A three-dimensional puzzle such as, for example, a spherical puzzle, has shiftable, and optionally also slidable, puzzle elements that are arranged to enclose a hollow center. The enclosed hollow center defines a secret compartment for optionally containing a prize or other object. The secret compartment can be accessed by manipulating the puzzle elements to match a predetermined (and optionally reprogrammable) pattern that unlocks the puzzle to thus provide access to the secret compartment. A set of keys and corresponding keyways on certain puzzle elements provides the requisite interlocking of elements. Only when the keys are properly aligned with respective keyways can the puzzle be opened to reveal the interior compartment. This puzzle can be a coreless-type puzzle or a puzzle having an inner center element. The puzzle can be spherical, polyhedral or odd-shaped provided there is a suitable opening path for engagement of keys and keyways.
FIG. 2
FIG. 10
<table>
<thead>
<tr>
<th></th>
<th>10s + 10s'</th>
<th>20s</th>
<th>10s + 10s'</th>
<th>20s</th>
</tr>
</thead>
<tbody>
<tr>
<td>1*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>29</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**FIG. 14**
KEYED ACCESS TO HOLLOW THREE-DIMENSIONAL PUZZLES

TECHNICAL FIELD

[0001] The present invention relates generally to three-dimensional logical puzzles and, in particular, to three-dimensional logical puzzles having, or suited to have, an enclosed hollow center.

BACKGROUND OF THE INVENTION

[0002] In the prior art, techniques and devices are proposed to challenge the enthusiast to attempt to open a secret enclosed compartment. The enthusiast is able to gain access to the enclosed compartment by performing or reproducing a given sequence of twists and turns, or matching a pattern disposed on a device’s outer surface. When user manipulates the device into the correct pattern or combination, the device opens to reveal an interior chamber. An example of this is the Cryptex® Security Box (http://www.cryptex.org/) which was inspired by Leonardo Da Vinci’s cryptex.

[0003] The challenge is associated with the complexity and magnitude of possible permutations in the sequence to be reproduced or the complexity of the surface pattern to be matched, or a combination of both.

[0004] Most of these techniques and devices are of moderate complexity with often a single solution. So once it is solved there is very little challenge left for the enthusiast. It is also known, however, to devise programmable mechanisms for these devices. For example, the Cryptex® Security Box has a “mechanically changeable code feature” that enables the user to personalize the code or to reprogram it.

[0005] To the best of Applicant’s knowledge, however, none of the three-dimensional shifting puzzle types (such as the world famous Rubik’s Cube®, and its many variants, or the spherical and Buckball-shaped puzzles disclosed in Applicant’s U.S. patent application Ser. No. 11/738,673 (Paquette) entitled “Three-Dimensional Logical Puzzles”, which was filed on May 2, 2007 and Applicant’s U.S. patent application Ser. No. 11/868,713 (Paquette) entitled “Dividing Method for Three-Dimensional Logical Puzzles filed Oct. 3, 2007) have an interior compartment that is enclosed within the puzzle and which can be accessed by manipulating puzzle elements into a correct combination or pattern.

[0006] Therefore, a three-dimensional puzzle having an enclosed compartment that can only be accessed by manipulating puzzle elements into a predetermined pattern would constitute a very challenging and entertaining puzzle.

SUMMARY OF THE INVENTION

[0007] An object of the present invention is to provide a three-dimensional puzzle having an enclosed secret compartment that is accessible by manipulating the puzzle elements into a predetermined pattern or arrangement so as to unlock the puzzle to thereby provide access to the secret compartment.

[0008] In one main group of embodiments, keyed access is provided to the secret compartment puzzle by virtue of appropriately selected keys and keyways integrated within some of the puzzle elements. In other words, in embodiments of the present invention, some of the elements constituting each puzzle are converted into keyed elements with the addition of keys and keyways in such a fashion that they can be put together to create a circular slideway along the opening path. Rotation around this circular slideway allows the keyed elements to be placed in a proper matching position to allow the keyed elements to slide out once the keys match up with respective keyways, thus permitting the user or puzzle enthusiast to split open the three-dimensional puzzle.

[0009] In certain embodiments, the puzzle can have more than one opening path. In other words, the secret compartment puzzle can potentially be accessed via more than one access point.

[0010] In yet other embodiments of the present invention, the keyed elements can be rearrangeable at the user’s will to enable the user to reprogram the solution pattern (or “matching pattern”) displayed on the puzzle’s outer surfaces that enables the enthusiast to gain access to the secret enclosed compartment.

[0011] These hollow three-dimensional puzzles with secret compartment features can be classified into two major categories. The first category encompasses coreless-type puzzles, while the second category encompasses puzzles having a center element as a constituent part, either a split spherical inner center (SC) element, or to be split by aforesaid opening path.

[0012] In one group of embodiments, the secret compartment puzzles belong to the family of spherical puzzles. These spherical puzzles are perfectly suited for this purpose due to their extremely high number of permutations and the complex range of possible patterns. However, secret compartment puzzles need not be spherical; polyhedral or odd-shaped puzzles can be designed to have an enclosed secret compartment by analogically applying any of the various techniques described herein. In other words, the present disclosure explains how this method can be applied to other shapes of three-dimensional puzzles provided that they have, or are suited to have, an enclosed hollow center and a possible opening path (which is typically the case with most of the existing three-dimensional puzzles). Provided an opening path exists, i.e. a trajectory slicing the puzzle in two parts and giving access to the enclosed hollow center, these techniques can be utilized to create a large variety of differently shaped puzzles having enclosed secret compartments.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] The embodiments of the present invention will now be described with reference to the appended drawings in which:

[0014] FIG. 1 is an isometric view of a coreless keyed pivoting element designed to be part of a coreless three-dimensional puzzle, having a keyway integrated to one of its circular retaining grooves;

[0015] FIG. 2 illustrates five non-interfitting keyway designs usable for keying all the different parts of the coreless puzzle;

[0016] FIG. 3 is an isometric view of a coreless end-keyed mobile element;

[0017] FIG. 4 is an isometric view showing how the coreless keyed pivoting element and the coreless end-keyed mobile element are interfitted and allowed to separate;

[0018] FIG. 5 is an isometric view showing a coreless side-keyed mobile element;

[0019] FIG. 6 is an isometric view illustrating a coreless keyed gap element;

[0020] FIG. 7 is an isometric view showing how the four basic keyed elements are interlitted;
FIG. 8 is an isometric view showing an assembled keyed circular slideway with its matching keyed cap assembly shown opened as part of a coreless spherical type of puzzle;

FIG. 9 is an isometric view showing a coreless spherical puzzle with two openings (in a puzzle created using a "multi-opening technique") in which one keyed cap assembly is shown partially exploded, while the second keyed cap assembly is not shown;

FIG. 10 is an exploded view of a spherical inner center (SIC) element puzzle;

FIG. 11 is an isometric view of a SIC keyed pivoting element having integrated multiple keyways created using a "multi-keying technique";

FIG. 12 is an isometric view of a SIC keyed mobile element with different keys at each end;

FIG. 13 shows how the SIC keyed pivoting element and the SIC keyed mobile elements are interlaced and allowed to separate;

FIG. 14 shows a possible key codification that can be implemented in order to get a unique solution for opening the SIC puzzle;

FIG. 15 depicts one possible configuration of keys implementing one possible solution (but wherein any change to this configuration is equivalent to a reprogramming of the key code in what is known as the "reprogramming technique");

FIG. 16 is an isometric view illustrating a latching split inner center element (LSIC) with latching disk grooves;

FIG. 17 is an isometric view of a sectioned spherical puzzle illustrating two LSIC elements each with one associated SIC keyed pivoting element and latching disk constituting locking devices shown in closed and opened positions;

FIG. 18 is an isometric view (of a sectioned spherical puzzle) showing how the two LSIC elements are split when both latching disks are disengaged;

FIG. 19 is an isometric view (of a sectioned spherical puzzle) showing how the SIC keyed mobile elements are allowed to slide out of the SIC keyed pivoting element;

FIG. 20 is an isometric view of a complete SIC puzzle with some of the SIC keyed mobile elements shown in exploded positions (wherein, when the SIC puzzle is split, these SIC keyed mobile elements are released); and

FIG. 21 illustrates how the present method can be applied to almost any odd-shaped solid to create a three-dimensional puzzle with an enclosed secret compartment.

These drawings are not necessarily to scale, and therefore component proportions should not be inferred therefrom.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

By way of introduction, the present invention is a three-dimensional puzzle having a plurality of puzzle elements arranged in such a manner as to enclose a hollow interior space defining a secret compartment. The secret compartment can be accessed by manipulating the puzzle elements into one or more predetermined patterns or arrangements that unlocks or opens the puzzle to reveal the interior secret compartment. As will be elaborated below, in the preferred embodiments, this is achieved by manipulating keyed puzzle elements so that they align with corresponding keyways formed in adjoining puzzle elements. When the keyways are appropriately aligned in a proper combination, pattern or arrangement, the puzzle can be unlocked or opened to provide access to the interior compartment. In one specific group of embodiments, as will be elaborated below, the key code can be reprogrammed by the user or puzzle enthusiast so that a new (different) pattern or solution is required to open (unlock) the three-dimensional puzzle.

Although spherical puzzles are described and depicted as the preferred embodiments, it is to be expressly understood that other shapes and forms of puzzles can be used to create a secret compartment puzzle, all of which lie fully within the scope of the present invention.

In addition to embodiments of the puzzles themselves, the present disclosure also describes and illustrates a number of different methods or techniques that are used to create or design an effective, challenging and enjoyable three-dimensional puzzle. The methods presented in this disclosure for creating secret compartment puzzles involve one or more of the following techniques: a path-positioning technique, a keying technique, a multi-keying technique, a multi-opening technique, and a reprogramming technique. These techniques will be elaborated below.

Reference is now made to FIG. 1 showing a coreless keyed pivoting element designed to be part of a coreless three-dimensional puzzle. Circular retaining grooves are disposed around said coreless keyed pivoting element. A detailed description of a similar unkeyed version of this pivoting element and its retaining grooves is presented in Applicant's U.S. patent application Ser. No. 11/738,673 (Paquette) entitled "Three-Dimensional Logical Puzzles" and thus require no further explanation. This particular coreless keyed pivoting element is used only to illustrate one specific implementation of the present invention. It is to be understood that many other types of puzzles could have been used to illustrate how the present invention can be applied to a coreless puzzle. One way to implement "secret compartment features" in a coreless three-dimensional puzzle (i.e. to create a selectively accessible enclosed hollow center space in the coreless three-dimensional puzzle) entails integrating a keyway in one of its circular retaining grooves. This keyway is composed of an outer keyway and an inner keyway. This composite keyway is part of face 12 which is situated on an "opening path" (i.e. the path along which one or more puzzle elements can be removed from the puzzle to provide access to the interior secret compartment.)

Reference is now made to FIG. 2. The preceding composite keyway, which is made of outer keyway 13 and inner keyway 14, needs to be unique, so that only one composite key can be compatible with said composite keyway. Examples of proper composite keyway designs are illustrated in FIG. 2. Five composite keyways are shown as being constituted of five outer keyways and five inner keyways numbered from K1o-K1i for the first outer-inner combination to K5o-K5i. The black markings represent the material to be removed in the circular retaining groove to allow the puzzle to be opened when the pieces or elements of the puzzle are in the correct pattern, arrangement or combination. In FIG. 1, keyways K1o and K1i are used, which are cut out from face 12 to give keyways 13 and 14. The composite keyway designs should provide smooth circular retaining grooves to avoid sliding interferences when the puzzle parts are moved or "actuated" by the enthusiast. Five composite keyways are enough for keying the puzzle illustrated herein. It is to be
noted that a different puzzle may, or may not, require a different quantity of composite keys and keyways in order to provide a unique configuration (single solution) to gain access to the secret inner compartment. As will be appreciated, other shapes or types of keys and keyways can be used.

[0041] Reference is now made to FIG. 3 showing a coreless end-keyed mobile element 20 designed to be part of a coreless three-dimensional puzzle. Circular guiding tongues 21 are provided at both ends of the coreless end-keyed mobile element 20. Detailed descriptions of a similar unkeyed version of this mobile element and its guiding tongues are presented in U.S. patent application Ser. No. 11/738,673 (Paquette) entitled “Three-Dimensional Logical Puzzles”, which was filed on May 2, 2007 and thus require no further explanation. This particular coreless end-keyed mobile element 20, which is part of a coreless three-dimensional puzzle, is used only to illustrate one specific implementation of the present invention. To implement secret compartment features in a coreless three-dimensional puzzle, a composite key is integrated into one of its guiding tongues 21. This composite key is composed of an outer key 23 and an inner key 24, and is selected to match one of the aforementioned composite keyways. The composite key is part of face 22 which is situated on the previously mentioned opening path, and is coincident with face 12 of FIG. 1 when the puzzle is in a closed configuration.

[0042] Reference is now made to FIG. 4 where the interfiting of a coreless keyed pivoting element 10 and a coreless end-keyed mobile element 20 is shown. It can be appreciated that, if face 12 and face 22 are coincident, then key 23 and key 24 act as guiding tongues interlocking the coreless end-keyed mobile element 20 to the coreless keyed pivoting element 10. Accordingly, a rotating motion of the coreless end-keyed mobile element 20 along the coreless keyed pivoting element circular retaining groove 11 will be possible. Also, a slide out movement, as shown in FIG. 4, will be possible when key 23 and key 24 are perfectly aligned with keyway 13 and keyway 14 respectively. The selection of matching keys and keyways and their physical disposition on the puzzle elements is known as the “keying technique” of the present method. It is to be understood that every secret compartment puzzle requires proper application of the keying technique in order to obtain a properly functioning secret compartment puzzle. The unique matching of the keys and keyways poses the greatest challenge to the enthusiast. However, the same matching key-keyway combination can be repeated more than once in a given puzzle to simplify its solution.

[0043] Reference is now made to FIG. 5 showing a coreless side-keyed mobile element 30. It is the same mobile element as in FIG. 3 except that instead of having an end-key the element 30 is provided with a side keyway as illustrated. So the side circular retaining groove 31 of the coreless side-keyed mobile element 30 integrates an outer keyway 33 and an inner keyway 34. For illustration purposes herein, composite keyways K3o-K31 of FIG. 2 are used. In the assembled puzzle, face 32 would be coincident with the aforesaid opening path.

[0044] Reference is now made to FIG. 6. This figure shows a coreless keyed gap element 40. A detailed description of a similar gap element and its guiding tongue is presented in U.S. patent application Ser. No. 11/738,673 (Paquette) entitled “Three-Dimensional Logical Puzzles” and require no further explanation. One of the three guiding tongues is provided with an outer key 43 and an inner key 44 intended to interfit with the coreless side-keyed mobile element 30. As can be appreciated from FIG. 5 and FIG. 6, the composite key 43-44 is transposed in order to match the composite keyway 33-34.

[0045] Reference is now made to FIG. 7 showing the four basic keyed elements 10-20-30-40 required to construct a complete secret compartment coreless puzzle. The matching of keyways 33-34 with keys 43-44 is evident from that figure. These keys and keyways interfit perfectly when faces 32 and 42 are aligned and brought together.

[0046] Reference is now made to FIG. 8. Firstly, a keyed cap assembly is made of five coreless end-keyed mobile elements 20, five coreless keyed gap elements 40, and a non-keyed coreless pivoting element 10. Secondly, a complete keyed circular slideway is assembled from five coreless keyed pivoting elements 10 and five coreless side-keyed mobile elements 30. The remainder of the secret compartment coreless puzzle is assembled to the aforesaid keyed circular slideway by adding elements 10-20-30-40. By properly positioning every key and keyway carrying elements, the assembled keyed circular slideway is made to match the keyed cap assembly as shown in FIG. 8. The aim of the puzzle is to twist and rotate the puzzle elements in order to obtain this matching configuration, at which point the secret compartment can be opened. The planar path situated on the opening edges of the coreless puzzle is the aforesaid opening path. The step of locating this path with respect to the puzzle’s elements is referred to herein as the “path-positioning technique” of the present method. Usually this path is selected to correspond with a shifting plan of the basic puzzle that is to be converted to the secret-compartment type. Exceptions to this rule are possible without departing from the invention disclosed herein. It is to be mentioned that the rearrangement of the elements constituting the keyed circular slideway will create a new matching position and thus a completely new challenge for the enthusiast. In FIG. 8, a particular arrangement is identified by a key code Kc1 for the keyed cap assembly and a matching key code Kc2 for the keyed circular slideway. The rearrangement of the key codes is referred to herein as the “reprogramming technique”. With this particular coreless puzzle, there are 14400 different key codes giving rise to multiple challenges for the enthusiast.

[0047] Reference is now made to FIG. 9 which illustrates the “multi-opening technique”. A second opening planar path is introduced having its own key code Kc3. Various numbers of opening paths can be associated with a given puzzle, all within the scope of the present invention. By repeating keys, keyways, and key codes on the various opening paths, the difficulty level of the secret compartment puzzle can be modulated. The coreless type of three-dimensional secret compartment puzzles carries a second interesting feature being that a given puzzle can be completely disassembled by its user and also put back together. It is thus a further challenge for the enthusiast to assemble a coreless puzzle from loose parts. In doing so, the enthusiast can rebuild and reprogram the puzzle to have a different opening position, requiring a new pattern for gaining access to the secret compartment. This will give the enthusiast a secret compartment puzzle for which only he or she knows the solution. Accordingly, the secret compartment puzzle can be used as a toy version of a security box, safe or lockbox. For example, a person could reprogram the secret compartment puzzle with an access pattern that only he knows, in order to store a belonging or object inside the secret compartment.
The secret compartment puzzle is also particularly well suited to being used as a promotional or marketing vehicle. The secret compartment puzzle can hold a prize or other object, such as a promotional item, voucher, coupon, ticket, etc. that could confer some commercial or financial benefit or opportunity upon the enthusiast who is clever enough to solve the puzzle. Reference is now made to FIG. 10 which is an exploded view of a spherical inner center (SIC) element puzzle. The method and techniques described above can also be applied to SIC puzzles in order to add secret compartment features. This is done with the same techniques: a path-positioning technique, a keying technique, a multi-keying technique, a multi-opening technique, and a reprogramming technique, all of which are useful for creating secret compartment SIC puzzles. With this type of puzzle, however, the opening path is not necessarily planar as shown in FIG. 10. This particular SIC puzzle is constituted of pivoting, mobile, gap, and inner center elements, as previously introduced in U.S. patent application Ser. No. 11/738,673 (Paquette) entitled “Three-Dimensional Logical Puzzles”. To implement secret compartment features, the SIC puzzle elements are keyed and become the SIC keyed pivoting elements 10s, the optional SIC non-keyed pivoting elements 10s’, the SIC keyed mobile elements 20s, the SIC gap elements 40s, and the split inner center (SIC) elements 50. The SIC elements 50 are provided with retaining means 51 to secure both types of pivoting elements 10s-10s’ while enabling rotation of these elements. The inner center element as previously mentioned is either split or to be split. In this embodiment, the inner center element is of the split type and both SIC elements meet on a planar inner opening path, which can be different from the previously mentioned opening path for the outer shell elements. In a typical SIC puzzle, the SIC elements are provided with means 52-53 to align and securely assemble the SIC puzzle. Similar or identical SIC elements are disclosed in U.S. patent application Ser. No. 11/738,673 (Paquette) entitled “Three-Dimensional Logical Puzzles” and require no further explanation. Other configurations of SIC puzzles could have been used for illustrative purposes in the present disclosure without departing from the technology introduced herein.

Reference is now made to FIG. 11 presenting a SIC keyed pivoting element 10s having integrated multiple keyways Ks1 to Ks5. The use of more than one keyway is required to obtain a unique solution for the entire SIC puzzle, and is known as the multi-keying technique. This pivoting element 10s is constructed and operates as described and illustrated in U.S. patent application Ser. No. 11/738,673 (Paquette) entitled “Three-Dimensional Logical Puzzles” through faces 10s1-10s2, protrusion 10s3 and retaining means 10s4, and needs no further explanation. The added features to element 10s come from the introduction of five keyways Ks1 to Ks5. Depending on the SIC puzzle configuration and the desired complexity, less than five keyways can be used. On two of the five keyways, modifications are required to allow element separation when the SIC puzzle is opened. These modifications involve removing material on the keyways identified as a, b and c in FIG. 11.

Reference is now made to FIG. 12. In this figure a SIC keyed mobile element 20s is presented. Each end of the SIC keyed mobile element 20s is provided with a protrusion 20s2 for the first end, and 20s4 for the second end. Both of these protrusions are keyed Ks6 and Ks7. Keys Ks6 and Ks7 can be identical or different as shown in FIG. 12. With many key duplications the puzzle resolution can be made simpler.

Reference is now made to FIG. 13. This figure shows a SIC keyed pivoting element 10s with two out of five surrounding SIC keyed mobile elements 20s. These two SIC keyed mobile elements 20s can slide out of the SIC keyed pivoting element 10s as illustrated in FIG. 13. This movement is allowed by aforesaid modifications involving removal of material on the keyways Ks1 and Ks2. As mentioned, this removed material is identified as a, b and c in FIG. 11. As will become evident from the remainder of this disclosure, only two SIC keyed mobile elements 20s need to slide out to allow opening of this particular SIC puzzle. Other configurations of SIC might require a greater or lesser number of sliding-out elements per pivoting element.

Reference is now made to FIG. 14. In order to code the SIC puzzle so that the puzzle has only a unique solution, thus presenting the greatest challenge, unique key designs need to be provided. By doing so, a given unique key will only match a single keyway on the SIC keyed pivoting elements. Here also, duplications of key-keyway combinations will modulate the puzzle difficulty. FIG. 14 illustrates an example of proper key-keyway designs, although it will be appreciated that other shapes or types of keys and keyways can be used instead of those shown. Keyways are associated with elements 10s-10s’ and keys with elements 20s. As can be appreciated, key codes represent a transposition of their associated keyway codes, and one is made male (protrusion) and the other female (indent). To provide a full keying of this SIC puzzle, sixty non-interfitting key-keyway designs are required. The black markings represent the material to be removed in the keyways or added to the keys (which follows a simple binary coding). In this particular implementation of key-keyway designs, some are intended for being associated with the sliding-out elements mentioned before and are identified by an asterisk. The key-keyway designs selected for the sliding-out elements simplify the material removal that is required. With these key-keyway designs, attention should be provided to obtain smooth sliding surfaces to avoid sliding interferences when the puzzle parts are actuated by the enthusiast. It is to be understood that a different puzzle configuration may, or may not, require a different quantity of key-keyway designs in order to obtain a unique configuration to gain access to the secret inner compartment.

Reference is now made to FIG. 15. Now that the key-keyway designs are made unique, they also need to be positioned in a unique fashion. FIG. 15 illustrates one possible configuration of key-keyway designs separated in two half puzzle groups implementing one possible solution. Any change to this configuration is equivalent to a reprogramming of the opening key code and thus gives the enthusiast a completely new challenge. The opening path is schematized by the dashed lines in both groups. The asterisk-identified elements are positioned in contact with the dashed line.

Reference is now made to FIG. 16 presenting a latching split center inner (LSIC) element 60. This LSIC element 60 has mounting holes 61 in its outer shell intended to receive the retaining means for the SIC keyed pivoting elements. These retaining means allow the SIC keyed pivoting elements to rotate around the mounting holes 61 to create said SIC puzzle shifting movements. These retaining means are also intended to enable the enthusiast to disassemble any SIC keyed pivoting element to modify its position on the SIC puzzle in order to reprogram the opening pattern that needs to
be matched in order to solve the SIC puzzle. To allow a reprogramming of the puzzle, some key-keyway duplication needs to be incorporated into the puzzle elements. This is known as the reprogramming technique. Latching disks positioned in latching disk grooves 62 are intended to firmly secure together two interfitting LSIC elements 60. Two LSIC elements 60 are perfectly interfitting together when their respective tongues 63 engage opposed LSIC element grooves 64, so that both faces 65 are brought together (i.e. made coincident).

[0056] Reference is now made to FIG. 17 showing a “sliced view” of two LSIC elements 60 each with one associated SIC keyed pivoting element 10s and latching disk 70. The combined SIC keyed pivoting element 10s with its associated latching disk 70 is called a locking device. The top locking device is shown in a locked or engaged position and the bottom one is shown in an open or disengaged position. A locking device is actuated by pushing it inwardly when its SIC keyed pivoting element 10s matches every key of its surrounding SIC keyed mobile elements (not shown in FIG. 17). A spring device also not shown, or similar mechanism, keeps the unactuated locking device pushed outwardly to avoid interferences when the puzzle elements are displaced or shifted. It can be appreciated that for this particular puzzle the inner opening path is non-planar and follows the line defined by the aforementioned tongues 63, grooves 64 and faces 65.

[0057] Reference is now made to FIG. 18. The exact same sliced view as in FIG. 17 is presented, but with both LSIC elements 60 separated. The opening of this hollow center element constituted of two LSIC elements 60 is possible only if every locking device disposed along the inner opening path is simultaneously actuated, i.e. pushed inwardly. The simultaneous actuation is only allowed when every key and keyway are perfectly positioned to match an opening pattern. The puzzle difficulty can be modulated by duplications of the key-keyway designs. If every key were to be the same then the puzzle solution would be trivial. By using more and more key-keyway designs the puzzle is made more and more challenging. This is known as the multi-keying technique. Also, not every SIC keyed pivoting element needs to be part of a locking device. Only a few locking devices can be used in a given puzzle for the sake of simplicity.

[0058] Reference is now made to FIG. 19 showing an isometric sliced view that illustrates how the SIC keyed mobile elements 20s are allowed to slide out of the SIC keyed pivoting element 10s when the locking devices 10s-70 are actuated and the LSIC elements 60 are pulled apart. To be noted, some of the SIC keyed mobile elements 20s are released from the remainder of the puzzle as shown by their exploded position, or firmly retained with the remainder of the puzzle as shown for the bottom element. The SIC gap elements 40s also remain secured with the remainder of the puzzle. FIG. 19 illustrates the necessity of removing material on two of the keyways of the SIC keyed pivoting elements 10s as shown in FIG. 11 to enable a sliding-out motion as illustrated in FIG. 13. The present figure (FIG. 19) depicts the underlying principle used to implement secret puzzle features in a spherical inner center element puzzle. As will be readily appreciated by those of ordinary skill in the art of three-dimensional puzzles, many minor and obvious variations and modifications can be made to the techniques and puzzles described herein. It is therefore to be understood that three-dimensional puzzles having varying shapes and structures can be created with internal secret compartments, and that these lie well within the scope of the present invention.

[0059] Reference is now made to FIG. 20. This isometric and partially exploded view of a complete SIC puzzle shows all the SIC keyed mobile elements 20s that are released when the SIC puzzle is opened. These SIC keyed mobile elements 20s would be coded using the asterisk-identified codes previously mentioned. With this particular puzzle, ten SIC keyed mobile elements 20s are released.

[0060] Reference is now made to FIG. 21. This figure explains how to apply this method and its various particular techniques to create an odd-shaped puzzle of virtually any kind. The first condition to be met is that the odd-shaped puzzle must have an enclosed hollow center. As a second condition, there must exist at least one opening path along which the puzzle can be sliced, and this opening path must give access to the enclosed hollow center. The opening path can be planar or not. Another requirement for the opening path is that it should pass along the puzzle element edges and rotate with one of the puzzle pivoting axes known as a shifting plan, or it should be provided with such an axis. As a third condition, there should exist a circular ring area along the opening path wide enough to receive the necessary keys and keyways. This circular ring area is either integrated within the puzzle elements when a coreless design is used, or integrated to an inner center element. In a coreless type of puzzle, the interlocking of the different elements is assured solely by tongues and grooves or similar mechanisms. In an inner core type of puzzle, locking devices are provided to interlock two or more split or “splittable” inner center elements that carry all of the puzzle elements, with possibly an exception for free keyed elements released when the puzzle is opened. Having met these three conditions, the puzzle elements are then keyed or multi-keyed, and multi-opening paths may optionally be provided. With an inner center element puzzle, the key and keyway design can optionally enable the reprogramming of the puzzle solution with some key-keyway duplication. This, however, is an automatic feature with a coreless type of puzzle. A simplified representation of this procedure is illustrated in FIG. 20. An odd-shaped puzzle having a hollow center is divided in two parts S1 and S2 by planar path P1 and P2 being coincident with the opening path when this puzzle is closed. What is not shown, however, is that the puzzle elements edges lie on this opening path. The circular ring areas represented by dash-dot lines carry matching key codes Ks1 and Ks2. From this point, multi-keying, multi-opening and reprogramming techniques can be implemented to the puzzle in order to complete a fully functional secret compartment puzzle.

[0061] The techniques disclosed in the prior art for arranging the display of colours, emblems, logos or other visual indicia on the outer surfaces of the puzzles to modulate the difficulty level are of lesser utility for secret compartment puzzles, since it is the keying, multi-keying and multi-opening techniques that are used to modulate the difficulty level for this type of puzzle. Once an indicia pattern is associated with the key elements of the puzzle, it is the key-keyway configuration that becomes important for solving the puzzle. The indicia pattern will then serve as visual indication for the enthusiast trying to match a programmed opening pattern. So it is essential for the user when he or she reprograms a puzzle to retain the exact pattern to be matched. Otherwise, he or she won’t be able to solve the puzzle without trying all the various
combinations and permutations. In other words, the indicia pattern doesn’t modulate the difficulty level, but is essential to know for opening the secret compartment. Since it is reprogrammable no unique solution pattern can automatically be considered the puzzle solution. As mentioned, the enthusiast who reprograms his puzzle must use caution and take note of the modified indicia pattern.

Different visual indicia patterns (e.g. colours, logos, emblems, symbols, etc.) can be used for identification of the puzzles.

It should be noted that advertising, corporate logos or team logos could also be placed onto the surfaces of the puzzles to create promotional vehicles or souvenirs. However, if they are reprogrammed the puzzle will be very difficult to solve.

Optionally, slidable elements can be superimposed on shiftable puzzle elements of a secret compartment puzzle. Very careful design is required to ensure that the superimposed slidable elements do not slide off the puzzle. Once this design difficulty is overcome, the remainder of the design of the puzzle elements is analogous with the implementations of sliding features to shifting puzzle as described in U.S. patent application Ser. No. 11/738,673 (Paquette) entitled “Three-Dimensional Logical Puzzles”, and therefore need not be repeated herein.

The present method could also be applied to any polyhedron to achieve and create other interesting and challenging secret compartment puzzles. Accordingly, the drawings and description are to be regarded as being illustrative, not as restrictive.

It will be noted that exact dimensions are not provided in the present description since these puzzles can be constructed in a variety of sizes.

While the puzzle elements and parts are preferably manufactured from plastic, these puzzles can also be made of wood, metal, or a combination of the aforementioned materials. These elements and parts may be solid or hollow. The motion of the puzzle mechanism can be enhanced by employing springs, bearings, semi-spherical surface knobs, grooves, indentations and recesses, as is well known in the art and are already well described in the prior art of shifting and sliding puzzles. Likewise, “stabilizing” parts can also be inserted in the mechanism to bias the moving elements to the “rest positions”, as is also well known in the art.

It is understood that the above description of the preferred embodiments is not intended to limit the scope of the present invention, which is defined solely by the appended claims.

1. A three-dimensional logical puzzle comprising a plurality of shiftable puzzle elements that are interfitted together so that the puzzle elements can be shifted relative to one another into a plurality of different arrangements, the puzzle elements being arranged to enclose a hollow center defining an enclosed secret compartment, wherein at least one of the arrangements of the puzzle elements corresponds to a puzzle solution that unlocks the puzzle to provide access to the enclosed secret compartment.

2. The puzzle as claimed in claim 1 wherein a plurality of the puzzle elements have keys and keyways for selectively interlocking the puzzle elements so that the puzzle can only be unlocked when the keys and corresponding keyways are aligned.

3. The puzzle as claimed in claim 2 wherein the puzzle elements are keyed by a keying technique comprising steps of: (i) selecting matching keys and keyways and (ii) disposing the keys and keyways along an opening path of the puzzle.

4. The puzzle as claimed in claim 3 wherein the puzzle elements are further keyed by a complementary multi-keying technique comprising steps of: (i) implementing keys and keyways on all or a subset of the puzzle elements that are not situated along the opening path.

5. The puzzle as claimed in claim 1 wherein the arrangement of puzzle elements corresponding to the puzzle solution is determined by a path-positioning technique comprising steps of locating at least one opening path coincident with a shifting plan of the puzzle and passing on edges of the puzzle elements, the opening path being defined as a trajectory slicing the puzzle in two parts and providing access to the enclosed secret compartment.

6. The puzzle as claimed in claim 5 wherein the puzzle elements comprise a plurality of opening paths, wherein each opening path has its own unique key and keyway combination.

7. The puzzle as claimed in claim 5 wherein the puzzle elements comprise a plurality of opening paths, wherein some or all of the opening paths share a common key and keyway combination.

8. The puzzle as claimed in claim 1 wherein the keys and keyways are reprogrammable by the user so that the user can change the arrangement of puzzle elements corresponding to the puzzle solution that opens the puzzle and provides access to the enclosed secret compartment.

9. The puzzle as claimed in claim 1 wherein the puzzle elements are self-supporting and interlocking to define a coreless puzzle.

10. The puzzle as claimed in claim 9 wherein the puzzle elements are arranged to define a spherical puzzle and wherein all or a subset of the puzzle elements are keyed elements having keys and keyways that are positioned along at least one opening path to enable the elements to slide out relative to one another when the puzzle elements are manipulated into a solution pattern in order to provide access to the enclosed secret compartment.

11. The puzzle as claimed in claim 9 wherein the puzzle elements can be completely disassembled and reassembled to provide a further challenge.

12. The puzzle as claimed in claim 9 wherein the puzzle elements are arranged to define a spherical, polyhedral or odd-shaped puzzle.

13. The puzzle as claimed in claim 1 wherein the puzzle elements are mounted on an inner center element by retaining means that retain at least some of the puzzle elements while allowing rotation of at least some of the puzzle elements relative to the inner center element.

14. The puzzle as claimed in claim 13 wherein the inner center element is a splittable inner center element having an inner opening path.

15. The puzzle as claimed in claim 14 wherein the puzzle elements together define a spherical, polyhedral or odd-shaped puzzle.

16. The puzzle as claimed in claim 13 wherein all or a subset of the puzzle elements comprise keys and keyways on all or a subset of protrusions and guiding faces of the puzzle elements to enable the elements to be activated to release locking devices that interlock the splittable inner center element when the puzzle elements are manipulated into a solution pattern in order to provide access to the enclosed secret compartment.
17. The puzzle as claimed in claim 16 wherein keyed puzzle elements can be reprogrammed to alter the arrangement of puzzle elements corresponding to the solution pattern required to open the puzzle, the puzzle being reprogrammed by relocating locking devices of the puzzle and duplicating some of the keys and keyways.

18. The puzzle as claimed in claim 16 wherein the locking devices interlock the splittable inner center element, upon which some puzzle elements are carried, with other free keyed elements that are released when the puzzle is opened, the splittable inner center element being provided with tongues and grooves along its inner opening path for interfiting opposed inner center element tongues and grooves when both halves of the splittable inner center element are reunited, thus providing an interlocking area for firmly securing together all puzzle elements.

19. The puzzle as claimed in claim 18 wherein the interlocking area is provided with latching disk grooves suited to receive a latching disk, the latching disk grooves being engraved in adjacent opposed inner center element tongues and grooves, the locking device being constituted of a latching disk attached to a keyed pivoting element, the locking device being actuated for disengagement when its keyed pivoting element matches every key and keyway of its surrounding keyed mobile elements.

20. A method of creating a three-dimensional logical puzzle having an enclosed secret compartment, the method comprising steps of: (i) applying a path-positioning technique comprising locating one or more opening paths, the one or more opening paths each being defined by a trajectory slicing the puzzle in two parts and providing access to the enclosed secret compartment; and (ii) applying either a keying or multi-keying technique that involves selecting matching keys and keyways and disposing the keys and keyways along one or more of the opening paths of the puzzle.

21. The method as claimed in claim 20 further comprising a step of applying a reprogramming technique that involves enabling the user to rearrange the puzzle elements to customize the solution pattern that opens the puzzle.

* * * * *