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TITLE: FOUR-LAYER INTELLECTUAL CUBE ✓

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention is related to a four-layer intellectual cube, and especially to a four-layer intellectual square cube comprises on each side thereof sixteen movable smaller blocks arranged horizontally and vertically, these smaller blocks can be rotated and can slide to change their orientations, so that each side of the square cube can be varied in combination by colors or patterns, and this can arouse brains of people to get an intellectual enhancing effect.

2. Description of the Prior Art

As shown in Fig. 1, a conventional intellectual cube (or so called magic cube) is a square cube A having six sides each composed of nine (3 x 3) movable smaller surfaces and is in three layers, normally the six sides of the square cube A are applied each with a different color, i.e., the nine small movable areas in each side formed by the nine smaller blocks are respectively in one color, when any layer is rotated to change their positions, the small movable areas in every side in this layer are moved respectively to another side of different color, therefore these sides have miscellaneous colors; when in playing, the way of playing is to mix up the colors of the six sides of the square cube A, then to rotate all the

layers to move every group of movable areas having the same color to get in their proper side, until all the six sides of the square cube A recover their own singular colors.

5 The structure of the three-layer intellectual cube is now described firstly, it is comprised, as is shown in Fig. 2, of a cross shaped central axle block 1, six rotatable blocks 2, twelve edge-blocks 3 and eight corner-blocks 4, wherein:

10 The cross shaped central axle block 1 is formed by intercrossing of three axles perpendicular to one another, so that the cross shaped central axle block 1 is formed to have six pivotal connecting ends 5 extending in different orientations.

15 The rotatable blocks 2 are pivotally connected respectively to each of the pivotal connecting ends 5, so that the rotatable blocks 2 are located at the centers of the six sides of the square cube A respectively and form therewith "T" shapes, these surfaces face outwardly and
20 are rotatable.

 The twelve edge-blocks 3 are positioned each between every two neighbouring rotatable blocks 2, taking the rotatable block 2 facing to the front side as a reference block, there are four edge blocks 3 allocated in the
25 front surface and respectively at the top, bottom, left and right ends thereof; the rear rotatable block 2 is

also accompanied by four edge blocks 3 allocated respectively at the top, bottom, left and right ends thereof; plus other four edge blocks 3 provided in the middle zone between the front and the rear sides, the total amount of the edge blocks 3 is twelve.

The corner blocks 4 are located each between every two edge blocks 3 in any one of the six sides, there are totally eight corner-blocks 4 forming the eight corners of the square cube A, they surround the rotatable blocks 2 together with the twelve edge blocks 3, when in rotation of any layer of the three layer intellectual square cube A, the rotatable block 2 on the layer rotates at its own site, while the corner blocks 4 and the edge blocks 3 in this layer circle about the rotatable block 2.

By means of the above stated three layer square cube A composed of the cross shaped central axle block 1, the rotatable blocks 2, the edge blocks 3 and the corner blocks 4, any of the six pivotal connecting ends 5 on the cross shaped central axle block 1 is the center of rotation of its corresponding rotatable block 2 (the central movable surface) as well as of the multiple surrounding movable surfaces on the same side as that of the rotatable block 2, and there are totally nine (3 X 3) movable surfaces in each side of the six sides of the square cube A.

SUMMARY OF THE INVENTION

The aforesaid conventional three-layer intellectual cube has prevailed for a very long time and thus is well known, the inventor of the present invention contemplates
5 to increase complexity of such intellectual cube. The most direct idea is to augment the three-layer intellectual cube to a four-layer intellectual cube, in other words, each side of the cube will have sixteen (4×4) movable smaller surfaces. However, this has been found
10 very difficult after being studied and deliberated, and that is why there never has been a four-layer intellectual cube in the markets.

In taking advantage of the cross shaped central axle block 1, as a center of a four-layer square cube, the pivotal connecting ends 5 at the centers of the six sides of
15 the square cube can not be positioned in the same way as that of a three-layer square cube A wherein the pivotal connecting ends at the centers of the six sides thereof are each located on a central movable surface of the nine
20 movable surfaces on a corresponding side, hence a four-layer square cube can not be put into practice with the same structure, and a novel structure is required to be designed.

In view of the above statement, the inventor of the
25 present invention provides an intellectual four-layer square cube after study and designing of the structure

therefor, this can increase complexity of a intellectual square cube.

In particular, the structure of the four-layer square cube of the present invention has six sides which each is divided vertically and horizontally into sixteen smaller movable surfaces; by changeability of orientation by rotation of these smaller movable surfaces, every side will have various possibility of combination of these smaller movable surfaces, this can arouse brains of people to get an intellectual enhancing effect. Complexity of such combination is larger than that in a conventional three-layer intellectual cube. The structure of the four-layer intellectual cube includes a central axle block, 6 rotatable blocks, 24 first slidable blocks, 12 second slidable blocks, 24 central movable units, 24 edge movable units, and 8 corner movable units, 6 pin holes on the 6 sides of the central axle block are pivotally provided each with one of the mentioned rotatable blocks, a first slidable block and a second slidable block of different shapes are received between every two mutually neighboring rotatable blocks, the first and second slidable blocks on each side limit 4 central movable units, 8 edge movable units and 4 corner movable units to a moving area for rotation and displacing for changing their orientations, in this way, each side of the four-layer square cube can have a variety of colors or patterns, when in

operation, make displacing of the movable units to change their positions, the six sides can have a variety of combinations of these movable units, thereby complexity of the intellectual square cube can be increased.

5 The present invention will be apparent after reading the detailed description of the preferred embodiments thereof in reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

10 Fig. 1 is a perspective view of a conventional three-layer intellectual square cube;

Fig. 2 is a structural perspective view of the conventional three-layer intellectual square cube;

15 Fig. 3 is a perspective view of a preferred embodiment of the present invention;

Fig. 4 is a schematic view showing use of the preferred embodiment of the present invention;

Fig. 5 is a perspective view of a central axle block of the present invention;

20 Fig. 6 is a front view of the central axle block of the present invention;

Fig. 7 is a perspective view of a rotatable block of the present invention;

25 Fig. 8 is a front view of the rotatable block of the present invention;

Fig. 9 is a schematic view showing assembling of a plurality of rotatable blocks with the central axle block of the present invention;

5 Fig. 10 is a perspective view showing the rotatable block with the central axle blocks of the present invention after assembling;

Fig. 11 is a perspective view of a first slidable block of the present invention;

10 Fig. 12 is a side view of the first slidable block of the present invention;

Fig. 13 is a perspective view of a second slidable block of the present invention;

Fig. 14 is a side view of the second slidable block of the present invention;

15 Fig. 15 is a perspective view showing the positions after assembling of a plurality of first and second slidable blocks of the present invention;

20 Fig. 16 is a sectional view showing the state after assembling of the first and second slidable blocks with the rotatable blocks and the central axle block of the present invention;

Fig. 17 is an analytic perspective schematic view showing the structure and the positions of the central movable units of the present invention;

25 Fig. 18 is an analytic perspective schematic view

showing the structure and the positions of the edge movable units of the present invention;

Fig. 19 is a schematic view showing the positions of the edge movable units of the present invention;

5 Fig. 20 is a perspective schematic view showing the positions of the corner movable units of the present invention;

Fig. 21 is a schematic view showing the positions of the corner movable units and a seat block of the present invention;

10 Fig. 22 is an analytic perspective schematic view showing the first step of assembling of the present invention;

Fig. 23 is an analytic perspective view showing the second step of assembling of the present invention;

15 Fig. 24 is a schematic view showing the second step of assembling of the present invention;

Fig. 25 is an analytic perspective view showing the third step of assembling of the present invention;

20 Fig. 26 is a schematic view showing the third step of assembling of the present invention;

Fig. 27 is an analytic perspective view showing the fourth step of assembling of the present invention;

25 Fig. 28 is a schematic view showing the fourth step of assembling of the present invention;

Fig. 29 is an analytic perspective view showing the fifth step of assembling of the present invention;

Fig. 30 is a schematic view showing the fifth step of assembling of the present invention;

5 Fig. 31 is an analytic perspective view showing the sixth step of assembling of the present invention;

Fig. 32 is a schematic view showing the sixth step of assembling of the present invention;

10 Fig. 33 is an analytic perspective view showing the seventh step of assembling of the present invention;

Fig. 34 is a schematic view showing the seventh step of assembling of the present invention;

Fig. 35 is an analytic perspective view showing the eighth step of assembling of the present invention;

15 Fig. 36 is a schematic view showing the eighth step of assembling of the present invention;

Fig. 37 is a schematic view showing the ninth step of assembling of the present invention;

20 Fig. 38 is a perspective view of the first embodiment of the central axle block of the present invention;

Fig. 39 is a perspective view of a first slidable block of the present invention;

25 Fig. 40 is a perspective view showing clockwise rotation for 90 degrees of the first slidable block of the present invention;

Fig. 41 is a perspective view of a second slidable block of the present invention;

Fig. 42 is a perspective view of an edge movable unit of the present invention;

5 Fig. 43 is a perspective view of a corner movable unit of the present invention;

Fig. 44 includes two perspective views showing assembling of an inner slidable block and an external plate of a central movable unit respectively of the present invention;
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Fig. 45 includes two perspective views showing another way of assembling of an inner slidable block and an external plate of a central movable unit respectively of the present invention.

15 DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to Fig. 3 and 4, the six sides B1 of the four-layer intellectual square cube B of the present invention each is divided vertically and horizontally into sixteen (4 x 4) smaller movable surfaces; by changeability of orientation by rotation of these smaller movable
20 surfaces, every side B1 will have various possibility of combination of these smaller movable surfaces, this can arouse brains of people to get an intellectual enhancing effect. Complexity of such combination is larger than that
25 in a conventional three-layer intellectual cube. The structure of the four-layer intellectual cube B, as is

shown in Figs. 5 - 21, includes a central axle block 10, six rotatable blocks 20 provided at each of six orientations, a plurality of first slidable blocks 30 and second slidable blocks 40 engaged between every two mutually neighboring rotatable blocks 20, the first and second slidable blocks 30, 40 on each side B1 limit four central movable units 50, eight edge movable units 60 and four corner movable units 70 to a moving area for rotation and displacing for changing their orientations, in this way, each side B1 of the four-layer square cube B can have a variety of colors or patterns, when in operation, make displacement of the movable units to change their positions, the six sides B1 can have a variety of combinations of these movable units, thereby complexity of the intellectual square cube B can be increased.

The structure of various members are now described as follows in detail in reference to the accompanying drawings.

Referring to the structure of the axle block 10 shown in Fig. 5 and 6, the axle block 10 is in the center of the four-layer square cube B, the six sides B1 of the axle block 10 are provided each with a pin hole 11, the axle block 10 comprises a seat block 12 which envelops with one corner thereof the center of the axle block 10.

Referring to Fig. 7 and 8, in the structure of each of the rotatable blocks 20 which amount to six and are

each in the shape of "T", a pivot joint 21 on one end thereof is pivotally connected to each pin hole 11 of the axle block 10, while a square limiting plate 22 is provided on the opposite end thereof, the bottom of the square limiting plate 22 is arciform.

Referring to Fig. 9 and 10, the axle block 10 is assembled with the rotatable blocks 20, wherein, the square limiting plate 22 of the rotatable blocks 20 each is drilled to form a throughhole 23 on the tailing end of its corresponding pivot joint 21, and a sleeve 24 with a flange on the outer end thereof is inserted in the throughhole 23, align the inner end of the sleeve 24 with a corresponding pin hole 11, a screw 25 is threaded in the sleeve 24 and is screwed fixedly in the pin hole 11, so that the rotatable block 20 is confined on the pin hole 11 but is rotatable about the same.

Referring to Fig. 11 and 12, there are shown the structure of one of the first slidable blocks 30 which amount totally to twentyfour and are provided at the four sides of all the rotatable blocks 20, the top of each of the first slidable blocks 30 is an abutting portion 31 being abutted against one lateral side of a limiting plate 22 of a rotatable block 20, the lower portion of the first slidable block 30 is a limiting portion 32 protruding toward a pivot joint 21 of the rotatable block 20 (Fig. 16). The front end of the abutting portion 31 is pro

-vided with a flange 33 which is arciform on the bottom thereof, the top of the limiting portion 32 is also arciform and is abutted against the arciform bottom of the limiting plate 22, so that the first slidable blocks 30
5 can not drop, the width of the limiting portion 32 is smaller than that of the abutting portion 31, so that both ends of the abutting portion 31 protrude laterally, the bottoms of these ends of the abutting portion 31 are also arciform.

10 Referring to Fig. 13 and 14, there are shown the structure of one of the second slidable blocks 40 which amount totally to twelve and are provided each between two first slidable blocks 30 (Fig. 15), and are triangular in shape, the width of the top of each second slidable
15 block 40 is equal to that of an abutting portion 31 and forms therewith a connecting portion 41 of which both ends are arciform and are abutted against two corresponding arciform bottom surfaces of the flange 33, so that the second slidable block 40 can not drop, the bottom of
20 the second slidable block 40 is provided with a guiding and limiting portion 42 having a smaller width than the connecting portion 41, so that both ends of the connecting portion 41 protrude laterally, the bottoms of these
25 ends of the connecting portion 41 are also arciform to be abutted and conformed in shape with the ends of the abutting portion 31, the width of the guiding and limiting

portion 42 is equal to that of the limiting portion 32 and is abutted thereagainst.

Referring to Fig. 15 and 16, there they show the relationship in assembling of the first slidable blocks 30 and the second slidable blocks 40 with the central axle block 10 and the rotatable blocks 20. As shown in the drawings, the rotatable blocks 20 are assembled to be at the positions on the central axle block 10 and face to six different orientations of a square cube, each side of each rotatable block 20 which is square is abutted against a first slidable block 30, a second slidable block 40 is provided between every two first slidable blocks 30 around the rotatable block 20, so that between every two neighboring rotatable blocks 20, there are two first slidable blocks 30 and one second slidable blocks 40 abutted thereagainst. Taking the top rotatable block 20 shown in the drawings as an example, each side thereof is downwardly abutted against a first slidable block 30 which in turn abuts against a second slidable block 40 which in turn abuts against another first slidable block 30 disposed in an upside down position, the latter first slidable block 30 in turn abuts against another rotatable block 20. In other words, the top rotatable block 20 forms a center and is surrounded at the four sides thereof by four first slidable blocks 30, four second slidable blocks 40, the other four first slidable blocks 30, and

other four rotatable blocks 20, the rotatable blocks 20 engage with the first and the second slidable blocks 30, 40 and thus can not drop, but all these members are displaceable, therefore, the slidable blocks 30, 40 and the four rotatable blocks 20 surrounding the central axle block 10 can be revolved therearound and change their positions. It is the same situation when taking another rotatable block 20 as a center, this is the interior structure of the four-layer intellectual cube B.

Referring to Fig. 17, there it shows the structure of a plurality of central movable units 50 which amount to twentyfour, each central movable unit 50 is comprised of an inner slide block 51 and an outer slide plate 52; wherein, the inner slide blocks 51 are positioned at the four corners of the rotatable blocks 20, i.e., positioned each between two of the four first slidable blocks 30 in the circumference of a rotatable block 20 (Fig. 15, 17), and are displaceable together each with the left or right neighboring first slidable block 30 thereof, it is in the shape of "Z", the lower portion thereof is a lower guiding and limiting portion 511 which is placed under the abutting portion 31 of a first slidable block 30, the upper portion thereof is an upper guiding and limiting portion 512 of which the top is extended slightly out of the top of the abutting portion 31 of the first slidable block 30 and is provided with an upwardly raised fixing por-

tion 513 which is excavated to form a screw hole 514. The outer slide plate 52 is in the shape of a thin sheet, the top surface thereof is square, four outer slide plates 52 are assembled into a set which forms the four central movable units 50 of each side of the four-layer intellectual square cube. The bottom of the outer slide plate 52 is provided with a groove 521 and a fixing hole 522 corresponding to the fixing portion 513 of the inner slide blocks 51, the groove 521 is engaged with the fixing portion 513, then extend a tiny screw 523 through the fixing hole 522 and the screw hole 514 for securing the outer slide plate 52 on the inner slide blocks 51, therefore, when the inner slide blocks 51 are displaced, the outer slide plate 52 is displaced therewith. Further, the outer slide plate 52 is provided on the bottom thereof with a depressed portion 524 to prevent the outer slide plate 52 from collision or interference by the rotatable block 20, the first slidable block 30 and the second slidable blocks 40.

Referring to Fig. 18 and 19, there they show the structure of a plurality of edge movable units 60 which are provided on the edges of every side of the four-layer intellectual square cube, a pair on each edge, and surround the four central movable units 50 in each side, these edge movable units 60 amount to twelve pairs, i.e., twentyfour individuals. Each edge movable unit 60 is compri-

sed of an inner and an outer portion 62, 61, the outer
portion 61 is square, while the inner portion 62 is tri-
angular and is extended inwardly to the lateral sides of
the first slidable blocks 30 and the second slidable blo-
cks 40 neighboring therewith, and is excavated to form a
5 lateral arciform slide groove 621 conforming in shape to
the abutting portions 31 and the connecting portions 41
provided on the tops of the first slidable blocks 30 and
the second slidable blocks 40 (Fig. 16); so that the bot-
10 tom of the inner portion 62 is restrained and not to drop
, but it can slide along the arciform bottoms of the abut-
-ting portions 31 and the connecting portions 41.

Referring to Fig. 20 and 21, there they show the st-
ructure of a plurality of corner movable units 70 which
15 amount to eight and form the eight corners of the four-
layer intellectual square cube; each corner movable unit
70 is comprised of an outer square portion 71 and an in-
ner triangular portion 72, the inner triangular portion
72 is engaged in the gap formed by three edge movable
20 units 60 neighboring therewith; so that the inner trian-
gular portion 72 is restrained and not to drop, and the
top thereof is arciform, it can thereby moved together
with any of the mentioned three edge movable units 60
neighboring therewith; the arciform top surface of the
25 inner triangular portion 72 connects the inner corner of
the outer square portion 71, they are connected by a con-

necting portion 73 provided therebetween to increase strength of connection.

The above statement concerns the structure and the relation of connection of the components of the four-layer intellectual square cube, when in assembling, due to restrain among the components and the rotatable blocks 20 which are the innermost and the first limiting members, the outer slide plates 52 of the central movable unit 50 are assembled lastly in order to restrain all the components, the assembling work shall be done according to the steps shown in Fig. 22 to 34 as follows:

As shown in Fig. 22, when in assembling, the limiting plate 22 of a rotatable block 20 faces down, and a sleeve 24 and a screw 25 are extended through a roughhole 23 thereon, then four first slidable blocks 30 and four inner slide blocks 51 are abutted thereon respectively on the four sides and the four corners thereof to form a small square block, this is the first step in assembling.

As shown in Fig. 23, 24, when in completion of the above stated assembling, four second slidable blocks 40 are assembled respectively on the flanges 33 of the four first slidable blocks 30, then eight edge movable units 60 and four corner movable units 70 are mounted on the laterals and corners of the four second slidable blocks 40 respectively, this is the second step in assembling.

As shown in Fig. 25, 26, when in completion of the above stated assembling steps, the bottom layer of the four-layer intellectual square cube is completed except the outer slide plates 52. In the completed bottom layer at this time, four first slidable blocks 30 are mounted on the four second slidable blocks 40, then eight inner slide blocks 51 are mounted so that every lateral side of the first slidable blocks 30 just mounted neighbors with an inner slide block 51, and other four edge movable units 60 are superimposed the four corner movable units 70, this is the third step in assembling, and the second layer of the four-layer intellectual square cube is completed.

As: shown in Fig. 27, 28, when in completion of the third step of assembling, the central area of the second layer has a depressed contour, so that the screw 25 extending through the pivot joint 21 of the bottom rotatable block 20 protrudes. In the fourth step of assembling, the pin hole 11 on the bottom of the axle block 10 is threadedly connected with the screw 25, so that the rotatable block 20 is pivotally connected to the bottom of the axle block 10, now, the other pin holes 11 of the axle block 10 are facing to the other five orientations corresponding to those of the other five sides of the four-layer intellectual square cube with six sides, then four further second slidable blocks 40 are mounted respective-

ly on the inner portions 62 of the four edge movable units 60 on the second layer, eight first slidable blocks 30 are mounted so that every lateral side of the second slidable blocks 40 neighbor with one of the first slidable blocks 30 which amount to eight here, and lastly, four rotatable blocks 20 are mounted along every pin hole 11 in a horizontal plane and each in a space between two first slidable blocks 30, the fourth step in assembling thus is completed.

As shown in Fig. 29, 30, when in completion of the fourth step of assembling, the central area of the second layer has a protruding contour, so that in the fifth step, in observing the third step but with the members being up side down, that is, four edge movable units 60 are in the first place located in position on the four edge movable units 60 in the second layer respectively, and eight inner slide blocks 51 are respectively placed at both the lateral sides of these edge movable units 60, four first slidable blocks 30 are placed each between one of four pairs of the inner slide blocks 51 on the four edges, the fifth step in assembling thus is completed, and the third layer of the four-layer intellectual square cube is completed.

As shown in Fig. 31, 32, when in completion of the third layer, the sixth step can be performed to assemble the top layer, the members in the top layer are the same

as those in the bottom layer but with the members being
up side down as compared with the case of the second la-
yer, that is to say, the four corner movable units 70 are
located on the four corners, and eight edge movable units
5 60 are mounted so that every lateral side of the four
corner movable units 70 neighbors with an edge movable
unit 60, four second slidable blocks 40 are mounted each
between the slide grooves 621 of two edge movable units
60, in this way, the sixth step in assembling thus is
10 completed, and the top layer of the four-layer intellec-
tual square cube is completed.

As shown in Fig. 33, 34, when in completion of the
top layer of the four-layer intellectual square cube, by
the fact that the top pin hole 11 of the axle block 10
15 has not yet been assembled with a rotatable block 20 and
the surrounding members thereof when in assembling the
third layer and the top layer, so that the top members
are only abutted against one another rather than are li-
mited in positions thereof, and more, the central area is
20 depressed, therefore, the seventh step of assembling is
that, the central area of the top layer is mounted with
the same members as those in the first step but the mem-
bers are up side down, i.e., the top pin hole 11 is taken
as a center, four first slidable blocks 30 and four inner
25 slide blocks 51 are abutted thereon respectively on the
four sides and the four corners thereof, then render the

pivot joint 21 of the last rotatable block 20 to direct
down, then a sleeve 24 and a screw 25 are extended through
a throughhole 23 thereon, so that the rotatable block
20, the first slidable blocks 30 and the inner slide blocks
51 are abutted thereon on the four sides and the four
5 corners thereof respectively to form a small square block
which is placed in the above mentioned depressed central
area, the screw 25 is threadedly connected with the top
pin hole 11 of the axle block 10, the limiting plate 22
10 of the rotatable block 20 is located at the center, the
above stated members assembled in the preceding steps can
be engaged one after one by the limiting plate 22, and
the seventh step in assembling thus is completed.

As shown in Fig. 35, 36, when in completion of the
15 seventh step of assembling, the four-layer intellectual
square cube is completed except that the outer slide plates
52 of all the central movable units 50 are not yet
assembled, all kinds of the movable units on the surfaces
thereof can be displaced to change their positions already,
20 then the eighth step is performed to extend each of a
plurality of tiny screws 523 through a fixing hole 522 of
an outer slide plate 52 to be secured on a fixing portion
513 of an upper guiding and limiting portion 512 on the
top of an inner slide block 51, so that assembling of the
25 central movable units 50 is completed, the appearance of
the four-layer intellectual square cube is neat, every

side thereof can be varied by displacement to change the positions of the movable units therein.

As shown in Fig. 37, the last step of the present invention is to provide various colors or patterns for the six sides B1 of the four-layer intellectual square cube B; in order to prevent the tiny screws 523 and the fixing holes 522 from destroying the neat appearance of the whole cube B, sticking papers B2 of various colors and/or patterns can be stuck to the multiple movable units, and the assembling of the whole cube B thus is completed.

The function of the above mentioned seat block 12 of the axle block 10 shown in Fig. 5 has to be explained here: by the fact that a conventional three-layer intellectual cube is a three-layer structure, therefore, no matter which layer is rotated, the cross shaped central axle block 1 (Fig. 1, 2) is moved synchronically with the middle layer; while the four-layer intellectual cube is a four-layer structure, it does not have the middle layer as is the case in a conventional three-layer intellectual cube. Therefore, when the two middle layers thereof are rotated relatively, such as are shown in Fig. 4 (b) and (c), by virtue that the central axle block 10 is located between the two middle layers (Fig. 16), if the axle block 10 does not rotate with any of the middle layers, when these two middle layers rotate relatively with each other for 90 degrees, the central axle block 10 is rotated only

for any angle between 0 - 90 degrees, thereby, after the middle layers of the four-layer intellectual cube are rotated, the central axle block 10 will deviate, hence when the four-layer intellectual cube is to be rotated in the direction as shown in Fig. 4 (d), the whole interior structure thereof (such as is shown in Fig. 15) will be positionally in a mess, and are stuck by one another, so that the whole four-layer intellectual cube is out of work. Therefore, when the two middle layers rotate relatively with each other, structurally, the central axle block 10 must be rotated together with one of the two middle layers. Practically, the seat block 12 is the very wanted member to allow the central axle block 10 to be rotated together with one of the two middle layers. The relative relation of the seat block 12 with other members is shown respectively in Fig. 16, 21, 27 and 28. By the fact that the seat block 12 is a small cube, and that the seat block 12 envelops the center of the central axle block 10 with one corner thereof, so that the opposite corner thereof is eccentric, this eccentric corner renders the six sides of the cube B to be abutted against by the lower guiding and limiting portions 511 of the central movable units 50 and the limiting portions 32 of the first slidable blocks 30, so that the central axle block 10 keeps in the eccentric positional relation. When the two middle layers of the whole four-layer intellectual

cube rotate relatively with each other, the seat block 12 keeps stationary with one of the two middle layers, while the other of the middle layers is rotated relatively thereto.

5 The names and the shapes shown of the above mentioned members are only for convenience of describing the structure of the present invention, and not for giving any limitation to the scope of the present invention. It will be apparent to those skilled in this art that various modifications or changes can be made to the elements of the present invention with the same result. For example:

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 Fig. 38 to 43 show that the above stated members are made by plastic injection moulding, to prevent reducing of weight of the plastisol after shrinking by cooling, all the blocks of the members are excavated to be hollow; wherein, Fig. 38 shows the seat block 12 of the axle block 10 being excavated, and Fig. 39 shows an abutting portion 31 of a first slidable block 30 being excavated on the top thereof, Fig. 40 shows a limiting portion 32 of a first slidable block 30 being excavated on the bottom thereof, Fig. 41 shows a connecting portion 41 of a second slidable block 40 being excavated on the top thereof, Fig. 42 shows the interior of an edge movable unit 60 being excavated, and Fig. 43 shows the interior of a corner movable unit 70 being excavated. Further, when in ma-

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nufacturing, all the members are provided with rounded edges to facilitate displacing.

Fig. 44 (I) and (II) are two perspective views showing assembling of an inner slidable block 51 and an external plate 52 of a central movable unit 50 respectively of the present invention, in the drawing, the lower guiding and limiting portions 511 of the inner slidable block 51 is excavated to be hollow, the fixing portion 513 of the upper guiding and limiting portion 512 is excavated to form a square hole 515, an engaging portion 525 is extended down from the bottom of the external plate 52 and is opposite to the square hole 515, the engaging portion 525 is engaged in the square hole 515 when in assembling, thereby; assembling of the inner slidable block 51 and the external plate 52 is completed.

Fig. 45 (I) and (II) are two perspective views showing another way of assembling of an inner slidable block 51 and an external plate 52 of a central movable unit respectively of the present invention, wherein, the lower guiding and limiting portion 511 on the bottom of the inner slidable block 51 is excavated to be hollow, the fixing portion 513 of the upper guiding and limiting portion 512 is excavated to form a round hole 516, a fixing rod 526 is extended down from the bottom of the external plate 52 and is opposite to the round hole 516, the fixing rod 526 is engaged in the round hole 516 when in as-

sembling and is snugly fitted therein or is adhered there-
-in, in this way, assembling of the inner slidable block
51 and the external plate 52 is completed.

5 The embodiments stated above are only examples for
illustrating the present invention. It will be apparent
to those skilled in this art that various modifications
or changes can be made to the members of the present in-
vention without departing from the spirit, scope and cha-
racteristic of this invention. Accordingly, all such mo-
10 difications and changes also fall within the scope of the
appended claims and are intended to form part of this in-
vention.

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CLAIMS

1. A four-layer intellectual cube having apparently six sides which each is divided vertically and horizontal-ly into four smaller movable surfaces respectively, said
5 cube has sixteen movable smaller surfaces totally; by changeability of orientation by rotation of these smaller movable surfaces, said six sides can provide a variety of combinations by colors or patterns, structurally, said cube is comprised of:

10 a central axle block, being located at the center of said four-layer intellectual cube, said six sides of said central axle block axle block being provided each with a pin hole, said axle block comprising a seat block which envelops with one corner thereof the center of said
15 axle block;

six rotatable blocks, being each in the shape of "T", a pivot joint on one end thereof being pivotally connected to each of said pin holes of said central axle block, while a square limiting plate being provided on
20 the opposite end thereof, the bottom of said square limiting plate being arciform;

twentyfour first slidable blocks, being provided at the four sides of all said rotatable blocks, the top of each of said first slidable blocks being an abutting
25 portion abutted against one lateral side of one of said square limiting plates on one of said rotatable blocks,



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the lower portion of said first slidable block being a limiting portion protruding toward one of said pivot joints of said rotatable block, wherein, the front end of said abutting portion being provided with a flange which
5 is arciform on the bottom thereof, the top of said limiting portion being also arciform and is abutted against an arciform bottom of said limiting plate, so that said first slidable blocks being not subject to dropping, the width of said limiting portion being smaller than that of
10 said abutting portion, so that both ends of said abutting portion protrude laterally, the bottoms of said ends of said abutting portion being also arciform;

twelve second slidable blocks, being provided each between two of said first slidable blocks, and being triangular in shape, the width of the top of each of said
15 second slidable blocks being equal to that of said abutting portion of said first slidable blocks and forming therewith a connecting portion of which both ends are arciform and are abutted against two corresponding arciform
20 bottom surfaces of said flange, so that said second slidable block being not subject to dropping, the bottom of said second slidable block being provided with a guiding and limiting portion having a smaller width than said connecting portion, so that both ends of said connecting
25 portion protruding laterally, the bottoms of said ends of said connecting portion being also arciform to be abutted



on and conformed in shape with the ends of said abutting portion, the width of said guiding and limiting portion being equal to that of said limiting portion and being abutted thereagainst;

5 twentyfour central movable units, each being comprised of an inner slide block and an outer slide plate, wherein, said inner slide blocks being positioned at the four corners of said rotatable blocks, and being displaceable each together with the left or right neighboring
10 one of said first slidable blocks, the lower portion thereof being a lower guiding and limiting portion which is placed under said abutting portion of said first slidable block, the upper portion thereof being an upper guiding and limiting portion of which the top being extended slightly out of the top of said abutting portion of said
15 first slidable block; said outer slide plate being in the shape of a thin sheet, the top surface thereof being square, a set of four of said outer slide plates forming a set of four of said central movable units on each side
20 of said four-layer intellectual square cube;

 twentyfour edge movable units, being provided on the edges of every side of said four-layer intellectual square cube, a pair on each edge, each of said edge movable unit being comprised of an inner and an outer portion
25 , said outer portion being square, while said inner portion being triangular and being extended inwardly to la-



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teral sides of said first slidable blocks and second slidable blocks neighboring therewith and being excavated to form a lateral arciform slide groove conforming in shape with said abutting portions and said connecting portions provided on the tops of said first slidable blocks and second slidable blocks respectively, so that the bottom of said inner portion being restrained and not to drop, but being slidable along said arciform bottoms of said abutting portions and connecting portions; and

eight corner movable units, each being comprised of an outer square portion and an inner triangular portion being mutually connected by a connecting portion provided therebetween, said eight outer square portions forming the eight corners of said four-layer intellectual square cube, said inner triangular portion being engaged in a gap formed by three of said edge movable units neighboring therewith and thus being restrained and not to drop, and the top thereof is arciform, it being thereby movable together with any of said three edge movable units;

by providing of said central axle block, said six rotatable blocks, twentyfour first slidable blocks, twelve second slidable blocks, twentyfour central movable units, twentyfour edge movable units and said eight corner movable units, assembling of said four-layer intellectual square cube can be completed.