

[54] **PUZZLE WITH MULTIPLE PASSAGEWAYS HAVING A COMMON INTERSECTION AND OBJECTS SHIFTABLE AMONG SAID COMPARTMENTS**

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[52] U.S. Cl. **273/109, 273/153 S**
 [51] Int. Cl. **A63f 7/04**
 [58] Field of Search **273/109, 113, 115, 132, 153 R, 273/153 S**

[56] **References Cited**

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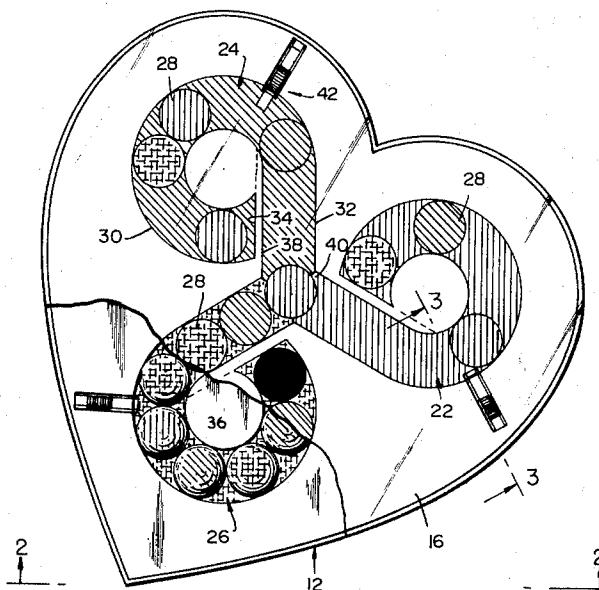
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[57] **ABSTRACT**

A puzzle comprising several passageways. The distal ends of the passageways are closed and retroverted. The proximal ends of the passageways meet at a common intersection. The passageways contain shiftable objects such as spheres which are individually wider than half the width of the passageways so that there never can be two objects abreast in a passageway. The number of objects does not exceed the total number of objects that can be accommodated in all but one passageway. By way of example in a typical puzzle with three passageways, each long enough to contain eight objects, there are 16 objects in all. The objects are characterized, as by color, in a fashion such that they can be subdivided into groups equal in number to the number of passageways with the solution of the puzzle consisting of shuttling the objects into and out of the passageways through the intersection until there is a different group of objects of like character in each different passageway. Thus, with three passageways and 16 objects, there may be five objects, each of three different colors, to be arranged for correct solution by manually tilting the puzzle so that five similarly colored objects are situated in each different passageway with the sixteenth differently colored object situated at the intersection. Each of the passageways may have a slide gate to selectively retain objects in any passageway in order to facilitate solving of the puzzle.

13 Claims, 3 Drawing Figures



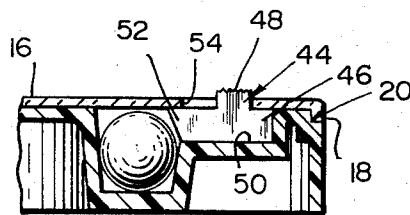
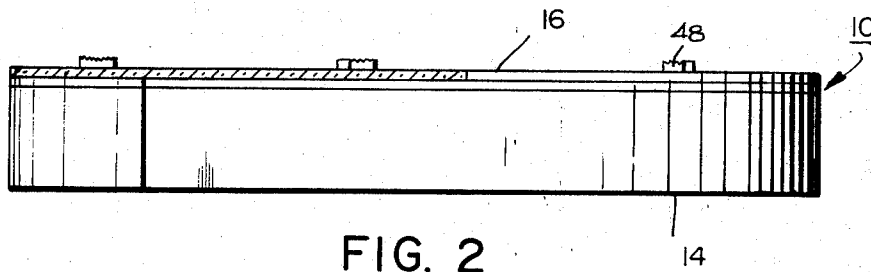
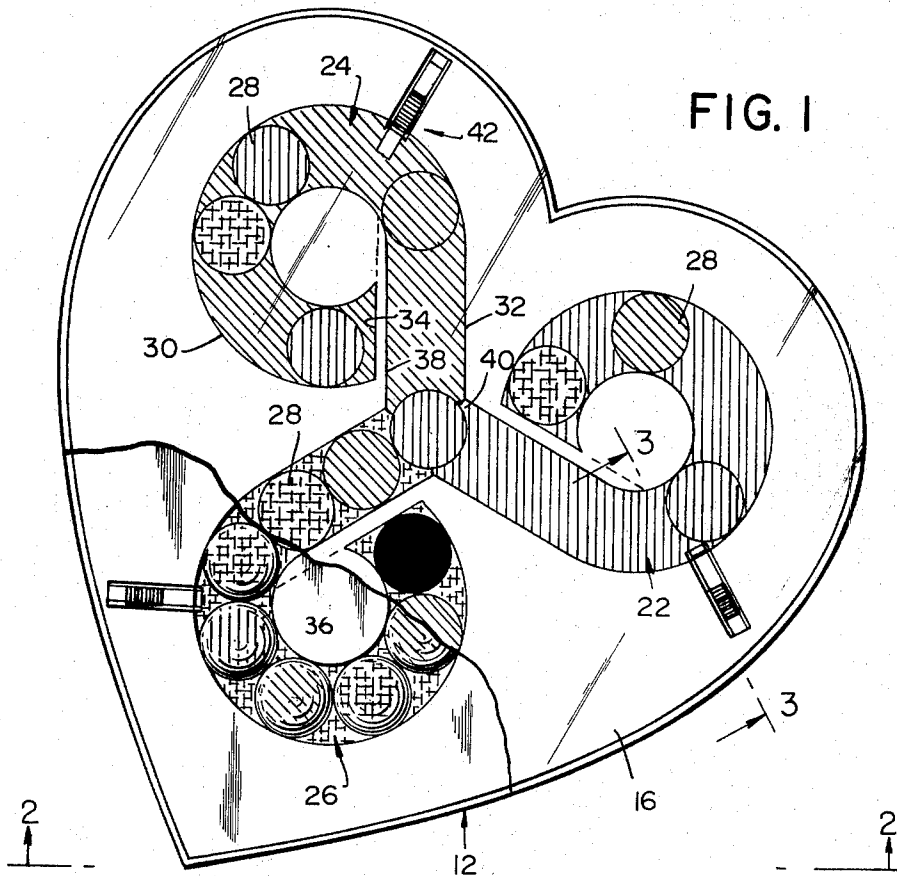


FIG. 3

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PUZZLE WITH MULTIPLE PASSAGEWAYS HAVING A COMMON INTERSECTION AND OBJECTS SHIFTABLE AMONG SAID COMPARTMENTS

BACKGROUND OF THE INVENTION

1. Field of the Invention

A puzzle with plural object-containing passageways meeting at a common intersection.

2. Description of the Prior Art

The closest art of which the inventor is aware is the "Fifteen Puzzle" which constitutes an open-faced shallow square tray containing square tiles, each bearing a different number in the series 1 - 15 inclusive. The sizes of the tiles are such that if there were sixteen they would completely fill the tray when arranged in rows and columns. With fifteen tiles there is one open space the presence of which permits the tiles to be shifted within the tray without lifting them. The object of the game is by proper shifting, in a manner which the solver must determine for himself, the tiles can be arranged so that they run in sequence from one through 15, e.g., starting at the upper left-hand corner and running first across the top row and then across the second row, then across the third row, and then across the fourth row to an empty space at the end of the fourth row. It is difficult to solve this puzzle without lifting the tiles out of the tray which, of course, is not permitted. The difficulty arises from the fact that there is only a single empty space. Hence, it is necessary to shift many tiles just to get one tile in a desired position and the difficulty becomes progressively greater as the tiles start to take on a semblance of order, i.e. one through 15, regardless of their absolute position in the tray. Accordingly, the solving of a "Fifteen Puzzle" requires a logical and reasoned approach to the shifting of the tiles. However, this approach is the only problem that the puzzle presents. It does not present any challenge to the player's manual dexterity and ability to balance objects nor does it present a further order of difficulty by subdividing the space in which the objects that are to be shifted must be moved.

SUMMARY OF THE INVENTION

1. Purposes of the Invention

It is an object of the present invention to provide a puzzle which is somewhat in the order of a "Fifteen Puzzle" but which presents a greater challenge to the solver's powers of reasoning and logic.

It is another object of the invention to provide a puzzle of the character described which, in addition to challenging the solver's reason and logic, presents a challenge to his manual dexterity in the form of delicate manipulation of passageways along which spheres can roll past a multiple intersection.

It is another object of the invention to provide a puzzle of the character described which constitutes relatively few and simple parts, which is inexpensive to manufacture, which is rugged and durable and which, in employing spheres, presents a highly animated demonstration of its manipulation during solving so that it lends itself to a dramatic presentation on television.

Other objects of the invention in part will be obvious and in part will be pointed out hereinafter.

2. Brief Description of the Invention

In accordance with the invention the puzzle is composed of more than two passageways; three passageways present a sufficiently difficult problem and more passageways are provided only if a higher order of challenge is desired to be presented to the solvers. The passageways radiate from a common intersection at their proximal ends and each passageway has its distal end closed. Moreover, the portion of each passageway adjacent the distal end is retroverted so as to minimize the space occupied by the passageways. The three passageways are equiangularly disposed in radial orientation about the intersection. The passageways may be of any length and preferably are long enough to accommodate up to a substantial number of objects, the number in the illustrated example being eight for

each passageway. The objects used in the preferred form of the invention are spheres.

The objects are individually characterized in such a fashion that they can be subdivided into a number of differently characterized groups equal to the number of passageways. For example, for three passageways there may be three different colors of objects. Desirably the number of objects of each color is equal to the total number of objects divided by the total number of passageways, disregarding any proper fractional remainder.

The total number of objects in a puzzle should be such that all the objects can be accommodated in less than all of the passageways. Thus, if each passageway holds up to eight objects and there are three passageways, the total number of objects should not exceed sixteen. Moreover, it is desirable to have as large a number of objects as is possible without exceeding the critical maximum number. Thus, in the example just given there would be sixteen objects, five of each color. The remainder of the objects can be differently identified. Again, in the example just given where there are sixteen objects, there would be five of each of three colors and one of a fourth color.

It is not necessary, but it is desirable, to have all the passageways shaped to accommodate the same number of objects. Moreover, the passageways should have a breadth such that two objects cannot be disposed abreast; hence, it is not possible for any one object to pass another in a passageway.

If, for example, there are four passageways each able to hold eight objects, in a preferred form of the invention there would be a total of twenty-one objects, five each of four colors and a single object of a fifth color. The puzzle with four passageways can be made more difficult to solve by including 24 objects in all, in which event there would be four objects of the fifth color.

To solve the puzzle, the puzzle must be so manipulated as to segregate the objects into differently characterized groups with a differently characterized group in each different passageway, so that with the sixteen objects colored as aforesaid the solution would entail placing all five objects of each color in a different one of the three passageways and having the sixteenth object of the fourth color at the intersection. With the 21 objects the solution would be essentially the same, i.e., five objects of each different color, each such group of five objects being in a different passageway and with the twenty-first object of a fifth color being at the intersection. If, with the same four passageways, 24 objects are used, the solution would be to have five objects of each different color in each different passageway and the remaining four objects of the fifth color grouped around the intersection.

The mentioned identification of the different groups by color is only by way of example. Alternate identifications might be different symbols on the objects; for instance, one group might have a symbol denoting a certain animate object and other groups have symbols denoting different animate objects. Other symbols could be different inanimate objects or different letters of the alphabet or different numbers of a series of numbers or a series of letters. For example, with 16 objects there could be one group of five objects carrying the numeral "1" or the letter "A," the next group of five objects carrying the numeral "2" or the letter "B," etc.; or the first group of objects could bear the numerals "1" thru "5" or the letters "A" thru "E," etc.

Alternate forms of the invention are shown. In general, these are characterized by the planarity of the puzzle, i.e., the location of all passageways in a common plane. However, in one form of the invention different pairs of passageways are in different planes so that the puzzle is, in effect, three dimensional. In most of the forms of the puzzle the objects are spheres. However, in one puzzle the objects are square plaques (flat tiles). In most of the forms of the puzzles the puzzles are fully closed so as to prevent direct manual touching of the objects, thereby discouraging an improper method of solution by picking up the objects and placing them in a desired lo-

cation. However, in one form of the puzzle, the puzzle has the passageways open on one surface so as to deliberately encourage direct manual manipulation.

The puzzle may be simplified by including an object detent or object stop, particularly where the objects are spheres, in each of the passageways in order to isolate the spheres in that passageway at a point between the distal end of the passageway and the stop or detent.

Basically, each passageway is subdivided in function into a compartment for containing the group of objects that properly belong in a passageway upon correct solution of the puzzle and what might be deemed a throat which is a channel connecting the compartment to the intersection. The configuration of the compartment is not critical. For example, it may be a continuation of the throat, that is to say, a continuation having the same cross-section as the cross-section of the throat, or it may be an area of considerably greater cross-section. Whether the form of the invention in any given case has a passageway of uniform cross-section or whether it is subdivided into a throat and a compartment of larger cross-section depends upon the degree of skill which the maker of the puzzle demands of the solver inasmuch as the use of a throat and a larger compartment may make the puzzle easier or more difficult to solve.

The puzzle further may include identification means to indicate to the solver a specific group of objects which are properly to be allocated to a given passageway. Thus, assuming that the objects have three principal groups of different colors and three passageways, each of the passageways may be colored to correspond to a color of a different one of the groups indicating that objects of that color are to be segregated from the remaining objects and accumulated in that particular passageway.

The invention consists in the features of construction, combinations of elements, and arrangements of parts which will be exemplified in the puzzle hereinafter described and of which the scope of application will be indicated in the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawings in which are shown various possible embodiments of the invention:

FIG. 1 is a top plan view of a puzzle embodying a preferred form of the present invention, a portion of the transparent cover of the puzzle being broken away;

FIG. 2 is an elevational view of the puzzle, the same being taken substantially in the direction indicated by the arrows on the line 2—2 of FIG. 1; and

FIG. 3 is a fragmentary sectional view taken substantially along the line 3—3 of FIG. 1.

PREFERRED EMBODIMENT OF THE INVENTION

Referring now in detail to the drawings, the reference numeral 10 denotes a puzzle which presently constitutes the preferred form of the invention. The puzzle includes a housing 12 constituting a base 14 and a cover 16. The materials of which the housing is made are not critical. Preferably, the base is made of an opaque material and the cover must be made of a pellucid material, preferably transparent. The presently most economical material for the base and cover is plastic since it may easily be molded into the required intricate shapes. Desirably, these parts are made by injection molding from a thermoplastic synthetic resin such, for instance, as cellulose acetate, cellulose acetate butyrate, high density polyethylene, or a styrene-butadiene copolymer, e.g., 90% styrene and 10% butadiene to provide a high impact resistance.

The housing is shown in the shape of a heart. However, this is purely exemplificative and any other shape can be employed, e.g., circular, oval, rectangular, square, stellate, or arms radiating from a common center.

The cover and base are of the same plan configuration and are peripherally secured to one another in any conventional manner, e.g., by heat and pressure welding, solvent welding or an adhesive. Optionally, the joint between the base and cover may, as shown in FIG. 3, be made more secure by providing the perimeter of the base with a marginal seat 18 and the perimeter of the cover with a dependent marginal flange 20 which is received in the seat and secured thereto in any one of the manners aforementioned.

The housing has imparted to it by the molding operation a configuration such that there are provided three open-top passageways (channels) 22, 24, 26 in the upper surface of the base in which there are contained spheres 28, i.e., balls, e.g., marbles, all of the same major diameter. The passageways are of a width such as to nicely accommodate the spheres therein widthwise; that is to say, the major diameters of the spheres are just a little smaller than the widths of the passageways so that the spheres can roll easily therein but so that it is not possible for one sphere to pass another within a passageway, that is to say, two or more spheres cannot roll abreast in a passageway. Each passageway includes a retroverted hook 30 and a throat 32 which jointly make up the passageway. The throat is straight. The retroverted hook extends over an arc of substantially 270° so that the closed end, i.e., distal end 34, of each passageway comes close to but does not communicate with the throat. The retroverted hook thereby defines a central plateau 36 of generally circular configuration, being truly circular except for the portion of the plateau which runs into a partition 38 that defines the closed end 34. The three throats 32 for the purpose of symmetry of appearance are equiangularly spaced from one another, the center-to-center spacing therefore being 120°. The throats meet at an intersection 40 having the same width as the passageways so that spheres can roll from one passageway to another through the intersection.

The number of spheres present is such that all the spheres can be accommodated in two of the passageways with the third passageway and the intersection being left clear of spheres. In the puzzle 10 there are sixteen spheres and each passageway has a length such that it will accommodate eight spheres in contacting relationship with one end sphere at a distal end 34 of the passageway and the other end sphere at the portion of the throat adjacent the intersection, this sphere, however, being clear of the intersection so as not to block the same. The retroverted hook is sometimes hereinafter referred to as a "compartment." The compartment must be large enough to accommodate at least five spheres, (actually six), the at least five because, as has been mentioned previously, when the puzzle is solved there must be disposed in each passageway (or more limitatively in each compartment) a group of commonly characterized spheres equal to the total number of spheres divided by the number of passageways, disregarding any proper fractional remainder.

It should be mentioned that although the entire passageway is shown in FIGS. 1 - 3 as being of uniform width, i.e., the retroverted hook and the throat are of the same width, the invention also may be practiced with a compartment having greater width than the associated throat. Thus, the major portion of one or more plateaus 36 projecting beyond the dotted line shown in FIG. 1, and that constitutes an extension of the partition 38, may be eliminated to provide a rather large compartment. However, the portions of the passageways, to wit, the throats 32, which lead from the intersection to the compartments must have the width previously noted, to wit, enough to permit only one sphere at a time to roll through any transverse sections thereof.

In the preferred form of the invention shown there is, as already has been observed, a compartment 30 large enough to hold six spheres and a throat 32 long enough to hold two spheres, thus totaling eight spheres for each passageway.

The spheres are individually characterized in such a fashion that they can be subdivided into a number of groups equal to the number of passageways, plus one further differential characterization of the remaining spheres of the proper frac-

tional remainder, if any. For example, there are in the puzzle shown in FIGS. 1 — 3 five green spheres, five yellow spheres, five red spheres and one black sphere for three passageways each "eight spheres" long.

For a reason which will later be apparent the solving of the puzzle may be made easier by providing one or more passageways, preferably in the zone between the throat and the compartment, with a sphere detent 42, the same constituting a means which tends to at least check and optionally positively block movement of a sphere past the same. Thus, the sphere detent may simply constitute a shallow spherical seat in one or more passageways at the indicated location or, as illustrated, it may constitute a slide gate 44. Said slide gate is in the form of a plate having a shank 46 with an upstanding manually manipulatable tab 48 whose upper edge is knurled to facilitate manual movement of the slide gate. The slide gate is longitudinally reciprocable in a channel 50 in the upper surface of the base extending perpendicularly away from its associated passageway at the zone between the compartment and the throat. The channel is sufficiently long to substantially fully accommodate the slide gate so that in the position shown in FIG. 3 wherein the slide gate is fully retracted the tip 52 thereof leaves the associated passageway clear for rolling of a sphere past the gate. However, when the gate is reciprocated in a direction toward the associated passageway its tip will extend into the passageway to block movement of spheres past the same. The direction of movement of the slide gates (one for each passageway) is indicated by the double-headed arrow A.

Each tab 48 extends through an affiliated slot 54 in the cover 16. The blocking position of the slide gate is indicated by the dashed lines in FIG. 3. The slot limits inward movement of the tab to its blocking position.

At the start of the solving of the puzzle the spheres are indiscriminately located in different passageways and are randomly mixed as to color (characteristics). The solution of the puzzle is to accumulate all spheres of one color in one passageway, all spheres of the second color in a second passageway and all spheres of the third color in the third passageway. Optionally, each of the passageways may be colored to indicate the color of the spheres required to be accumulated in that passageway. The solver of the puzzle accomplishes the solution by tilting the puzzle manually so as to roll the spheres back and forth among the passageways through the intersection. The solving of the puzzle is made difficult by the fact that there are so many spheres present. The more spheres present for a given length of passageway, the more difficult the solution, the most difficult being where, as previously mentioned, the number of spheres equals a number sufficient to fill up two passageways completely leaving the third passageway and the intersection clear. Moreover, the proper solution with the sixteen sphere three passageway puzzle includes locating the sphere of the fourth color at the intersection.

It will be observed that, as shown in FIG. 3, the cover is sufficiently far above the bases of the passageways to permit the spheres to roll freely through the passageways but is not so high as to permit one sphere to pass over another. In the preferred form of the invention, the passageways are approximately equal in depth to the major diameter of the spheres and the open tops of the passageways are simply closed by the cover.

In solving the puzzle it is necessary to manipulate the spheres in a fashion such that spheres of the same color are gradually fed into one passageway. This requires considerable dexterity in the tilting of the puzzle because the spheres will tend to roll past the intersection uncontrollably and to enter into the wrong passageway and it is necessary to practically empty any given passageway of all but one sphere before a second sphere of the same color can be rolled into it. Indeed, it is necessary to completely empty a passageway if the black sphere is at the closed end of that passageway. When the maximum number of spheres is present, the spheres tend to collide with one another at the intersection, thus making guidance of

the spheres into the proper passageway require even more dexterity on the part of the solver. If a greater number of spheres than that mentioned were used, it would not be possible to completely empty one passageway so that it would not be possible to correctly solve the puzzle under all starting conditions.

The slide gates are handy in solving the puzzle, making the same simpler to achieve, because, after one or more spheres of a desired color are rolled into a compartment, the compartment can be closed off while the solver's attention is directed to getting other spheres of different colors into the other passageways. Then the slide gates for one or more of the other passageways can be closed while manipulating the puzzle to guide spheres of the proper color into the first passageway, the slide gate of which will then be opened.

It will be apparent that the passageways can be longer or shorter, as desired, providing the above described criteria are observed, to wit, that there are at least three passageways and that the number of spheres is such that they all can be contained in all but one of the passageways, i.e., in the total number of passageways minus one. Although it has been indicated that all passageways are of the same length, this is not essential although it is preferred. The passageways may be of different lengths providing, of course, that the aforementioned criteria are met, or some may be of the same length and one or more of different lengths.

It will be understood that the number of spheres mentioned is exemplificative, being based upon three passageways, each long enough to accommodate eight spheres, there being 16 spheres in all, five each of three colors and a sixteenth sphere of a fourth color.

It is pertinent at this point to observe that the spheres bear individual characteristics, of which different colors are an example, enabling them to be classified into the number of groups equal to the number of passageways plus a remainder group, if any. The instant invention is not restricted to a color method of characterization coding. Other modes of characterization are suitable; for instance, all the spheres of one group may bear symbols indicating one of different animate objects (different animals) or inanimate objects, e.g., different implements, or numbers or letters. For example, one group of spheres can have the numbers "1," another group the numbers "2" and a third group the numbers "3," or one group the numbers "1" — "5," a second group the numbers "6" — "10" and a third group the numbers "11" — "15," with the remainder bearing different numbers.

In the puzzle thus far described not only are the passageways coplanar but they are closed except at the proximal ends located at the intersections whereby to prevent a solver of the puzzle from physically manipulating the spheres. The puzzle solver must rely solely upon his manual dexterity in juggling the puzzle by tilting movements to cause desired rolling of the spheres among the passageways through the common intersection. This arrangement has the advantage of providing an element of training for a child in dexterity of manual manipulation. Furthermore, it will, if solved by thought and rationalization and logic rather than by pure chance, provide a form of mental training and discipline. The puzzle can also be modified in its physical form so as to retain solely the mental training and discipline aspect and eliminate the heightening of a child's manual dexterity.

The solution of the puzzle is the same as those previously described, to wit, to accumulate all the tiles of one color in one passageway, all the tiles of another color in a second passageway and all the tiles of the third color in the third passageway with the black tile situated at the intersection. A person solving the puzzle must, unless he moves the tiles haphazardly, deduce a proper sequence of moves to solve the puzzle.

In FIG. 8 there is shown a puzzle 106 embodying a still more sophisticated form of the invention in which all the passageways are not coplanar. In this puzzle each passageway is provided by a different tube 108, 110, 112, 114. The tubes

meet at a common intersection 116. All of the tubes are of the same length and their distal ends are closed, the proximal ends being located adjacent a common intersection 116. The tubes are of circular cross-section and there are located within the puzzle 21 spheres 118, five of one color, five of a second color, five of a third color, five of a fourth color and one of a fifth color. The length of each tube is sufficient to accommodate seven spheres so that the 21 spheres can be accommodated in three passageways, not including the intersection, which is one less than the total number of four passageways. No three tubes lie in the same plane. In the example illustrated the center lines of the tubes lie on the surface of a circular cone with the center of the intersection of the center lines at the apex of the cone and the angular spacing between the tubes such that they form equal angles at the apex of the cone.

The puzzle 106 is solved in the same fashion as the previous puzzles with the added difficulty, however, that instead of a simple slight tilting movement off horizontal, as is required to move the spheres in the puzzles of FIGS. 1 - 3, 4, 5 a and 6, greater angular tiltings are required with the puzzle 106, thus presenting a greater challenge to the solver.

It thus will be seen that there is provided a puzzle which achieves the various objects of the invention and which is well adapted to meet the conditions of practical use.

As various possible embodiments might be made of the above invention, and as various changes might be made in the embodiment set forth above, it is to be understood that all matter herein described or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

Having thus described the invention there is claimed as new and desired to be secured by Letters Patent:

1. A puzzle which comprises:

- a. a base having at least three open-top channels of equal lengths in its surface, said channels radiating from and communicating with one another at a common intersection at their proximal ends, and extending from the common intersection as a straight portion and terminating in a retroverted hook configured portion whereby the retroverted hook portion extends over an arc of substantially 270° so that the closed distal end of each channel is spacially proximate the straight portion;
- b. several spheres, each having a diameter slightly smaller than the widths of the channels whereby the spheres can roll easily therein, the total number of spheres being such that all of the spheres can be accommodated in all but one channel;

c. means individually characterizing the spheres and differentiating them at least into a number of groups equal to the number of channels, each group of spheres limited in number to that which can be accommodated in one channel; and

d. a transparent cover secured to the top surface of the base and sufficiently above the bases of the channels to permit the spheres to roll freely therein, whereby said cover prevents direct manual touching of the spheres and the solution of the puzzle is accomplished by tilting the puzzle manually so as to roll the spheres back and forth among the channels through the common intersection.

2. A puzzle as set forth in claim 1 wherein all of the channels are in a common plane.

3. A puzzle as set forth in claim 1 wherein each channel has a uniform width throughout its length.

4. A puzzle as set forth in claim 1 wherein the channels are equiangularly oriented around the common intersection.

5. A puzzle as set forth in claim 1 wherein the number of spheres in each group is the same.

6. A puzzle as set forth in claim 1 wherein there are three channels and a total number of spheres is enough to fill two of the channels, the number of spheres in each group being equal to the total number of spheres divided by three disregarding any proper fractional remainder.

7. A puzzle as set forth in claim 1 wherein the means individually characterizing the spheres and differentiating them into groups are different colors.

8. A puzzle as set forth in claim 1 wherein the means individually characterizing the spheres and differentiating them into groups are different symbols.

9. A puzzle as set forth in claim 1 wherein the means individually characterizing the spheres and differentiating them into groups are symbols of different inanimate objects.

10. A puzzle as set forth in claim 1 wherein the means individually characterizing the spheres and differentiating them into groups are symbols of different animate objects.

11. A puzzle as set forth in claim 1 wherein the means individually characterizing the spheres and differentiating them into groups are different numbers.

12. A puzzle as set forth in claim 1 wherein the means individually characterizing the spheres and differentiating them into groups are different letters.

13. The puzzle of claim 1 wherein at least one of the channels is provided with a slide gate longitudinally reciprocatable therein to selectively retain spheres whereby solving of the puzzle is facilitated.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,677,547

Dated July 18, 1972

Inventor(s) Alan A. Hicks

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

In column 2, line 68, change "passage-ways" to
-- passageways --.

In column 2, line 72, change "tile s" to -- tiles --.

Signed and sealed this 26th day of February 1974.

(SEAL)

Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents