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J. GLANZER
CONSTRUCTION TOY COMPRISING CONNECTORS
HAVING ORTHOGONAL CHANNELS

3,360,883

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2 Sheets-Sheet 1

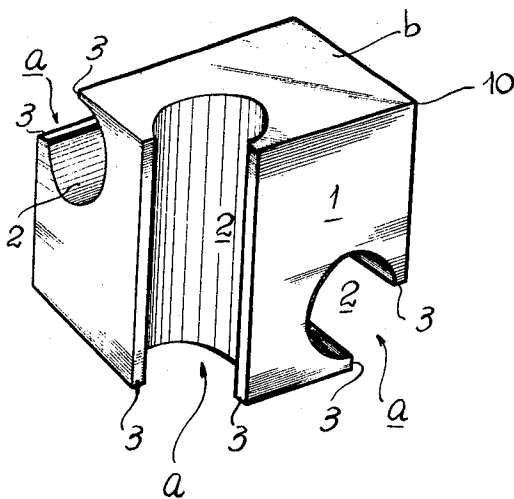


FIG. 1

FIG. 2

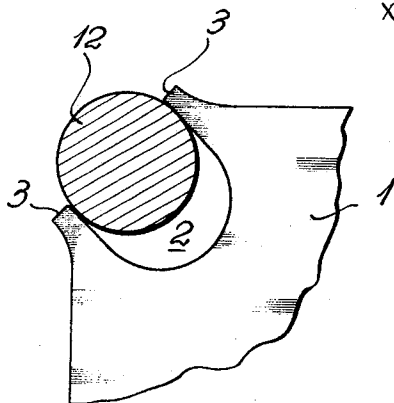
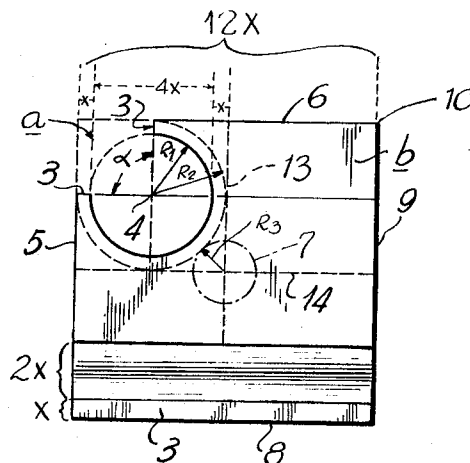


FIG. 4

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FIG. 3

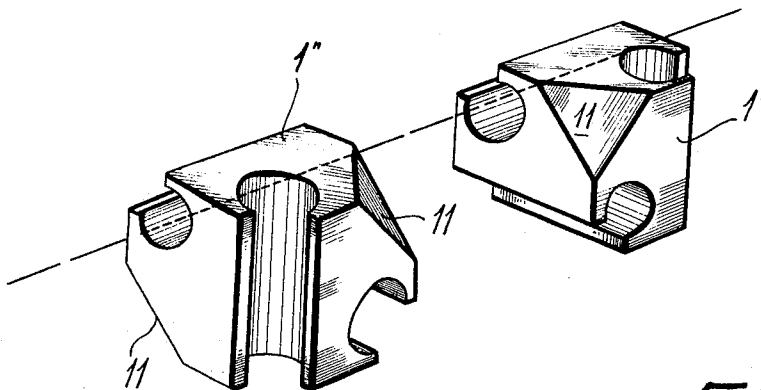


FIG. 3A

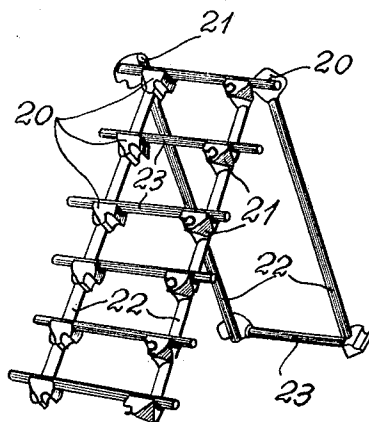
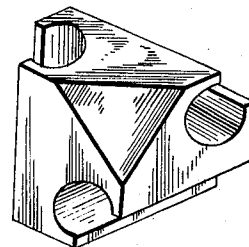


FIG. 5

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3,360,883 CONSTRUCTION TOY COMPRISING CONNECTORS HAVING ORTHOGONAL CHANNELS

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ABSTRACT OF THE DISCLOSURE

A first substantially cubic connecting piece and a second substantially cubic connecting piece being the mirror image of the first connecting piece, both made of resilient material with three straight orthogonal open ended channels at pertinent edges and which open channels allow the press-fitting of rods thereinto, whereby the rods linked by said connecting pieces enable to build a great variety of fancy structures and the like.

Specification

This application is a continuation-in-part of application Ser. No. 243,766, filed Dec. 11, 1962, now abandoned.

The present invention relates to a composite toy formed mainly by a plurality of connecting pieces each constituted by a body of resilient material provided with three straight orthogonal open-ended channels of substantially equal lengths which, in combination with a plurality of cylindrical rods of different lengths provide the possibility for assembling a great variety of fancy structures or models representing objects of the actual life.

Composite toys are known which comprise connecting blocks provided with holes conditioned to receive joining or coupling rods or pins. These blocks may be combined to form object models or fancy structures.

However, experience has shown that in the known composite toys the connecting blocks generally constitute the basic elements of the toy, due to the fact that the pins serve as mere coupling elements between adjacent blocks which, addressed directly one to the other, form the desired structure.

In other known composite toys, where the blocks act as coupling elements for a plurality of rods representing the structure of the toy, the insertion of the rods into the seats provided in the blocks requires an effort, and sometimes means, which are beyond the physical possibilities of children playing. This constitutes a serious disadvantage for the use of these toys in practice and sometimes makes it practically impossible to disassemble the toy built-up and to assemble a new toy.

The main object of the present invention consists in providing a composite toy easy to assemble, so that it can be used by children of even very young age, the toy offering the possibility for building-up a large variety of structures with practically only three basic elements.

The composite toy according to the present invention is inexpensive due to the fact that it comprises only two structurally different connecting pieces of identical outer dimensions and a plurality of cylindrical rods of various lengths, but nevertheless gives the user a possibility for building-up very complex structures.

According to the invention the connecting piece is provided with three orthogonal channels of equal substantially circular cross-sections, which are substantially tangential to a central imaginary sphere of minimum volume, so that these three channels, taken in pairs, are substantially tangential one to another. On the other hand, the substantially parallel edges of each channel are separated by a distance which, when measured along the circumference of an imaginary circle inscribed within the cross-section of each channel, corresponds substantially to a

quarter of such circumference, the channels extending in parallel with respect to the symmetry axes of the body of the connecting piece.

According to another feature of the present invention the connecting pieces of the composite toy consist of a resilient material so that the parallel edges of the open-ended channels allow of the lateral insertion of the rods into the channels with a very small pressure, the same edges operating as elastically yielding retention means for the rods, so that the assembling and disassembling of the different structures is simplified to a great extent.

In a particular embodiment of the composite toy according to the invention, the connecting pieces are constituted by cubes of a resilient material, preferably polyethylene, the channels being provided in three non-crossing cube edges thereof. Thus, each channel interconnects two opposite faces of the cube, each open end of the channel corresponding to the circumference of an imaginary circle concentrically arranged within a second imaginary circle located in the plane of the respective face and tangential to the two adjacent cube edges of the same face, the diameter difference between the two circles corresponding to the thickness of the longitudinal edges of the channel. The second channel may extend then along one of the two mutually parallel and, with respect to the first channel, orthogonal but non-crossing edges of one of those two faces of the cube which mutually determine an edge diagonally opposite to and parallel with the edge along which is located said channel. The location of the third channel is thus automatically determined, since the same can then be located only along that cube edge which is perpendicular to but non-crossing with both the first and second channels. Thus, a connecting piece according to the present invention may be one of two possible types, i.e. either (a) dextrorotary or (b) levorotary, corresponding to (a) clockwise (toward the right) or (b) counter-clockwise (toward the left) location respectively, of the upward pointing channel ends as seen in the direction towards the center of the cube along the axis passing through the diagonally opposite apexes of the cube free of channel ends.

In a particularly advantageous embodiment of the connecting piece according to the invention at, the opposite apexes of the cube free of channel ends, the material of the cube is cut-off providing two bevelled triangular diagonally opposite surfaces extending in parallel planes at 45° with respect to the faces of the cube providing convenient surfaces to grip the cube for handling.

In a further embodiment of the connecting piece according to the invention, the abovementioned triangular surfaces are provided with raised marks to allow of easy identification of the two types of connecting piece by blind persons when gripping the cubes at these surfaces.

In order that the invention may be readily carried out, two embodiments thereof will be described in detail, by way of example, with reference to the accompanying drawings in which:

FIGURE 1 is a perspective view of a first embodiment of the connecting piece of the composite toy according to the invention;

FIGURE 2 illustrates a frontal view of one face of the connecting piece shown in perspective view in FIGURE 1, this figure showing various relative dimensions;

FIGURE 3 illustrates the two types of connecting pieces forming part of the composite toy according to the invention;

FIGURE 3A shows a perspective view of a connecting piece having a dextrorotary arrangement with its apex in the same position as the apex 11 of cube 1' of FIGURE 3.

FIGURE 4 illustrates the insertion of a cylindrical rod

into a channel of the connecting piece described in the preceding figures;

FIGURE 5 shows a simple toy structure with the rods and the connecting pieces according to the invention.

In the figures, the same reference numbers correspond to equivalent parts of the composite toy according to the present invention.

FIGURE 1 shows a cube 1 of a resilient material, preferably polyethylene, in which three open-ended non-crossing and straight channels 2 are provided. These channels 2 are located along three non-converging cube edges and therefore are parallel to the symmetry axes (not shown) of the cube. Channels 2 have identical substantially circular cross-sections, the longitudinal apertures a of these channels extending in parallel and covering an arc extending substantially over a quarter of the circumference of an imaginary circle inscribed within the channel cross-section.

FIGURE 2 illustrates face b of cube 1 in which the location of the open end of one of channels 2 may be appreciated in detail. This open end of the channel coinciding with the plane of face b (but also the cross-sections of the channel) corresponds to an imaginary circle of radius R_1 centered on imaginary axis 4. The circle of radius R_1 is concentrically inscribed in an imaginary circle of radius R_2 which is tangential in the plane of face b to the cube edges 5 and 6 of the cube 1 converging towards the open end located in this plane. The difference between radius $R_2 - R_1$ determines the thickness of edges 3 of each channel 2.

As can be observed in FIGURE 2, the distance between the opposite edges 3 of aperture a of each channel 2 subtends an arc α of 90° . It should be understood however that angle α can vary within certain limits in correspondence with the nature of the resilient material used for cubes 1. An angle of 90° has been determined by experimentation as the appropriate one for cubes 1 made of polyethylene but it is well within the scope of the present invention to use angles differing from the value of 90° given hereinabove when other resilient materials, or even the same, is used for cubes 1.

With respect to the position of channels 2 in cubes 1 according to the present invention it should be mentioned that, in general and basically, these channels are arranged in such a manner that the inner walls thereof are tangential to an inner imaginary sphere located at the center of the cube. In order to illustrate this peculiarity of the connecting pieces according to the present invention, the inner outlines of the imaginary cylinders corresponding to the circles of radius R_2 of the other two channels 2 of the same cube 1 are indicated by broken straight lines 13 and 14 in FIG. 2, where it can be observed that the imaginary cross-sectional cylinders corresponding to outer circles of the three channels 2 are tangential to an imaginary sphere 7 of radius R_3 located in the geometrical center of cube 1, the inner walls of the three channels 2 being tangential to an imaginary concentric sphere of larger diameter the radius of which is larger than that of sphere 7 by a value corresponding to the thickness of edges 3 of the channels.

It will be understood that, without deviating from the main features of the present invention, cubes 1 according to the present invention might have a rather large volume or, to say it in other words, imaginary sphere with radius R_3 might have radii of varying lengths. One of the basic features of the present invention is that such sphere 7 is of minimum volume, i.e. that in each cube 1, the three channels 2 are located as closely together as possible without intersecting.

In this connection it is interesting to note that experimentation has shown that with polyethylene as resilient material for cubes 1, the most advantageous relation between the longitudinal extension of channels 2 and their diameters is approximately 3:1, this relation being the optimal one as regards the facility of laterally

inserting or withdrawing the connecting rods 12 (see FIG. 4) into and from channels 2. With cubes 1 of minimum volume, the relationship between the channel diameters and the thickness of edges 3 is approximately 4:1. This is shown in FIGURE 2 where the thickness of edge 3 is shown by dimension x and channel diameter is shown by dimension $4x$. The channel length which corresponds to the length of edge 6 is shown as having the dimension $12x$, that is, three times the dimension of the diameter $4x$.

Consequently, in connection with the fact that in accordance with one aspect of the present invention, imaginary inner sphere 7 is of minimum volume, once connecting rods 12 of a determined diameter have been chosen by the designer of the composite toy, the total minimum volume of connecting cubes 1 follows automatically, thus providing connecting pieces of maximum grip and facility of assembly and disassembly with the least possible expenditure of the material used for these pieces or cubes.

The possibility of distributing the three channels 2 in a dextrorotatory or levorotatory arrangement will be explained with reference to FIG. 2 where it can be observed that the other channel 2, visible in the figure, extends along cube edge 8, thus producing the dextrorotatory type of cube 1 according to the present invention, while if this channel would extend along cube edge 9, a cube 1 of levorotatory type would be obtained. In fact, when viewing, for instance dextrorotatory cube 1 as shown in FIG. 2, in a direction towards the center of the cube and along a virtual axis passing through apex 10 (free of channels 2) and through the other cube apex located in diametrical opposition to apex 10 and not visible in FIG. 2, the virtual longitudinal axes of the three channels, in the direction of the observer, are inclined in a dextrorotatory arrangement with respect to the aforementioned virtual apex axis.

Cubes 1 of both types are shown in perspective in FIG. 3, where according to a further embodiment of the present invention, the diagonally opposite apexes 10 have been cut-off to provide two opposite triangular gripping planes 11 the surfaces of which form an angle of 45° with respect to cube faces b . As can be easily observed in FIG. 3, dextrorotatory cube 1' corresponds to the mirror image of levorotatory cube 1'', both having otherwise identical dimensions and comprising channels 2 of identical cross-sections and length. The cube of FIGURE 3A has its apex in the same position as apex 11 of cube 1' of FIGURE 3 but illustrates a dextrorotatory cube.

From the foregoing it will be understood that, according to the principal feature of the present invention, once a designer decides on a location for the other channel 2 with respect to the upright channel 2 in FIG. 2, the location of the third channel is determined univocally in accordance with the structure of cubes 1 according to the present invention.

It must be mentioned that, though cubes 1' and 1'' show triangular opposite gripping planes 11 of identical dimensions surfaces and arrangement, such gripping planes 11 may be also of different dimensions and angles with respect to the same cube as well with respect to the two possible types of cubes 1.

FIGURE 4 illustrates a rod 12 in cross-section when the same is introduced laterally into channel 2. Since the material of cube 1 is resilient, edges 3 of the channel are deformed during the insertion of the cylindrical rod (the inner diameter of which is substantially equal to the diameter of the cross-section) and return then to their original position, thus maintaining the rod elastically clamped within the channel.

FIGURE 5 illustrates a very simple toy structure assembled with the components of the composite toy according to the present invention. This figure shows a plurality of dextrorotatory and levorotatory cubes 21 and 20, respectively mounted on two stringers 22 and both supporting shorter rods or steps 23 thus forming a ladder.

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Due to the use of the two types of cubes 20 and 21, steps 23 extend in a plane parallel to the plane comprising stringers 22.

As mentioned hereinbefore, when using cubes 1 of polyethylene, the most advantageous relationship between the channel length and the diameter of rods 12 is approximately 3:1 and, with cubes 1 of minimum volume, this results in a relationship between the channel diameters and the thickness of edges 3 of approximately 4:1.

It will be understood that various changes may be made in the structural details of connecting pieces 1 shown in the drawings and described in the foregoing specification without departing from the invention the scope of which is determined by the claims which follow hereinafter.

I claim:

1. A toy comprising connecting pieces and rods, each of said connecting pieces being constituted by a body of resilient material formed along three edges thereof with three straight mutually non-intersecting orthogonal open-ended channels of substantially equal length, said channels having longitudinal apertures and having identical cross sections substantially tangential to a imaginary central sphere, the radius of said sphere being such that the channels are located as closely together as possible without intersecting while allowing adequate wall thickness, the longitudinal aperture of each channel having two opposed substantially parallel edges separated by a distance corresponding approximately to a quarter of the circumference of an imaginary circle inscribed within the interior wall of the channel, said distance being measured along an arc of said imaginary circle, the opposed longitudinal edges of each channel constituting resilient means permitting manual lateral insertion and resilient holding of said rods, the cross sectional shape of the rods and the cross sections of the channels cooperating with each other to maintain the rods in the channels.

2. A toy according to claim 1, wherein said body is a cube.

3. A composite toy according to claim 2, wherein on each face of the body the open end of the respective channel viewed from a side of the cube corresponds to a circumference concentrically inscribed within an imaginary circle tangential to the two cube edges adjacent to said open end, the diameter difference between said two

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concentric circles corresponding to the thickness of the longitudinal edges of said channel.

4. A composite toy according to claim 3, wherein the longitudinal aperture of said channel extends along an edge perpendicular to said edges located tangentially with respect to said imaginary circle.

5. A composite toy according to claim 4, wherein the second channel extends along an edge of one of the faces of the cube having one open end of said first mentioned channel.

6. A composite toy according to claim 2, wherein said cube is formed with two identical diagonally opposed triangular bevels located one at each apex of the cube free of channels.

7. A composite toy according to claim 1, wherein the material of said body is polyethylene, the relationship between the length and the diameter of each channel being 3:1, while the relationship between the channel diameter and the edge thickness is 4:1.

8. A composite toy according to claim 2, wherein with respect to an imaginary axis passing through the apexes of the cube free of channels, the upwardly pointing channel ends, as seen in the direction towards the center of the cube, are placed in clockwise appearing locations, to form a dextrorotatory arrangement with respect to said imaginary axis.

9. A composite toy according to claim 2, wherein with respect to an imaginary axis passing through the apexes of the cube free of channels, the upwardly pointing channel ends, as seen in a direction towards the center of the cube, are placed in counterclockwise appearing locations, to form a levorotatory arrangement with respect to said imaginary axis.

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F. BARRY SHAY, *Primary Examiner.*

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,360,883

January 2, 1968

Jacobó Glánzer

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

In the heading to the printed specification, lines 4 and 5, for "Jacobó Glánzer, Avenida Roque Saenz Pena 570, Buenos Aires, Argentina" read -- Jacobó Glánzer, Jose C. Paz 433, Martinez, Buenos Aires, Argentina --.

Signed and sealed this 28th day of January 1969.

(SEAL)

Attest:

Edward M. Fletcher, Jr.

Attesting Officer

EDWARD J. BRENNER

Commissioner of Patents