

(12) UK Patent Application (19) GB (11) 2 076 663 A

- (21) Application No 8116235
- (22) Date of filing 28 May 1981
- (30) Priority data
- (31) 1347
- (32) 29 May 1980
- 26 Aug 1980
- (33) Hungary (HU)
- (43) Application published
- 9 Dec 1981
- (51) INT CL<sup>3</sup>
- A63F 9/08
- (52) Domestic classification
- A6H 12G
- (56) Documents cited
- GB 546015
- US 4214390A
- US 4040193A
- US 3727916A
- US 3036300A
- US 2967714A
- US 2444810A
- US 2134461A
- (58) Field of search
- A6H
- G5C
- (71) Applicants
- Politechnika Ipari
- Szövetkezet,
- H—1124 Budapest,
- Kosztá József utca 21/b,
- Hungary
- (72) Inventor
- József Bognár
- (74) Agents
- T. Z. Gold & Company,
- 9 Staple Inn, London
- WC1V 7QH

(54) Spatial logical puzzle

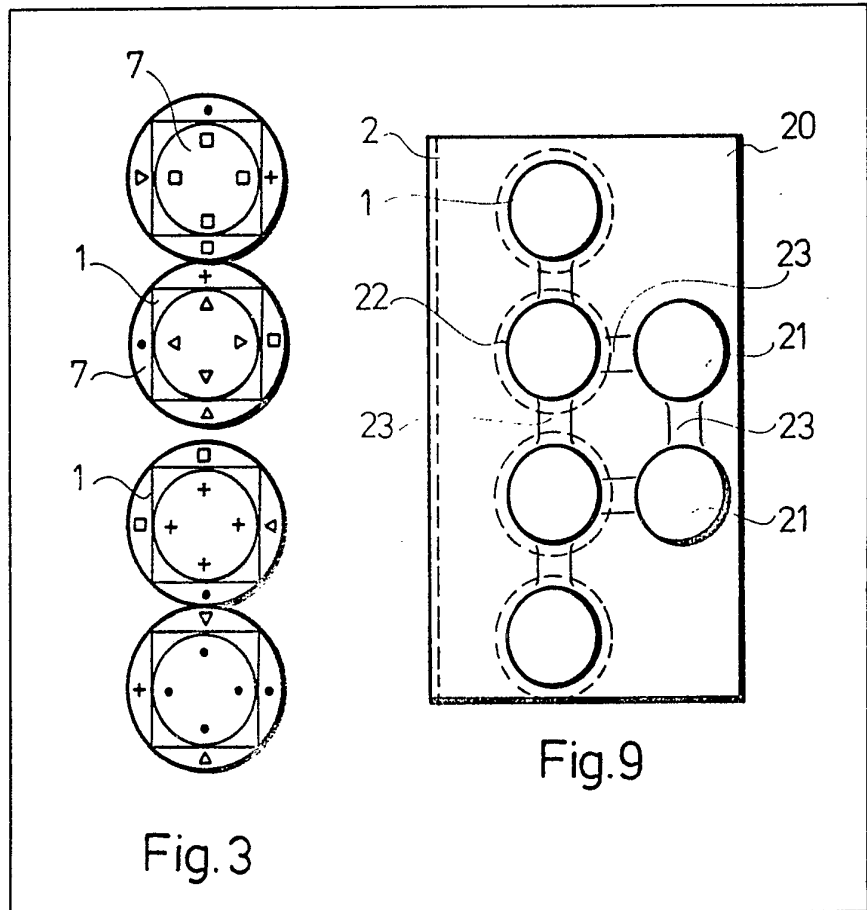
(57) A spatial logical puzzle has a windowed unit 20 holding at least two spherical elements 21, provided with symbols 7 which can be matched to a predetermined code system by relatively rotating the elements.

The unit 20 may be part of a pencil or be a piece of wire or a casing with

by-pass channels 23 for altering the order of the elements or a cube with the elements at the corners. The elements may be geared together or be marked to form a calendar.

Electrical or touch symbols may be provided.

The elements may be rotated by fluid-pressure and position magnetically.



GB 2 076 663 A

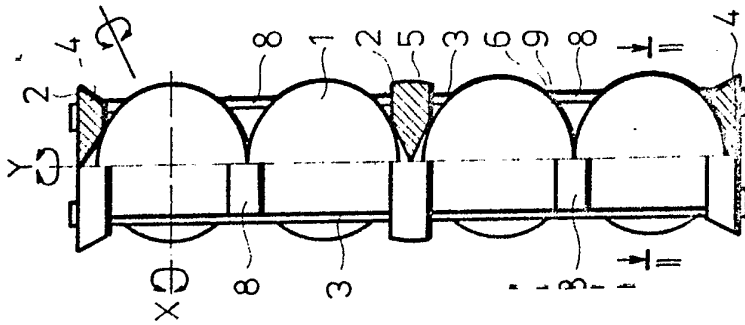


Fig. 1

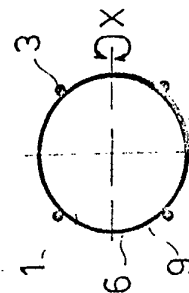


Fig. 2

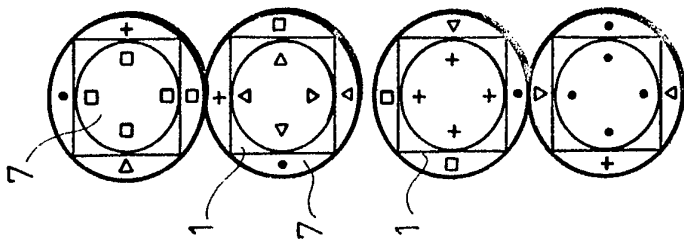


Fig. 3

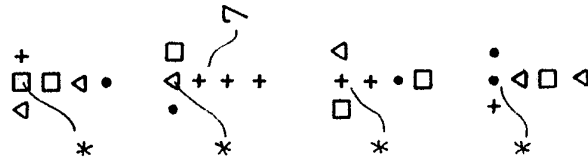


Fig. 10

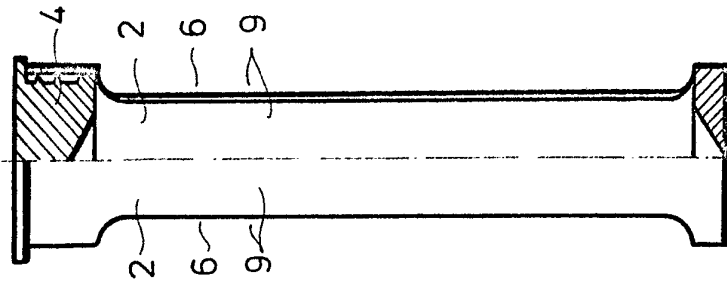


Fig. 6

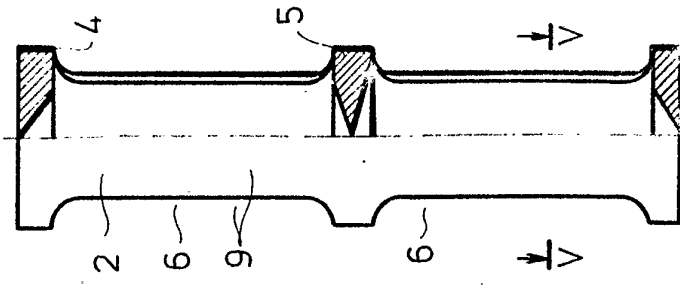


Fig. 4

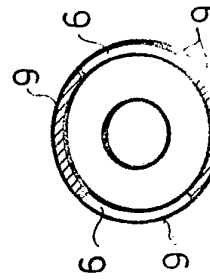


Fig. 5



Fig. 11

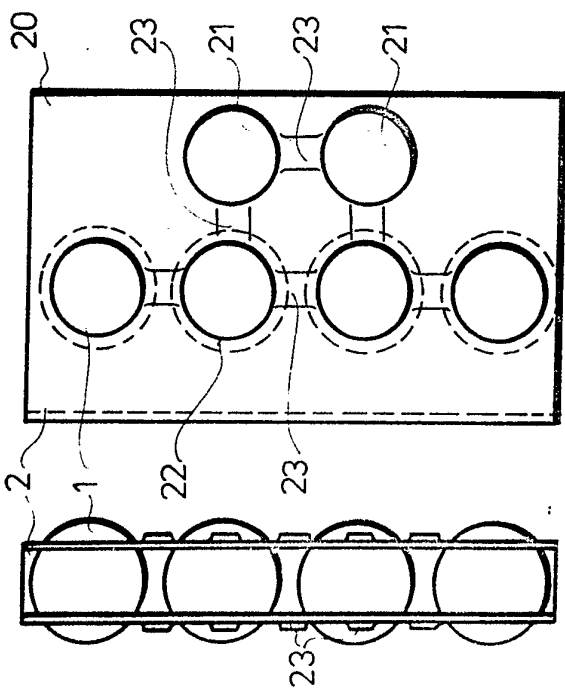


Fig. 7

Fig. 9

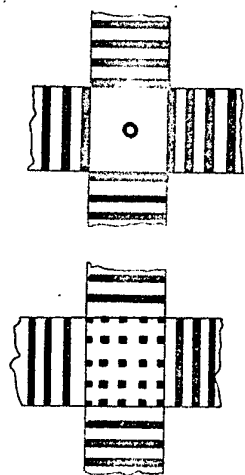


Fig. 14

Fig. 16

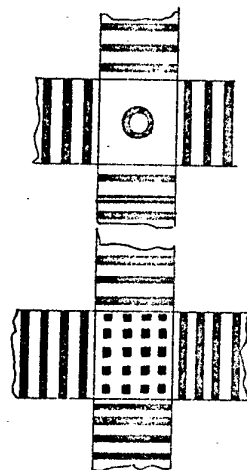


Fig. 15

Fig. 17

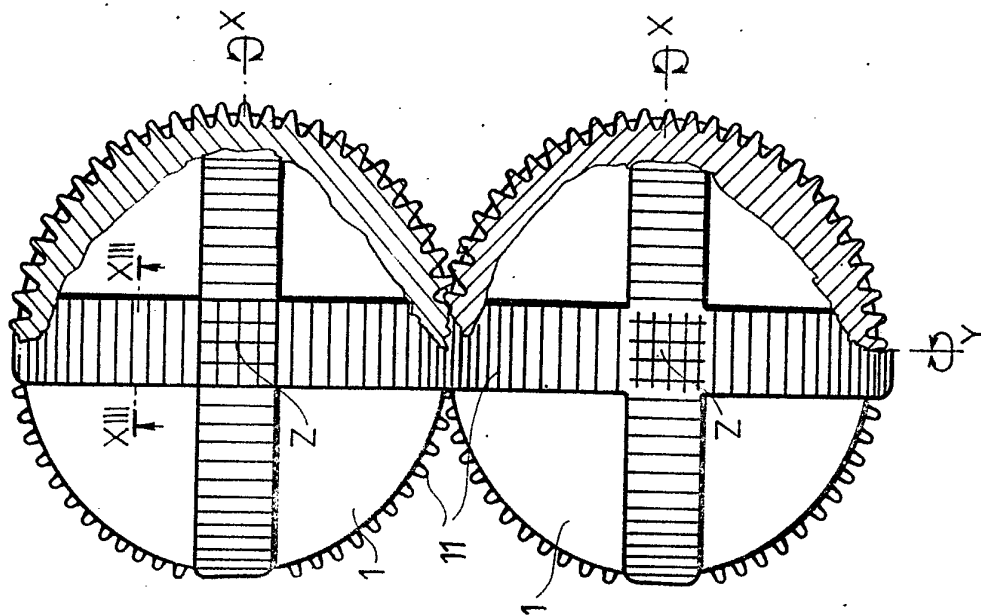


Fig. 12

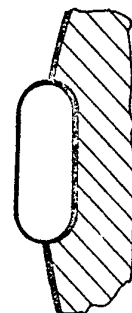


Fig. 13

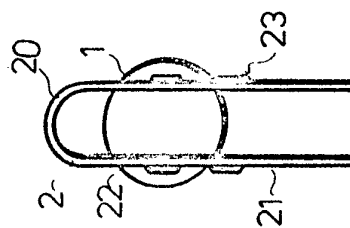


Fig. 8

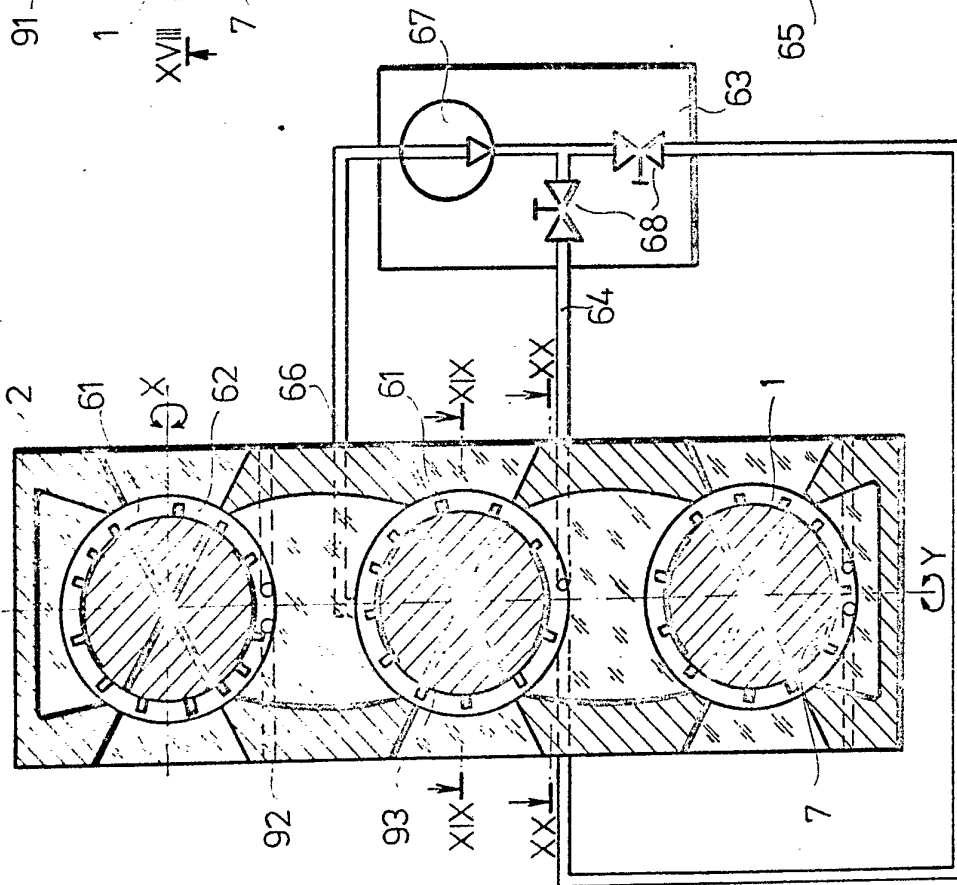


Fig.18

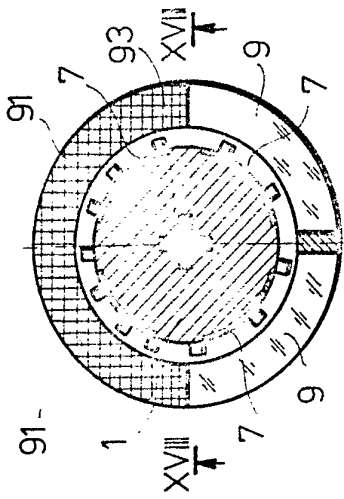


Fig.19

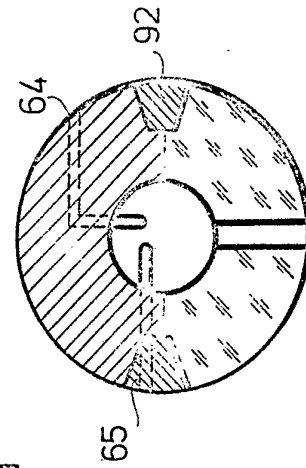


Fig.20

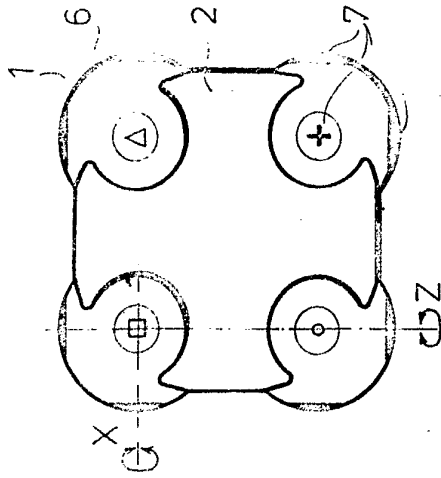


Fig.21

## SPECIFICATION

## Spatial logical toy

The invention relates to a spatial logical toy providing numerous possibilities or permutations of logical play while having a relatively small dimension.

The aim of logical toys or puzzles is to develop the combinative ability of the human mind as well as to improve logical thinking. In recent times, numerous logical toys based on the mosaic or jigsaw principle have become known. In general, with logical toys based on the mosaic or jigsaw principle, the individual elements of the toy or puzzle are provided with differing symbols which must be arranged or assembled into a predetermined system or pattern.

Also generally known are logical toys made up of individual cube elements which can be assembled into larger solid bodies wherein each face of the cube element bears a fragment of a picture or some other coded symbol. After assembling the cube elements into a correct sequence or order the faces of the solid body will bear a full picture or some correct logical sequence, e.g. a numerical series or a word made up of a series of letters, or a sentence.

Logical toys or puzzles are also known wherein there are coplanar interconnected discs which can be rotated about their own axes. The surface of these discs is divided into circular segments or sectors provided with different colours. The aim of the game is for the contiguous surfaces of neighbouring discs to be of the same colour and form a geometrical shape.

Another known and commercially successful spatial logical toy consists in a closed cube as regards its external shape or possibly a closed spherical body made up of individual elements, usually cube elements. In one preferred embodiment of a spatial logical toy of this type, the solid cube is made up of 27 smaller cube elements each face of which is made up of 9 elements, the cube elements being so arranged on a supporting core or frame that each of the 9 cube elements forming a given face of the cube may be rotated together and displaced from their initial position. The cube elements form a permanent or non-detachable unit with the frame or core.

In this known construction, the surfaces of the basic cube elements are provided with symbols or colours or planar diagrams or possibly plastic shapes or numbers which are all different from each other or which can be brought into identity. The essence of these known logical games or toys is that, in contrast with known logical toys they are formed as separate units internally held together with the frame or carrier so that the individual elements cannot become detached or lost.

Although the above-described spatial logical toys eliminate the discrete nature and the consequential loss of the individual toy elements, they have the drawback that, due to the complicated internal structure and the

requirement of accurate machining of the basic elements, they can be produced only in a relatively large size. In practice this means that there is a limit to the reduction of the size of the logical toy by the manipulatability, machinability and by size of the frame or carrier elements holding together the whole system in a unit. Such spatial logical toys are not small enough to be conveniently or comfortably carried in a pocket, such as for instance a trouser or waistcoat pocket, thus reducing the possibility of playing in a variety of situations.

This invention aims at producing a spatial logical toy or puzzle made up of simple elements that are easily manufactured with simple tools at a low cost; the dimensions of its basic elements being greatly reducible yet which, in spite of its small size, assures a great number of play variations or possibilities for the user.

The invention consists in a spatial logical toy having at least two elements which are provided with symbols, which are settable into a predetermined code system and which are angularly displaceable relative to each other, and a supporting unit holding the elements together; the essence of the invention is that the elements are formed as spherical bodies surrounded by, as well as journalled in, a supporting unit which is provided with a display window disposed in front of some of the surfaces of said elements, the said surfaces being provided with symbols, the said elements being angularly displaceable about at least two axes of rotation passing through the centres of the elements the said centres being fixed in space, all the points of the supporting unit that are in contact with the said elements being at a constant distance from the said fixed centres irrespective of the angular positions of the toy elements.

The number of play variations is increased according to preferred embodiments of the invention where the centres of said elements are displaceable or where the elements are exchangeably mounted and journalled in the supporting unit.

According to a further preferred feature of the invention, a by-pass space in the form of trough-shaped channels may be connected to the journal section of the said supporting unit.

Advantageously, the supporting unit according to the invention may be provided with means for turning or angularly displacing said elements.

The ability to reason logically may be developed further by providing at least a portion of the said elements and/or the supporting unit with mechanical positive coupling elements. In this case, it may be advantageous to provide on the surfaces of the positive coupling elements that positively couple, at least in part, the said at least two elements surface portions which are axially symmetrical in relation to at least two mutually intersecting axes of symmetry.

According to a further preferred embodiment of the invention the supporting unit is provided with symbols in the vicinity of the said window and/or

said window may be provided with symbols.

The versatility of the logical spatial toy or puzzle according to the invention is further enhanced according to a preferred embodiment wherein the

5 said symbols are information symbols.

According to yet another preferred embodiment of the invention, wherein the symbols are information symbols, the said window is formed as a sensing means for sensing the information

10 symbols.

The play variations may also be increased by arranging the centres of the said elements in the supporting unit according to a two or three dimensional regular or irregular configuration.

15 Finally, the supporting unit embodied in the invention may also be formed as part of some other article or artifact in use to offer further extensive possibilities of use thereby.

The spatial logical toy according to the invention may be contrasted with all known logical toys in that it consists in its preferred form of spherical toy elements angularly displaceable about several spatial axes held together in one unit by a supporting structure. Again in contrast

20 with known constructions, the supporting structure holds the elements together not necessarily internally but expediently externally so that the size of the toy will depend exclusively on the number and size of the elements employed and thus may be realised in shapes and forms of highly compact configuration.

In practice, the said elements are formed as spherical elements, e.g. balls whereby the dimension may be minimised and may therefore

35 be readily incorporated or integrated into a pencil or other writing instrument as a toy or puzzle.

The decrease in the dimensions of the basic elements is facilitated by the fact that they may be moved or displaced manually i.e. with the use of fingers. By displacing the centre of the spherical elements, or exchanging them for other elements, additional and unusual combinations and variations may be achieved. In order to displace the centre of the spherical bodies it is not

45 necessary completely to dismantle the toy according to the invention because this can be achieved by making use of the bypass spaces incorporated in the toy, to receive the toy elements during the exchange operation.

The logical toy according to the invention may also be used with advantage for code designation thus for instance as a calendar or other means for reminding.

The great advantage of the invention resides in its simplicity, small dimensions and extensive variation possibilities.

Preferred embodiments of the invention will now be described merely by way of example, with reference to the accompanying drawings, wherein:

60 Figure 1 is a part elevation, part vertical section of a first embodiment of a spatial logical toy according to the invention,

Figure 2 is a cross-section taken along the plane indicated by the line II—II shown in

65 Figure 1,

Figure 3 illustrates the spherical toy elements of the logical toy shown in Figure 1 but removed from their supporting unit for clarity,

Figure 4 is a part elevation, part section of a further preferred embodiment of the supporting unit forming part of the logical toy according to the invention, being made in this embodiment of a transparent material,

70 Figure 5 is a cross-section of a supporting unit shown in Figure 4, taken along the plane indicated by the line V—V shown in Figure 4,

Figure 6 is a part elevation, part vertical section of another embodiment of a supporting unit for a spatial logical toy according to the invention, made from a transparent material,

80 Figure 7 is an elevational view of yet another embodiment of a logical toy according to the invention,

85 Figure 8 is a plan view of the toy shown in Figure 7,

Figure 9 is a side elevation of the toy shown in Figure 7,

Figure 10 is a diagrammatic illustration of the code symbols provided on the toy elements shown in Figure 3, in a developed view for each toy element,

90 Figure 11 is an elevational view of a further preferred embodiment of a spatial logical toy according to the invention,

95 Figure 12 is a partially broken-away elevation of two spherical toy elements forming part of a further embodiment of a spatial logical toy according to the invention,

100 Figure 13 is a fragmentary view taken along the plane indicated by the lines 13—13 of Figure 12,

Figure 14 is a fragmentary view of the intersection of the positive coupling paths of the upper play element of the spatial logical toy illustrated in Figure 12,

105 Figure 15 is a view similar to Figure 4 but illustrating the intersection for the lower play element,

110 Figure 16 is a view similar to Figure 14 but showing a further embodiment for the upper play element,

Figure 17 is a view corresponding to Figure 15 but showing a further embodiment of the lower play element,

115 Figure 18 is a vertical section through yet another preferred embodiment of a spatial logical toy according to the invention, taken along the plane indicated by the lines 18—18 in Figure 19,

Figure 19 is a cross-section taken along the plane indicated by the lines 19—19 in Figure 18,

120 Figure 20 is a cross-section taken along the plane indicated by the lines 20—20 in Figure 18, and

Figure 21 is a diagrammatic view of yet another embodiment of the toy according to the invention, taken in plan, this plan view being identical with the front and side views of the toy due to its symmetrical form.

130 The spatial logical toy illustrated in Figures 1 to 3 and 10 essentially comprises play elements in the form of spherical bodies which are journalled

in a supporting unit 2 so that their centre-point cannot change but which are angularly displaceable about a plurality of (theoretical) axes of rotation passing through their centre-points. In this preferred embodiment, the journalling of the play elements 1 in the supporting units 2 is assured by lateral limiting elements 3, end limiting elements 4 and an intermediate securing element 5. The play elements 1 can be turned in the desired angular direction about the theoretical axis of rotation via openings 6 (constituting the angular displacement means) whereby the play elements 1 can be rotated within the journal space defined by the lateral limiting elements 3, the fixing element 5 and the end limiting elements 4. The fixing element 5 arranged between the neighbouring or adjacent play elements 1 and end limiting element 4 are so formed that they not only journal the play elements 1 but frictionally impede undesired angular displacements of the play elements 1 which are in contact with them.

To assure the presence of the necessary frictional force to fix the spatial position of the play elements 1 advantageously one or all the components of the toy is or are made from a resilient material e.g. a plastics material.

Advantageously, symbols 7 are associated with the surfaces of the spherical play elements 1; for the sake of greater clarity, the symbols 7 have not been shown in Figures 1 and 2 but they are shown in Figure 3. The symbols may be painted or stuck on the surfaces of they may be tactile or tangible plastic symbols or other symbols that can be sensed. The symbols 7 may be produced on a plurality of portions or parts of a given play element 1 and may be mutually distinguishable and/or made from different materials. Any known distinguishing symbol capable of being sensed may be used for the symbols 7.

In the example of Figure 3, each of the four spherically formed play elements 1 is provided with 6 symbols 7 in a symmetrical array. In this example, four different types of symbol 7 occur, for the sake of easier comprehension, the individual symbols 7 are shown in the Figure as a square, a triangle, a dot and a cross. The developed view in Figure 10 illustrates the distribution of the symbols 7 on the four play elements 1 shown in Figure 3. In the embodiment shown in Figure 1, an annular covering element 8 covers the symbols 7 which, if they were visible, would disturb or interfere with the solution of a given logical task or problem. The symbols 7 may be read by looking through a window 9 coinciding in this example with the opening 6 for displacing the elements in the portions of the elements which have not been covered up by the covering elements 8 in the supporting unit 2. In this embodiment, the end limiting elements 4 and the fixing elements 5 themselves are such as to cover over the symbols 7 adjacent to them.

Consequently, in the toy elements 1 in this example, those symbols 7 which lie along the theoretical axis of rotation Y may never be seen.

In Figure 10, a star or asterisk marks those

symbols 7 which in the position of the play elements 1 illustrated in Figure 3 are on the side facing the viewer. In the example shown in Figure 3, the play elements 1 are in the exact position wherein on all four sides a square, a triangle, a dot and a cross symbol 7 may be seen in some arbitrary sequence; thus in this example, each of the symbols 7 employed on the four sides only occurs once. The symbols 7 shown in the developed view of Figure 10 are in a position where the characteristics of the code system corresponds to the principle of "there is one symbol of every kind on each side".

The spatial logical toy shown in Figures 1 to 3 and 10 according to the invention is to be used according to the description given below starting from its original, assembled, "as sold", condition or state. In this state, the symbol 7 on the play elements 1 are arranged according to the configuration shown in Figures 3 and 10. In this case, a code system is achieved wherein on every side there is one of each type of symbols 7.

At the commencement of play, the original or above-described position is disturbed by angularly displacing an arbitrary number of play elements, e.g. by rotating them about the theoretical spatial axes, X, Y, Z by an integral number of rotations of + or  $-90^\circ$ . The play elements 1 are advantageously angularly displaced with the aid of a thumb and index finger via the openings 6. As a consequence of the angular displacement of the play elements, naturally the system of "on every side there is one symbol of each type" is destroyed. The task or game is now to restore or re-establish the original state of the predetermined code system by rotating the toy elements 1 as desired, i.e. to restore the condition or principle of "on each visible side there is just one of each type of symbol 7".

Although this task seems extraordinarily easy, in reality it can only be solved by applying logic because the number of the possible positions is extraordinarily large compared with the number of the play elements 1. Thus, for instance, in the case of applying six symbols 7 in a symmetrical array on a given play element 1, that play element 1 may take up 24 different positions within the support unit 2. On examining the positional possibilities of permutations of the four play elements 1 combined, the total number of variations are of the order of magnitude of 100,000. At the same time, the set aim or task is very tempting for the player because at the beginning of the play the solution of partial tasks is relatively easily achievable.

Naturally, several code problems may be set in the course of the game by providing predetermined code systems. In Figures 4 and 5 a further embodiment of a spatial logical toy according to the invention is illustrated wherein, for the sake of greater clarity, the play elements 1 and the covering elements 8 are not shown because they are similar to the play elements 1 and covering elements 8 according to Figures 1, 2 and 3.

In this example the supporting unit 2 is made wholly of transparent material or at least those portions of it are transparent where the symbols 7 of the play elements 1 are to be seen. Thus the reading window 9 of the transparent supporting unit 2 is basically a transparent surface to assure the observability of the symbols 7. This constructional solution very advantageously simplifies manufacture.

In a further preferred embodiment of the invention, shown in Figure 6, the spatial logical toy has an end limiting element 4 at one end of the supporting unit 2 which is in the form of a stopper, whereby to close the supporting unit 2. In this example, the supporting unit 2 is essentially a transparent tube slit from two sides where after removal of the end limiting element 4 in the form of the stopper, play elements 1 may be introduced in any desired sequence.

Should it be necessary or desirable the covering elements 8 and the fixing element 5 may also be placed in the supporting unit 1 from above after removal of the stopper like end limiting element 4. By changing over the individual play elements 1 or in other words by placing them in a predetermined sequence as desired, the player is afforded the possibility of modifying their sequence and increasing the play variations.

The invention may also be embodied in a form wherein in the course of play and between two successive rotations of the play elements, the centre points of the spherical play elements themselves may be displaceable. In this case, which may be seen in Figures 7 to 9, the supporting unit 2 is so formed that in addition to the journal space for the play elements 1, there are bypass spaces 21 capable of accommodating the play elements. By guiding one or other of the play elements 1 into the bypass spaces 21, their sequence can be altered without dismantling the whole toy. The advantage of this preferred embodiment is the prevention of the risk or possibility of losing any of the play elements 1. In this embodiment, the supporting unit 2 is formed expediently from a single piece of bent resilient and transparent material or sheet 20 wherein the journal space is formed by journal nests of seats 22 formed as apertures. The journal seats 22 and the bypass spaces 21 are connected by trough-like channels 23 which, by virtue of their projecting or protruding shape, enable the play elements 1 to be snapped over between the bypass spaces 21 and the adjacent empty journal nests 22, or vice versa. This preferred embodiment thus provides further play variations because the tasks set may include not only the angular displacement of the play elements 1 but their re-arrangement. The spherical play elements 1 according to the invention, or some of them, may be connected together by a full or partial positive mechanical coupling.

In such an embodiment the positively coupled play elements 1 cannot be angularly displaced completely independently of and relative to the remaining play elements 1; instead, such angular

displacement may only take place according to some kinematic law.

This possibility is shown in the embodiment according to Figure 2 where the two spherical play elements 1 are shown removed from the supporting unit 2 and partially in section. As the positive coupling element 11 the surfaces of the spherical play elements 1 are provided with tothing which meshes with the tothing of the adjacent play element. The theoretical axes of rotation of the tothing advantageously coincide with the spatial axes of rotation X, Y and Z of the play element 1. In this case, the supporting unit 2 is such that the distance between the centre points of the positively coupled play elements 1 is the same as the diameter of the pitch circle of the gearwheel forming the positive coupling 11. This dimension may vary only by a fraction of the tooth size forming the interlocking coupling elements 11. So, in this embodiment the forced coupling is provided by the teeth.

Figure 13 shows one tooth of the forced coupling elements 11 in a longitudinal partial section. By longitudinally rounding off the tooth forming the forced coupling element 11, it is made possible that on displacing the two interconnected play elements 1, the forced coupling teeth should guide the angular displacement of the play elements 1 in the supporting unit 2. This is important because the individual play elements are spheres and have no physical axes to fix the geometrical axes of rotation.

Figures 14 to 17 illustrate certain examples of the intersections of the forced coupling elements 11. In these figures, a dark tone illustrates the projecting teeth while the light tone illustrates the troughs or gaps between the teeth.

Figures 14 and 16 illustrate variations of the teeth for the upper play element 1, while Figures 15 and 17 illustrate the intersection variations of the teeth of the play elements shown at the bottom of Figure 12. These latter may also be considered as the "negative" of the teeth shown in Figure 14 and Figure 16.

As a separate solutional construction Figures 16 and 17 show by way of example that the forced coupling element 11 may also be formed in the form of a conical projection and a complementarily shaped (crater-shaped) recess, at the locations of intersections. In this way, a pin is formed which has the advantage that the play elements 1 may rotate around this pin about the axis of rotation Y without a positive coupling in that direction.

In the case where the play elements 1 of the spatial logical toy according to the invention are positively coupled together as shown in Figures 12 to 15, then whichever element 1 is angularly displaced by  $90^\circ$ ,  $180^\circ$  or  $270^\circ$  about the theoretical axes of rotation X, Y or Z then the other play element 1 will also be angularly displaced by the same angular extent.

If the angular displacement takes place about the illustrated theoretical axis Y, shown in the drawings, then both play elements 1 will rotate in



the same sense while, on the other hand, if the angular displacement takes place about the theoretical axis of rotation X or Z, then the interconnected play elements 1 will be displaced mutually oppositely, i.e. in the opposite angular senses. Thus, when there are four play elements 1 arranged in the supporting unit 2 such that the play elements are positively coupled together in pairs, then, when any one of the play elements 1 is angularly displaced another play element 1 is also displaced and consequently the player must also take into account this kinematic law in attempting to solve the logical problem. The mechanical positive coupling between the play elements 1 may naturally be realised not only with the positive coupling elements 11 shown in Figure 12 but also with other, differently constructed positive couplings 11. Thus, for instance the positively coupling elements 11 may also be formed so that the positive coupling is only partial. Thus, for instance, it may be arranged that a play element 1 is independently rotatable about certain axes of rotation while another may only be rotated with positive coupling about axes of rotation X or Z. Although this is not shown in the drawings, a partial positive coupling is readily conceived e.g. by replacing the toothing constituting the positive coupling elements 11 in Figure 12 by the provision of projecting rings and recessed rings on the upper and lower play elements 1. In this way, there may be three projecting rings on the upper play element 1 while the lower play element 1 may have three annular troughs or recesses. In this way, a positive coupling between the two play elements 1 arises only on the rotation about the theoretical axis of rotation Y, while the play elements 1 may be mutually independently and separately rotatable about the theoretical axes of rotation X and Z.

When the positively coupling elements 11 are as shown in Figures 16 and 17, there is a positive coupling for rotations about the axes of rotation X and Z while there is no such positive coupling for rotations about the axis of rotation Y. Thus the play elements 1 may be mutually independently rotatable about the axis of rotation Y. This last-mentioned constructional form of the invention again affords numerous play possibilities for a player while at the same time enables the game to be extended in a combinative way.

The invention is not restricted to the preferred embodiments illustrated so far but may also be achieved with the establishment of a positive coupling with the supporting unit 2. Although this is not shown in the drawings, the toy according to the invention may be further developed by providing symbols on the supporting unit also at the set tasks for the player wherein the code system to be achieved by the player incorporates as an organic part the symbols 7 provided on the supporting unit 2.

The spatial logical toy according to the invention may be formed as an information indicating device such as a memory unit e.g. a calendar. This is shown in Figure 11.

In further non-illustrated embodiments of the invention the spatial logical toy is integrated with, or forms part of another article or artifact for personal use. Thus for instance it may be built into or incorporated in writing instruments or other articles of personal use.

Instead of utilising the eye for sensing or detecting the symbols, they may also be formed to be sensed by touch thus enabling players with impaired sight to play.

Equally, symbols 7 may be employed which are indicated or signalled automatically, e.g. by means of electrical signals. In this case, a display board for electric signals may be actuated or some other construction or mechanism which in the event of a successful solution of the task provides a reward such as a gift or money or permits a further game to be played, etc.

Within the scope of the invention the play elements 1 or a part thereof may be angularly displaced by a purpose built displacement device. In this embodiment, the spatial logical toy according to the invention does not necessarily have an opening 6 in the support unit 2.

By utilising a displacement device expediently with an automatic read-out and evaluation device, the invention becomes suitable for automation e.g. for use in play arcades, or game rooms. All these embodiments may also be realised such that the achievement of a successful result requires logical ability, spatial perception, skill and luck.

In this way, visitors to such premises may be drawn into a game that develops their logic and spatial perception which would be useful to them in making them interested in entertainment of a higher standard.

A preferred embodiment of this nature of the spatial logical toy according to the invention is shown in Figures 18 to 20. Figure 18 shows the toy in elevation while Figures 19 and 20 are sections from above. In this embodiment also, the play elements 1 are formed as spherical bodies 1 angularly displaceable in a supporting unit 2. The play elements 1 are disposed in closed spherical nests or journaling elements in the supporting element 2.

In this embodiment there is a device for effecting angular displacement of the play elements 1. The device is in the form of a blade and is formed from a member 61 for receiving torque and formed on the surface of toy element 1, gaseous or liquid torque-transmitting medium 62 that fills the remaining part of the spherical journal or nest space and actuating device 63 to transmit energy to the medium 62 and controlled by human intervention. Six symbols 7 are symmetrically arranged on the toy elements 1, the arc sections in thicker lines along the circles illustrating the surfaces of the play elements designating the symbols. The spatial logical toy according to this embodiment is provided with an automatic symbol-reading device 91 for evaluating the position of the toy elements 1. Reading windows 9 are provided for reading the symbols 7 by the player and for observing the

operation of the toy.

To facilitate the automatic symbol-reading the toy is provided with an automatic adjustment device consisting of permanent magnets 92 and a ferro-magnetic cross 93 formed in the toy elements 1.

The ferro-magnetic cross 93 is formed from small iron rods disposed along four spatial diagonals of the largest imaginary cube that may be contained within the toy element 1.

In use, the gaseous or liquid transmitting medium 62 passes into the blade shaped torque-receiving device 61, for instance through inlet ducts 64 and 65. The medium forced out of the spherical journal space is discharged through a discharge-duct 66. The actuating device 63 consists of a pump 67 and control valves 68.

Although the symbols 7 are not shown in detail in these Figures, they may be similar to those found on dice, i.e. the conventional dots.

In the present embodiment, these signal dots are formed by securing small steel balls to the surface of the play elements 1.

The manner of using the toy will now be described on the basis of Figures 18 to 20. When the player wishes to play, he stands or sits in front of the toy and sees two symbols 7 on each toy element 1 through the window 9.

In Figure 18, the player sees the two symbols 7 on the central play element 1 which in Figure 19 is opposite the reading window 6, i.e. which symbols are disposed at the lower half of Figure 19. At this time, the automatic symbol-reading device 91 senses the two symbols 7 which are on the opposite sides of the play element, that is to say on the upper part of Figure 19, but on the basis of the symbol system of the dice, from this he can determine the value of the symbols 7 seen by the player in such a manner that it subtracts from seven the value of the signal of the symbols 7 sensed by itself. In this way, therefore, the symbol reading device 91 evaluates the same symbols as that seen by the player; reading the symbols 7 is possible because the adjusting device made up from the magnets 92 and the ferromagnetic cross 93 automatically fixes the play elements 1 in the position suitable for automatic reading because the lines of force of the magnets 92 are closed via the ferromagnetic cross 93.

Thus the player sees in total six symbols 7 on the two adjacent sides of the three play elements 1. The aim of the game is as follows: within a predetermined time the player must establish a symbol arrangement by suitably rotating the play elements 1 which gives or maximises the sum of the values of the six visible symbols 7. The point value achieved is also evaluated by the automatic symbol reading device 91 and in accordance with the achieved points may give a reward or gift or permit a further game, etc.

The symbol reading device 91 sense the symbols 7 made from steel balls by e.g. a magnetic principle.

Thus the maximum number of points

achievable is 33 arising from summing three 6s and three 5s. The player effects angular displacement of the play elements 1 by operating the control valve 68. When a given control valve 68 is opened, a flow of medium commences via the inlet duct 64 or 65 to the bottom half of the play element 1 where the inflowing transmitting medium 62 displaces the blade-like torque receiving member 61 whereby the play element 1 is rotated about the axis of rotation X or Z. When the valves 68 are shut off, flow of the transmitting medium 62 is stopped and the end points of the ferromagnetic crosses 93 move to the poles of the magnets 92 and set the playing element 1 to their position where they can be read off. The point value achieved by the player depends on how good his spatial perception is since he must choose the most appropriate direction of rotation from the two symbols that he can see. In addition, the result also depends on whether or how skilfully or finely he can control the control valve 68. In the course of rotating around the two axes X and Z he must make very rapid and logical decisions in order to manipulate the valves correctly. Finally, the results achieved will depend on the luck of the player as well since to some extent the player actuates the control valve by instinct or hunch and can achieve a good result accidentally also.

The operation of the toy may be made more visually pleasing by using a liquid as the transmitting medium 62 and its flow is rendered visible by mixing tiny flashing or glittering particles into the liquid which have the same specific weight as that of the liquid.

Toys of similar purpose or function may be achieved by many different embodiments. Thus the angular displacement of the play elements 1 may be achieved, e.g. by the use of compressed air, rotating electromagnetic fields mechanically etc.

As shown in Figures 18 to 20, the spatial logical toy according to the invention may have a supporting unit 2 which is completely closed and has no opening 6.

The spatial logical toy according to the invention may also be formed in such a way that the centre points of the play elements are disposed within the support unit 2 according to a planar or three-dimensional, regular or irregular array. This may be illustrated by way of example in Figure 21 wherein an embodiment is shown which expediently unites in itself the above-described various advantageous properties of the spatial logical toy according to the invention and while retaining very small dimensions can assure play variations or permutations of a number whose order of magnitude is in billions, i.e. million millions.

Although Figure 21 is stated to illustrate the logical toy in a plan view, the toy is completely symmetrical and consequently the view is the same in front or side elevation as well.

In this embodiment, the centre points of the expediently spherical ball shaped play elements 1

are disposed in a spatial array of regular configuration. In this example, there are eight play elements 1 which are arranged in a supporting unit 2 in such a manner that their center points are disposed at the apices of an imaginary parallelepiped such as a cube. In order to enable the play elements to be more conveniently displaced angularly, their surfaces are notched. The supporting unit 2 is disposed between the play elements 1, virtually filling that space. On the supporting surface there are eight recesses or nests, approximately hemispherical although slightly larger than a hemisphere and these serve to journal the play elements 1. Thus, in this embodiment the working surfaces of the supporting unit 2 that hold the play elements together hold them together in effect from the outside. To this end, it is required that the nests for journaling the play elements should be greater than hemispheres so that at least partially they may encompass the play elements 1. Thus, the supporting unit 2 surrounds and covers approximately one half surface of each toy element 1 leaving the other approximately one-half surface free to operate, in effect, as the gap 6 for turning it.

The supporting unit 2 is preferably made of a resilient material which facilitates the assembly of the toy and favourably ensures that the toy elements 1 are secured against unintentional displacement. Preferably six symmetrically arranged symbols 7 are disposed or provided on the toy elements 1.

In this way, the exterior appearance of the toy is reminiscent of a cube which has strongly rounded corners and edges. On each of the six bounding "faces" of the toy, four symbols 7 may be seen each of which belongs to a different play element 1. Three symbols 7 of each play element 1 may always be seen at any one time while the other three are covered over by the journal or nest of the supporting unit 2.

When a code system is worked out or designated in respect of symbols 7 visible on the faces of such a toy, which system must be assembled by angularly displacing the play elements 1, in the course of play, then the number of permutations or variations is of the order of 1,000,000,000 (one thousand million) or even a billion, (million  $\times$  million). Play may also take place by suitably forming the toy so that the play elements 1 can be lifted out of the supporting unit 2 and regrouped or transferred to different locations.

With regard to the material of the spatial logical toy according to the invention, no limitation is made and thus for instance all or some of the components may be made from a magnetic material or a magnetised material.

The great advantage of the spatial logical toy of the invention resides in its simplicity versatility, both as regards use and constructional possibilities, the high number of permutations and the small, compact size.

## 65 CLAIMS

1. A spatial logical toy or puzzle device, comprising at least two generally spherical playing elements, means for journaling each said playing element in a common supporting means for angular displacement relative to the other(s) about at least two imaginary axes of rotation, the centres of said playing elements remaining stationary during said angular displacement, and code symbols provided on externally visible surfaces of said playing elements to enable a player to attempt to bring said symbols into a predetermined configuration or array of the said symbols.

2. A device according to claim 1, wherein said supporting means is provided with an observation window.

3. A device according to claim 1 or claim 2, wherein the journaling means for each said playing element is effective to allow each playing element to be exchanged or to be readily removed and replaced.

4. A device according to any preceding claim, wherein the journaling means for the playing elements is connected with by-pass space(s) by way of channels along which said elements are guidedly displaceable from their journalled operative positions to a by-pass position and vice versa.

5. A device according to any preceding claim, wherein at least two playing elements are positively mechanically interconnected.

6. A device according to claim 5, wherein the positive interconnection or coupling is constituted by gear teeth.

7. A device according to claim 5, wherein the positive interconnection or coupling is constituted by at least two axially symmetrical surfaces associated with at least two intersecting axes of symmetry, formed on the surfaces of the said elements.

8. A device as claimed in claim 2 or in any of claims 2 to 7, when dependent on claim 2, wherein there are symbols on the supporting unit in the vicinity of and/or on the said window.

9. A device as claimed in any preceding claim wherein the said symbols are formed as information-indicating panels.

10. A device as claimed in claim 1 or in any of claims 3 to 9 dependent on claim 2, wherein the said window is formed as information symbol sensing means.

11. A device as claimed in any preceding claim, wherein the centres of the playing elements are arranged in the supporting means according to a predetermined planar or spatial array.

12. A device as claimed in any preceding claim, wherein the centres of said playing elements are arranged in said supporting means at the apices of an imaginary parallelepiped or cube.

13. A device as claimed in any preceding claim wherein said supporting means is integrated with an article of personal use, e.g. a writing device.

14. A device according to any preceding claim,

wherein said supporting means is a generally cylindrical member having two end closing faces, at least one of which is formed as a removable stopper.

5 15. A device according to any preceding claim, wherein fluid pressure operated means are provided to effect the angular displacement of said playing elements.

10 16. A device according to claim 15, wherein each playing element is provided with blades or the like pressure-receiving and transmitting means.

17. A device according to claim 15 or 16, wherein said fluid pressure means include player-actuated valves.

15 18. A device according to claim 10, wherein said window and said playing elements are at least partly of magnetic material.

20 19. A device according to claim 1, substantially as herein described with reference to and as shown in Figures 1 to 3, and 10 or Figures 4 and 5, or Figure 6 or Figures 7 to 9 or Figure 11 or Figures 12 to 17 or Figures 18 to 20 or Figure 21 of the accompanying drawings.