what this means, in the preferred embodiment, the puzzle apparatus 100 is based on a cube. For "inspheres", this is similar but with the base of the pyramid shaped puzzle blocks slightly "exploded" in a spherical way so that the general shape of the puzzle blocks looks like a sphere, as shown in Figure 11. The housing for "inspheres" is preferably a "cube", although it is still possible to use a spherical housing.

The same concept may be used with any other shapes (including the above two cases) which fall into the same type of topological transformation, including bandaging of pieces, stellation of pieces, and truncation of pieces, and addition of holes, provided that the concept of mechanism is preserved, main concept of mechanism being that the peaks of all pyramids meet at the centre of the complete structure and 3D sliding movement is allowed. Similarly, some of the puzzle blocks may be fixed to the housing to increase the complexity of the

game or to maintain the general shape of the solid. Likewise, some of the puzzle blocks may be placed looser compared to other puzzle blocks to allow the other puzzle blocks to fit and move freely while rotating to another position.

The game apparatus may be used for educational, civil, engineering, aviation, automobile and entertainment purposes. The game apparatus may also be adapted as part of a smart lock in a security system, for example, when the game apparatus is configured as a puzzle, when the puzzle is solved, this unlocks the security system guarding a door, for example.

The game apparatus may also have other applications, for example as a dice. The surfaces of the game blocks are provided with dots depicting numbers of a dice or the actual numbers and the game apparatus may be rolled to determine what number or number combinations are visible.

In this respect, it is also envisaged that the game apparatus may be implemented virtually or electronically such as for an interactive electronic game. An example would be to offer the game apparatus in virtual form as a 3-D representation on the internet so that a player can use some form of controller, such as a mouse or joystick to manipulate or control the movement of the virtual housing so as to rotate the virtual puzzle blocks. The puzzle may also be implemented as a multi-player game where two or more players compete with each other to solve the puzzle within the shortest period of time. It is also envisaged that this invention may be adapted to be a hand-held electronic gaming device, where the game apparatus 100 and the puzzle blocks 102 etc

are represented electronically or virtually. The gaming device may then have sensors configured to sense the directional movement of device as manipulated by the user's hands to rotate the virtual puzzle blocks according to the detected directional movement to play the game or solve the puzzle.

Further, with touch-screen technology becoming more widespread, it is also envisaged that a player may control the movement of the virtual housing by touching the screen of the hand-held gaming device programmed with the virtual gaming apparatus. The hand-held gaming device may be a mobile phone, PDA or any mobile gaming device.

Having now fully described the invention, it should be apparent to one of ordinary skill in the art that many modifications can be made hereto without departing from the scope as claimed.



**CLAIMS**

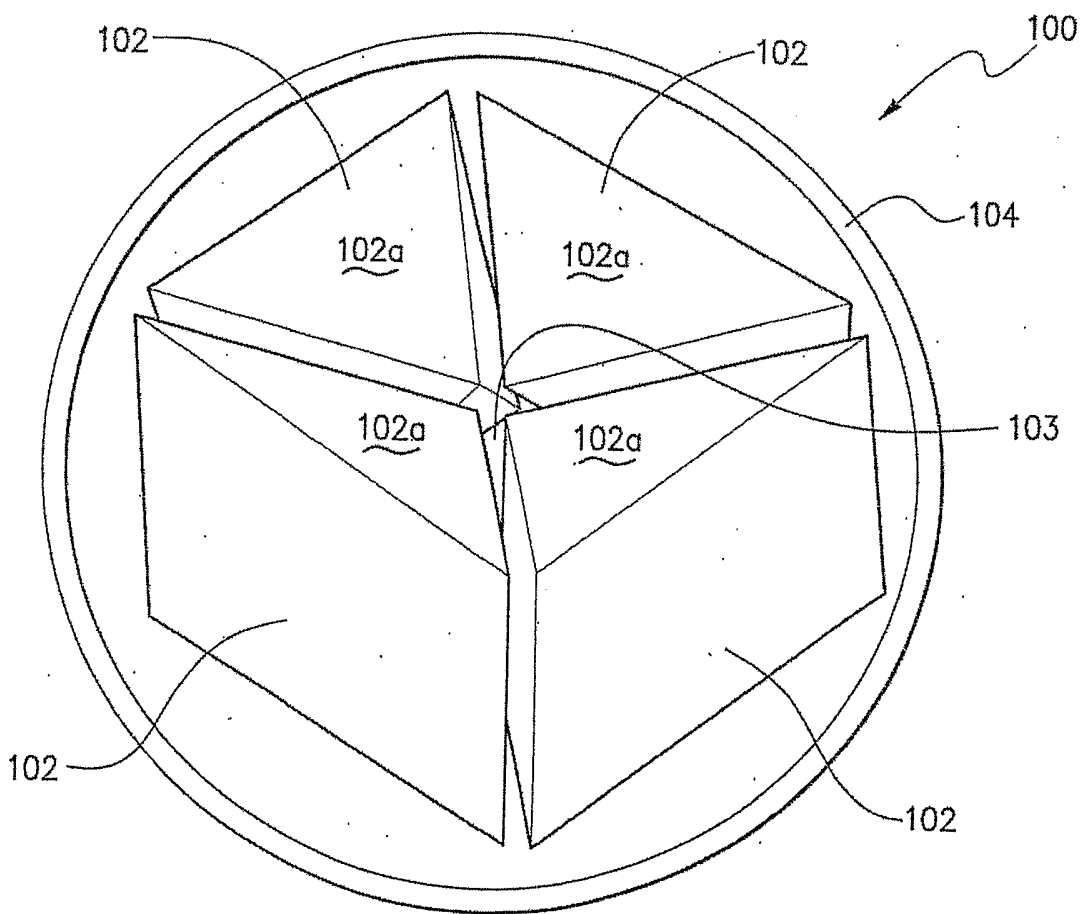
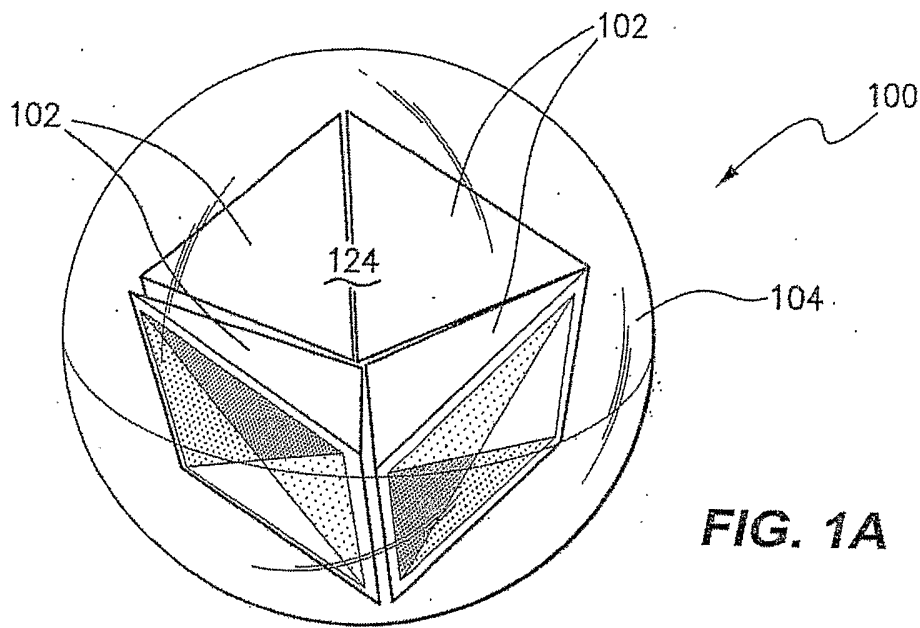
1. Game apparatus comprising:  
a plurality of game blocks and a void which is configured to receive one of the plurality of game blocks;  
a housing arranged to enclose the plurality of game blocks and the void, the housing being configured to circumscribe the plurality of game blocks so that the plurality of game blocks define and retain a predetermined shape as the plurality of game blocks are caused to rotate about a common axis to change positions via the void.
2. Game apparatus according to claim 1, wherein the plurality of game blocks comprises pyramid-shaped game blocks with the apex of each pyramid-shaped game block configured to meet at the common axis.
3. Game apparatus according to claim 1 or 2, wherein the game blocks are substantially identical.
4. Game apparatus according to claim 1 or 2, wherein the game blocks comprise two different types.
5. Game apparatus according to any preceding claim, wherein each of the game blocks have a regular polygon base.

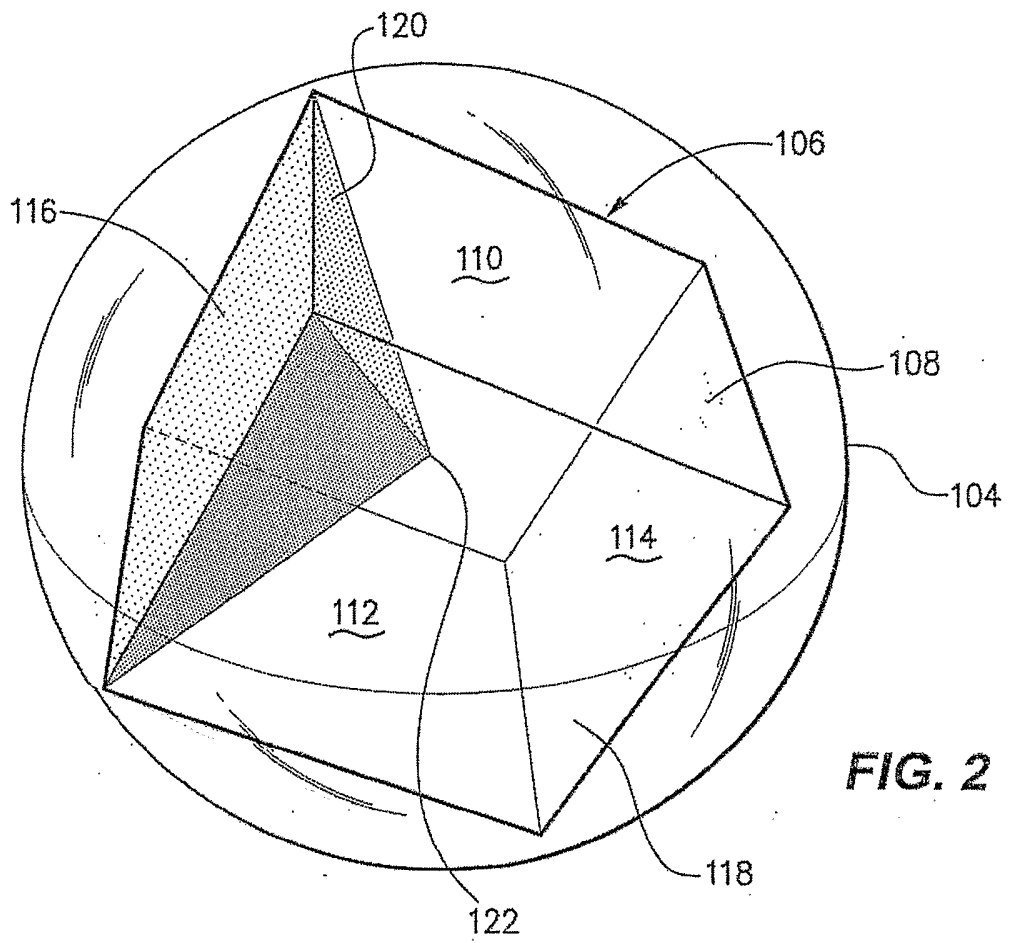
6. Game apparatus according to claim 4, wherein the two different types of game blocks comprises two different polygon-shaped bases.
7. Game apparatus according to any preceding claim, wherein each game block comprises a base that carries a visual representation, such that when the game blocks are properly arranged, the combination of the visual representations of each of the bases provides a distinct representation which represents a solution to the game.
8. Game apparatus according to claim 7, wherein the visual representation carried by each base is identical.
9. Game apparatus according to claim 7, wherein the visual representation comprises colours.
10. Game apparatus according to claim 7, wherein the visual representation comprises characters.
11. Game apparatus according to any preceding claim, wherein the plurality of game blocks are made of ferromagnetic material.
12. Game apparatus according to any of claims 1 to 10, wherein at least one side of the plurality of game blocks comprises a ferromagnetic material layer.

13. Game apparatus according to any preceding claim, wherein the housing comprises a finger hole.
14. Game apparatus according to any preceding claim, wherein the housing is hermetically sealed.
15. Game apparatus according to any preceding claim, wherein the housing has a sphere shape.
16. Game apparatus according to any preceding claim, further comprising a retaining mechanism arranged to releasably hold the position of one of the plurality of game blocks.
17. Game apparatus according to any preceding claim, wherein the plurality of game blocks are arranged to define the general shape of a Platonic or Archimedean solid.
18. Game apparatus according to any preceding claim, wherein the plurality of game blocks are edible.
19. Game apparatus according to claim 18, wherein the plurality of game blocks are made of chocolate.
20. Game apparatus according to claim 2, wherein the common axis is near or along the centre of the housing.

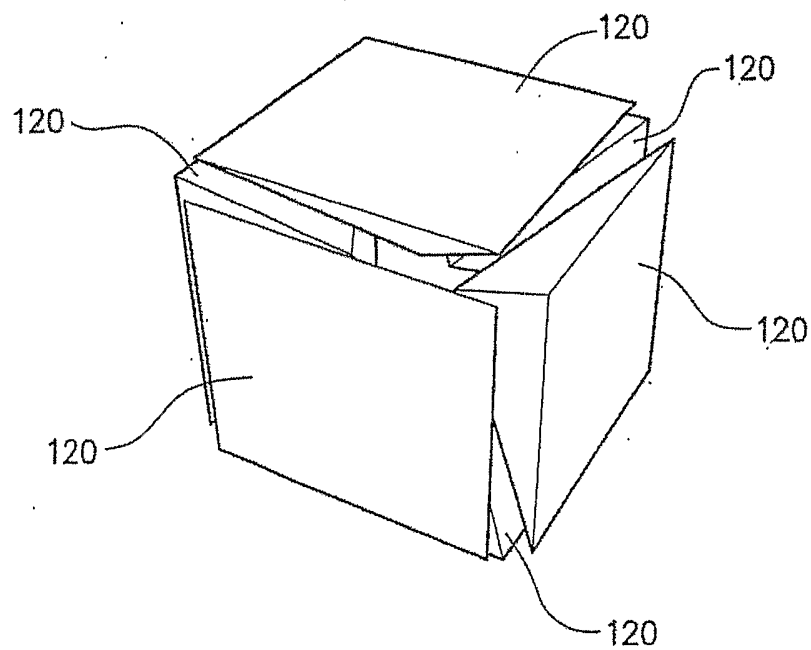
21. Game apparatus according to any preceding claim, further comprising a liquid medium within the housing.
22. Game apparatus according to any preceding claim, further comprising means for preventing the rotation of the game blocks about the common axis.
23. Virtual game apparatus comprising:
  - a plurality of virtual game blocks and a virtual void which is configured to receive one of the plurality of virtual game blocks;
  - a virtual housing arranged to enclose the plurality of virtual game blocks and the virtual void, the virtual housing being configured to circumscribe the plurality of virtual game blocks so that the plurality of virtual game blocks define and retain a predetermined shape as the plurality of virtual game blocks are caused to rotate about a common virtual axis to change positions via the virtual void.
24. An interactive electronic game comprising the virtual game apparatus of claim 23.
25. An interactive electronic game according to claim 24, further comprising a finger or hand controller to control the movement of the virtual housing, thereby causing the virtual game blocks to rotate about the common axis.

26. An interactive electronic game according to claim 23 or 24, wherein the electronic game is implemented online.
27. A hand-held electronic gaming device comprising the virtual game apparatus of claim 22.
28. A hand-held electronic gaming device according to claim 27, further comprising sensors configured to detect the directional movement of the electronic gaming device, and to cause the virtual game blocks to rotate according to the directional movement.
29. Game apparatus comprising:
  - a plurality of game blocks;
  - a housing arranged to enclose the plurality of game blocks, at least one of the game blocks being removable from the housing to create a void, wherein the housing is configured to circumscribe the remaining of the plurality of game blocks so that the remaining of the plurality of game blocks define and retain a predetermined shape as the remaining of the plurality of game blocks are caused to rotate about a common axis to change positions via the void to be created.

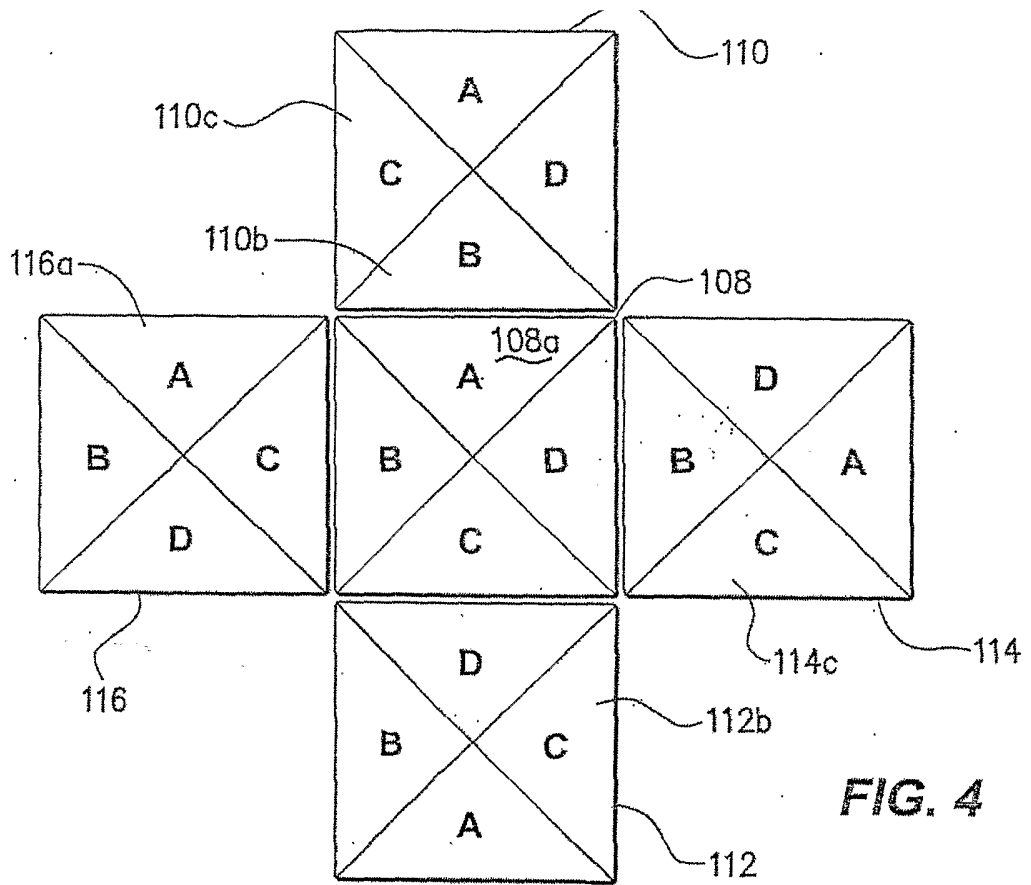




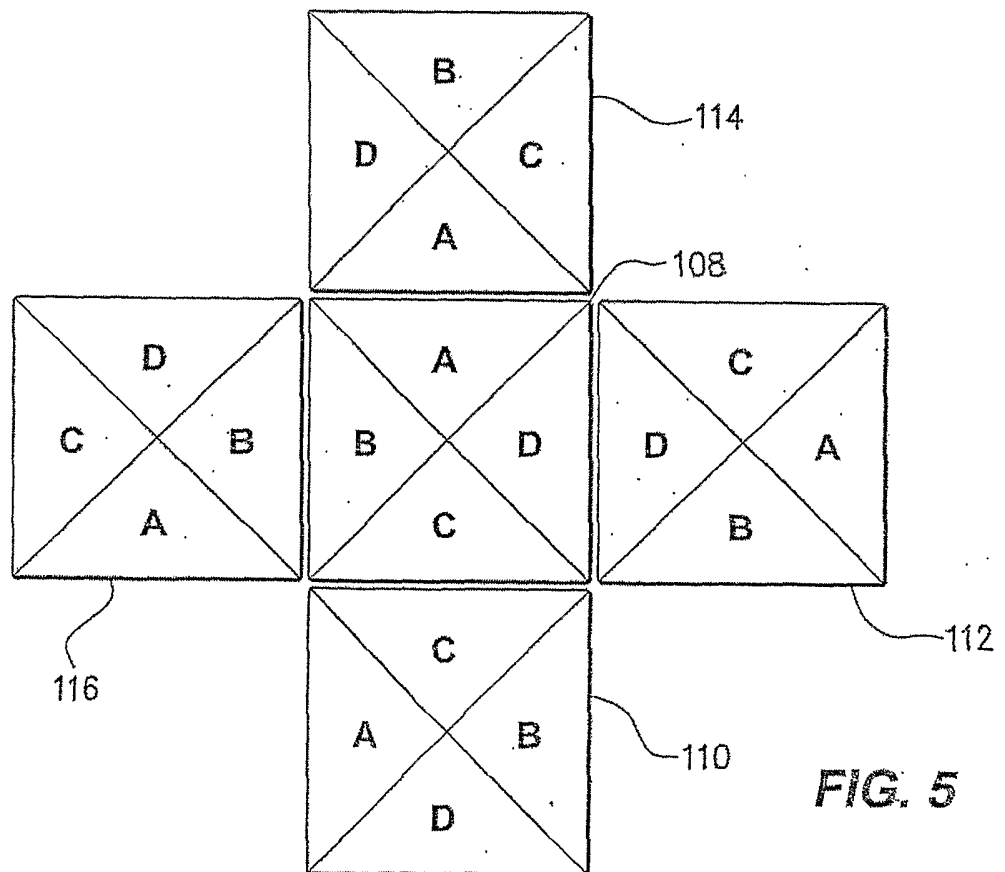
**FIG. 2**



**FIG. 3**

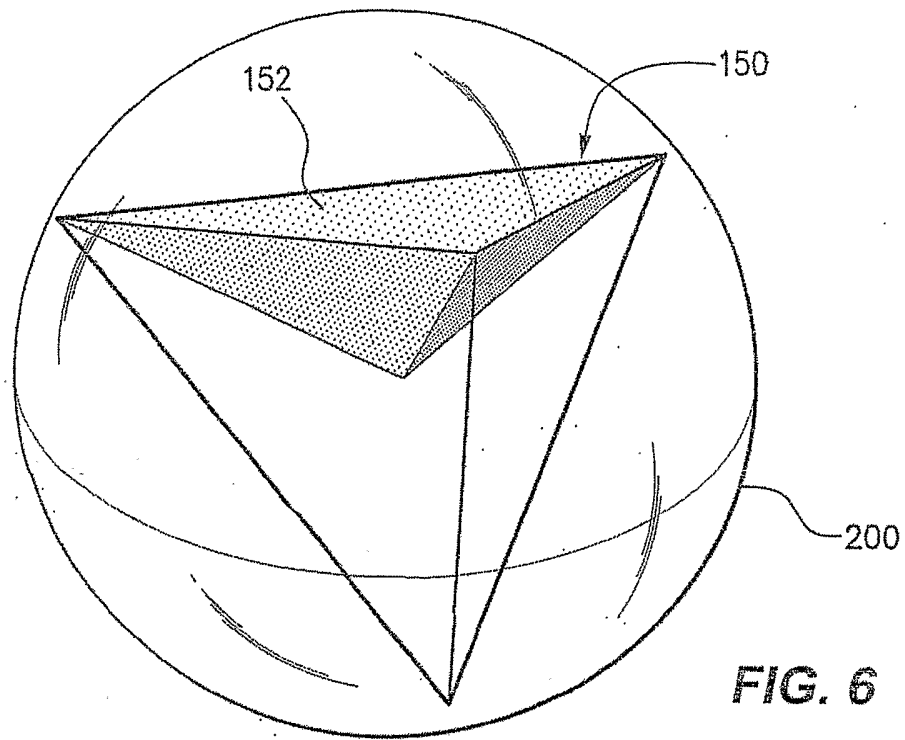


**FIG. 4**

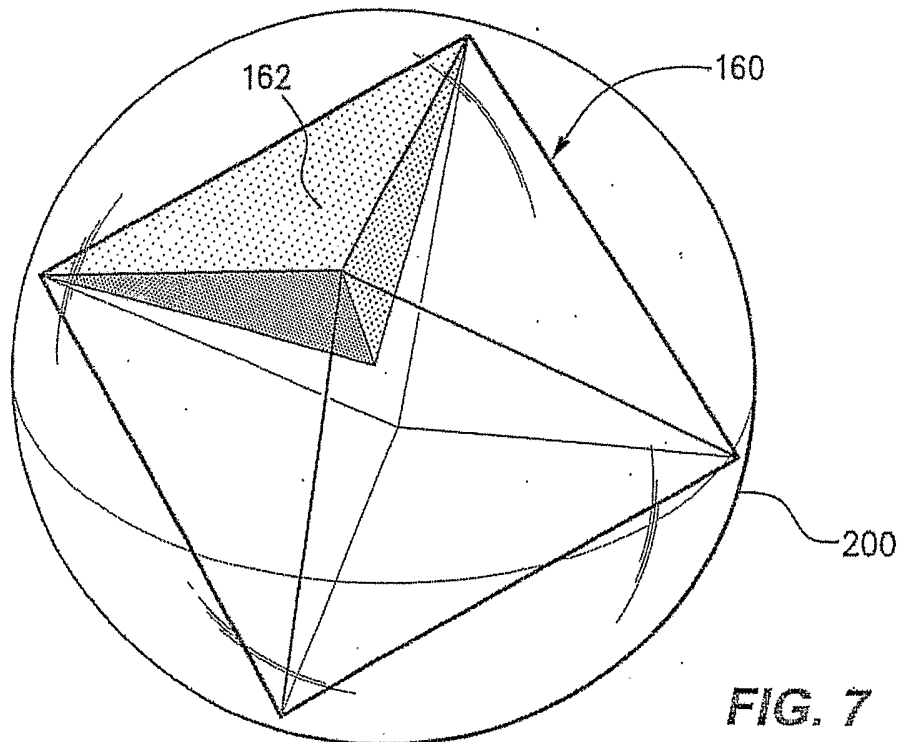


**FIG. 5**

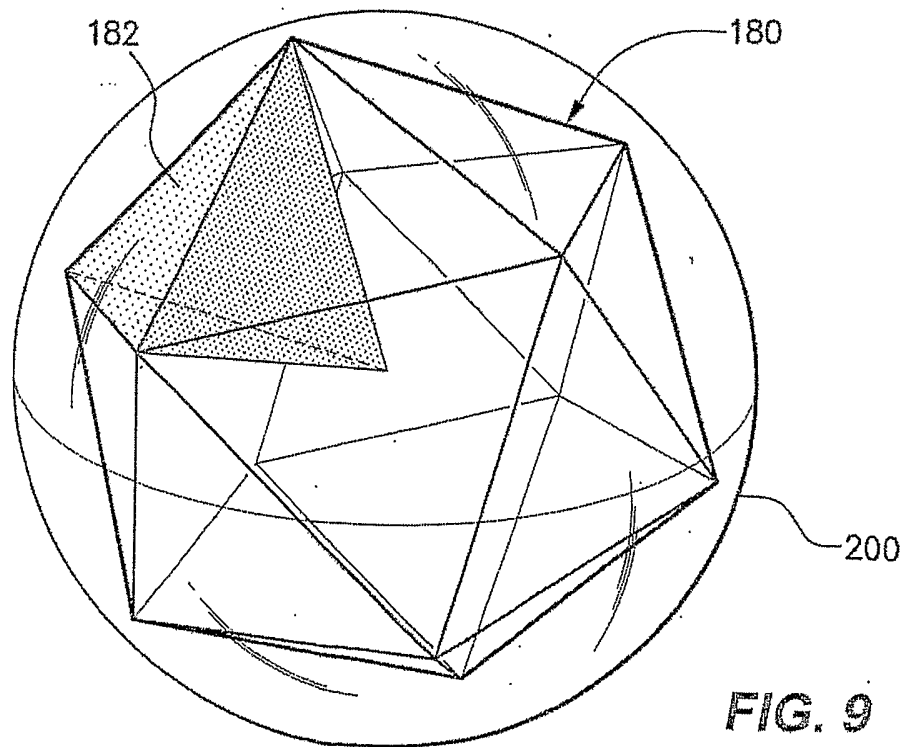
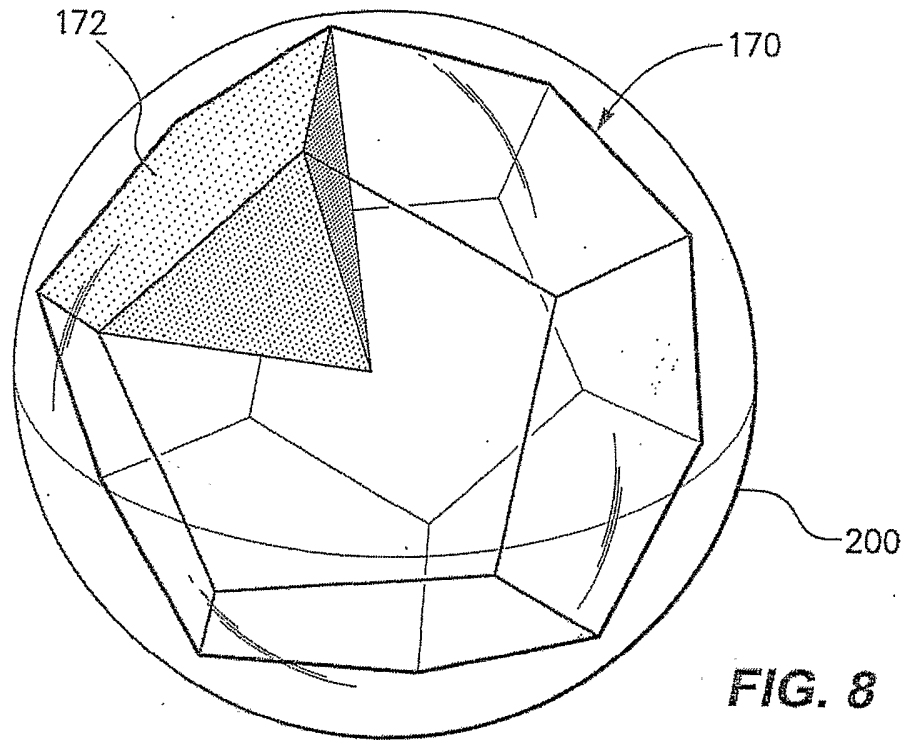




**FIG. 6**



**FIG. 7**



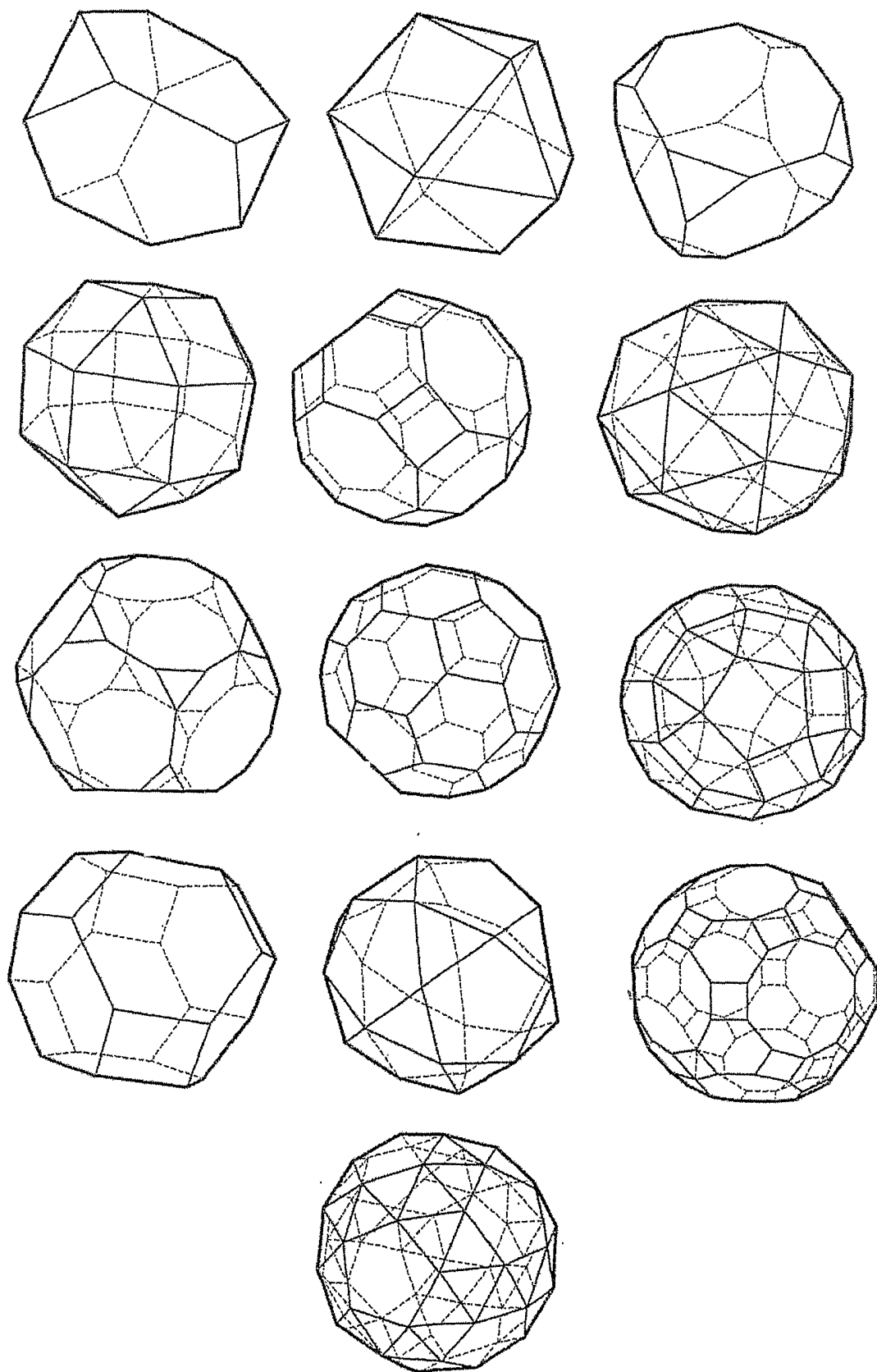
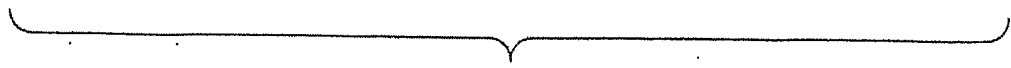
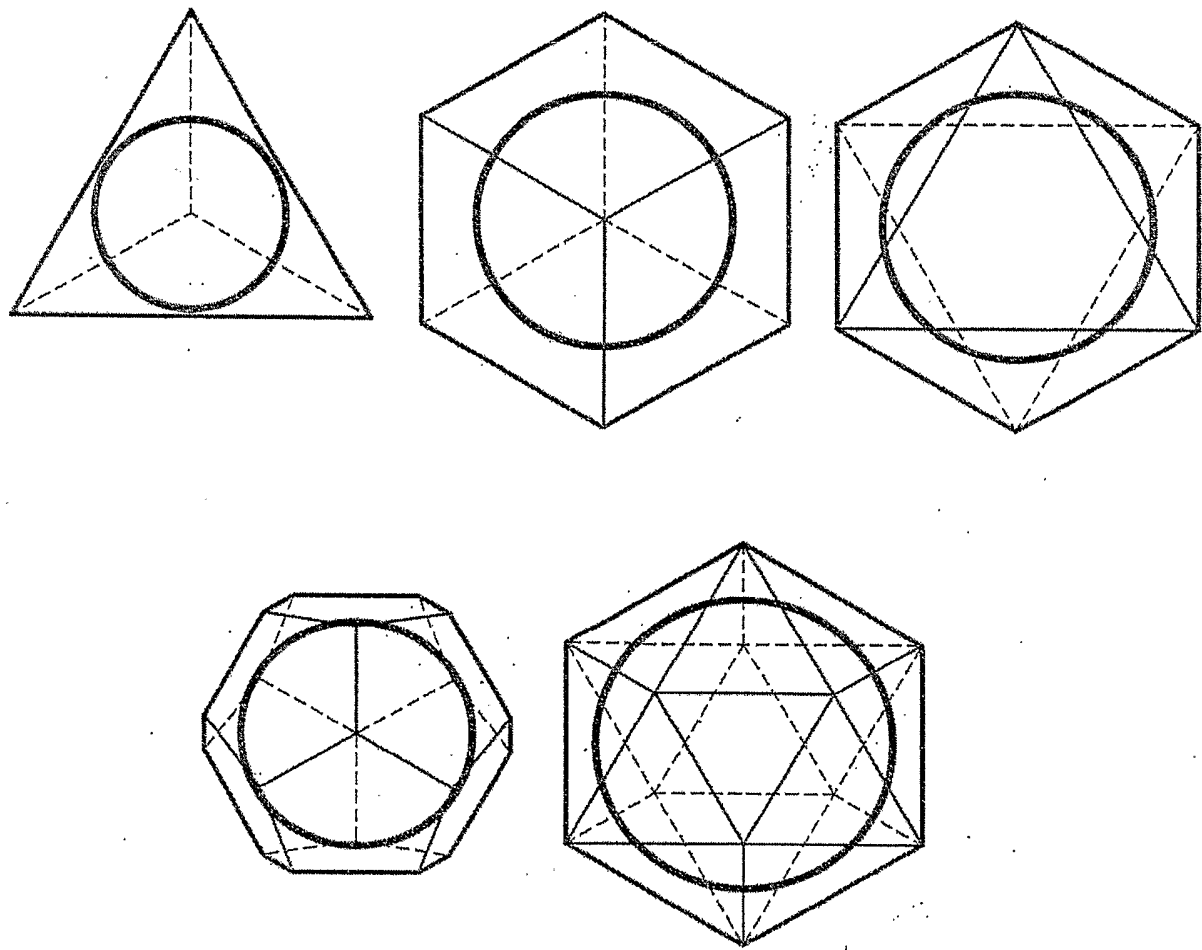


FIG. 10



**FIG. 11**

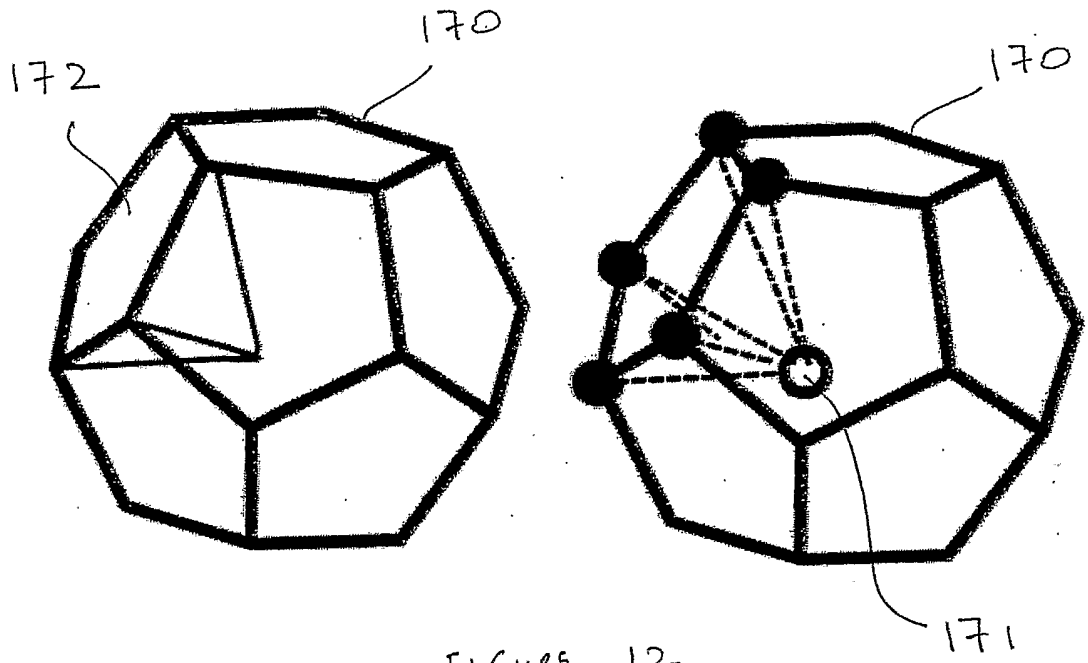


FIGURE 12

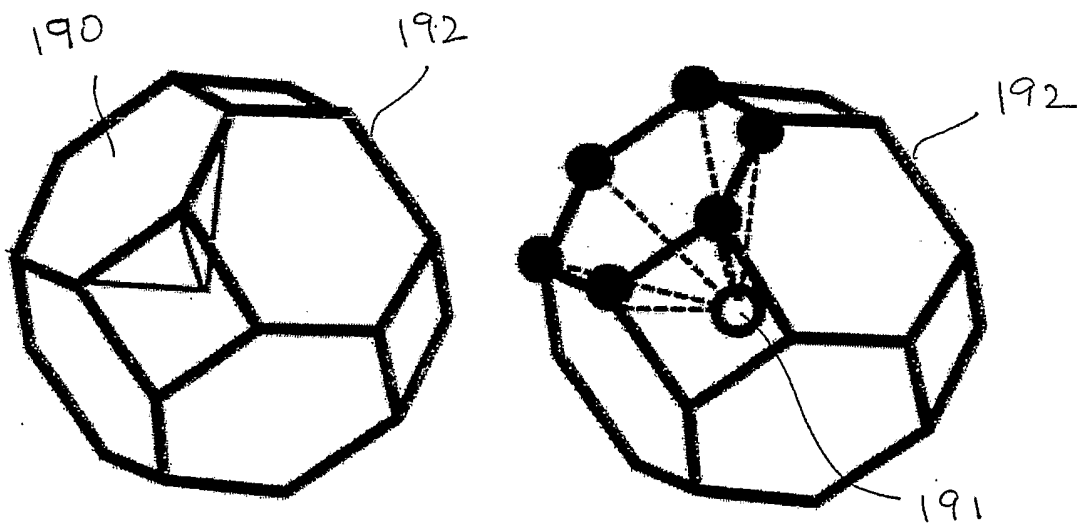


FIGURE 13

## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/SG 2009/000155

A. CLASSIFICATION OF SUBJECT MATTER IPC <sup>8</sup> : <b>A63F 9/08</b> (2006.01) 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) IPC <sup>8</sup> : A63F 9/08		
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 1994/017880 A1 (MAROUN) 18 August 1994 (18.08.1994) <i>Fig. 1 - 4; claims 1, 3; page 3, line 20 - page 4, line 6; page 5, lines 4 - 9 and 20 - 23</i>	1, 2, 3, 5, 7, 13, 14, 16, 17, 20, 22
Y	<i>Fig. 1 - 4; claims 1, 3; page 3, line 20 - page 4, line 6; page 5, lines 4 - 9 and 20 - 23</i>	4, 6, 15, 18, 19, 21
	--	
X	US 4,036,503 A (GOLICK) 19 July 1977 (19.07.1977) <i>Fig. 1 - 8; claims 1, 4; column 3, lines 33 - 59</i>	1, 3, 5, 7 - 10, 14
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X	EP 1 256 364 A1 (FANG) 13 November 2002 (13.11.2002) <i>Fig. 2 - 6, 10 - 12, 15 - 17; [0021], [0022], [0024]</i>	1, 3, 5, 7, 11, 12, 16, 29
Y	<i>Fig. 2 - 6, 10 - 12, 15 - 17; [0021], [0022], [0024]</i>	23 - 28
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<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "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) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "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 "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "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 "&" document member of the same patent family		
Date of the actual completion of the international search 27 July 2009 (27.07.2009)		Date of mailing of the international search report 28 August 2009 (28.08.2009)
Name and mailing address of the ISA/ AT <b>Austrian Patent Office</b> Dresdner Straße 87, A-1200 Vienna Facsimile No. +43 / 1 / 534 24 / 535		Authorized officer <b>BRÄUER C.</b> Telephone No. +43 / 1 / 534 24 / 338

## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/SG 2009/000155

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	FR 2 797 195 A1(HUGUET) 9 February 2001 (09.02.2001) <i>Fig. 1, abstract, page 2, lines 15 - 17</i>	4, 6, 15
Y	DE 43 05 752 A1 (GLAESER) 1 September 1994 (01.09.1994) <i>Fig., abstract</i>	18, 19
Y	US 2003/0232636 A1 (IONESCU) 18. 1 December 2003 (01.12.2003) <i>Fig. 1 - 26; [0004], [0017], [0019], [0020], [0030], [0034], [0042], [0052], [0053], [0055]</i>	23 - 28
Y	GB 2 094 644 A (LONCRAINE) 22 September 1982 (22.09.1982) <i>Fig. 1, 2; abstract</i>	21

## INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.  
PCT/SG2009/000155

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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US A 4036503		US A 4036503	1977-07-19
EP A 1256364		EP A1 1256364 US A1 2002167127	2002-11-13 2002-11-14
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DE A 4305752		DE A1 4305752	1994-09-01
US A 2003232636		WO A1 03105977 CA A1 2485147 AU A1 2003277304 US A1 2003232636	2003-12-24 2003-12-24 2003-12-31 2003-12-18
GB A 2094644		GB A 2094644	1982-09-22