STRUCTURE BUILDING TOY

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ABSTRACT

A toy structure building apparatus includes a plurality of connector members attached to a plurality of structural members. Each connector member has a pin portion and a retention element located on an external surface of the pin portion. The apparatus further includes a plurality of connectors, each connector having an aperture for receiving the pin portion of a connector member and a detent member disposed within the aperture. The detent member is adapted to lockingly engage the retention element and includes a flexible elongated locking element extending in a direction substantially parallel to the central axis of the pin portion when the detent member is lockingly engaged to the retention element. The pin portion is selectively insertable into the aperture to couple and uncouple the structural members to each other to build a toy structure.
Fig. 7.
Fig. 8.
Fig. 18.
STRUCTURE BUILDING TOY

FIELD OF THE INVENTION

[0001] The invention relates generally to a toy and in particular to a building toy.

BACKGROUND

[0002] “Fort building” is a universally loved activity among kids of all ages. Typically, the child uses existing pieces of furniture, such as couches and chairs, and bed sheets as the building materials for the fort. The child then creates a fort space by draping the sheet(s) over the furniture so that a space is created. It is desirable to provide a toy that permits the child to expand his fort building capabilities into a variety of configurations. Thus, it is desirable to provide a superfut toy and it is to this end that the present invention is directed.

SUMMARY

[0003] This summary is provided to introduce a selection of concepts in a simplified form that are further described below in the Detailed Description. This summary is not intended to identify key features of the claimed subject matter, nor is it intended to be used as an aid in determining the scope of the claimed subject matter.

[0004] The structure building toy is an activity toy that allows kids to imagine and build structures, including but not limited to fort-like objects, boats, spaceships, submarines, castles and the like, that become vehicles or other play environments for escape into a land of pure creative fantasy. The structure building toy is unique in its use of a familiar material, such as foam noodles. Using the foam noodle as a ‘building block’ allows for tremendous freedom in construction, while being inexpensive, safe and fun. The structure building system includes innovative magnetic connectors that playfully assemble and disassemble the noodles with a satisfying click. The structure building system is designed to radically expand the creative potential of kids building spaces. The structure building toy may include innovative “landscape mats” which are Bendable wire frames encased in fabric that fold out and may be connected together using base connectors. These landscape mats provide for additional stability for building larger structures as well as can be connected in a grid pattern to ease construction of certain structures. In an alternative embodiment, the landscape mat has floating metal disks, encapsulated between two layers of fabric wherein this embodiment of the landscape mat allows limitless possibilities for magnetic coupling to the floor and the landscape mat doubles as a roll-up storage system where all of the pieces can be inserted and simply stowed away. The structure building toy in accordance with the invention may also be used to build a structure without the landscape mat.

[0005] In order to fully catalyze a fantasy play experience, the structure building toy may include colorful fabric panel ‘skins’ to enclose the newly-created noodle space. The structure building toy may also have several of the fabric panels feature port holes with mesh so that children can look out of the port holes without easily being seen. Additionally, the mesh provides safety by preventing children from putting their heads through the port holes. In an alternative embodiment, the structure building toy may include multi-function “port holes” that foster creative expression wherein the port holes may be made of a clear material and the structure building toy may come with a set of picture cards that can be slide into the window from the inside to customize the play-space and enhance the fantasy and “spy” experience. For example, the pictures may include a power reactor core, a view into space, an under sea view, submarine’s periscope view, instrumentation panels etc. The clear vinyl windows can also act as a see-through pocket where pictures, drawings and precious items can be stored. The structure building toy may also have a solid/rigid panel that can be clipped onto the structure members.

[0006] Thus, a structure building apparatus is provided. The apparatus has one or more landscape mats having a plurality of connection areas to which a base connector can be connected. The apparatus also has a set of structural members that may be connected to any of the base connection areas and a set of connectors that couple the structural members to each other in order to build a structure using the mat, structural members and connectors. Further, the structure building system includes fabric that may be attached to the structural members in order to enclose spaces (or to create a wall of the structure) created by interconnected structural members and connectors.

DESCRIPTION OF THE DRAWINGS

[0007] The foregoing aspects and many of the attendant advantages of this invention will become more readily appreciated as the same become better understood by reference to the following detailed description, when taken in conjunction with the accompanying drawings, wherein:

[0008] FIG. 1A is a diagram illustrating an embodiment of a structure building toy in accordance with the invention;

[0009] FIGS. 1B1 and 1B2 are diagrams illustrating a preferred embodiment of a port hole that is part of the structure building toy;

[0010] FIG. 2A is a diagram illustrating details of an exemplary landscape mat that may be part of the structure building toy;

[0011] FIG. 2B is a diagram illustrating details of an example of an alternative embodiment of the landscape mat that may be part of the structure building toy;

[0012] FIGS. 3A1-3A3 are diagrams illustrating details of a set of connector devices that may be part of the structure building toy;

[0013] FIG. 3B is a diagram illustrating details of an alternative embodiment of a set of connector devices that may be part of the structure building toy;

[0014] FIG. 4 is a diagram illustrating details of a bottom portion of the alternative embodiment of the landscape mat shown in FIG. 2B;

[0015] FIG. 5 is a diagram illustrating details of a structural member that may be part of the structure building toy;

[0016] FIG. 6 is a diagram illustrating more details of the alternative embodiment of the base connector mechanism that may be part of the structure building toy;

[0017] FIG. 7 is a diagram illustrating more details of an alternative embodiment of the five way floor connector mechanism that may be part of the structure building toy;

[0018] FIG. 8 is a diagram illustrating more details of the alternative embodiment of the six-way connector mechanism that may be part of the structure building toy;

[0019] FIGS. 9A-9D are diagrams illustrating an example of a clip mechanism of the structure building toy;

[0020] FIG. 10 is an isometric view of a connector member in accordance with an alternative embodiment of the structure building toy shown in FIG. 1;
FIG. 11 is an isometric view of a six-way connector in accordance with an alternative embodiment of the structure building toy shown in FIG. 1;

FIG. 12 is an exploded isometric view of the six-way connector shown in FIG. 11;

FIG. 13 is a partial sectional view of the six-way connector shown in FIG. 11;

FIG. 14 is an isometric view of a “Y” connector in accordance with an alternative embodiment of the structure building toy shown in FIG. 1;

FIG. 15 is an exploded isometric view of the “Y” connector shown in FIG. 14;

FIG. 16 is an isometric view of a “C” connector in accordance with an alternative embodiment of the structure building toy shown in FIG. 1;

FIG. 17 is an exploded isometric view of the “C” connector shown in FIG. 16;

FIG. 18 is an isometric view of a base connector in accordance with an alternative embodiment of the structure building toy shown in FIG. 1; and

FIG. 19 is an exploded isometric view of the base connector shown in FIG. 18.

DETAILED DESCRIPTION

The invention is particularly applicable to a structure building toy that uses the particular materials and connectors described below and it is in this context that the invention will be described. It will be appreciated, however, that the structure building in accordance with the invention has greater utility, since the structure building toy may use other elements including other structural elements and connectors and the structure building toy may be utilized for various applications other than building a fort for a child and these variations, such as building various other structures, are within the scope of the invention.

FIG. 1A is a diagram illustrating an embodiment of a structure building toy 10 in accordance with the invention. The structure building toy, in a preferred embodiment, is used to build a fort as shown in FIG. 1 although the structure building toy may be used to create various other structures that are within the scope of the invention. The structure may be built on a landscape mat (not shown) that has two different embodiments. The preferred embodiment of the landscape mat is shown in FIG. 2A while an alternative embodiment of the landscape mat is shown in FIGS. 2B and 4. In accordance with the invention, the structure may also be built without using the landscape mat. The structure may be built using one or more connectors 12 that connect one or more structural members 14 together and/or connect a structural member 14 to the mat as shown in more detail in FIGS. 6 and 7. Once the structure is created using the mat, connectors and structural members, a sheet 16 of material may be placed over the structural members to create the internal space of the structure, such as the space on the interior of a fort. The sheets of material 16 may have different colors, patterns and fabrics to provide different fantasy experiences of the child. In one embodiment, each sheet of material may include a clip mechanism so that the sheet can be clipped onto the structural members. An example of a clip mechanism that may be used with the structure building system in accordance with the invention is described below with reference to FIGS. 9A-9D. The toy may be sold with one or more pieces of material 16 wherein some of the pieces of material may incorporate a porthole 18.

FIGS. 131 and 132 illustrates a preferred embodiment of the port hole 18 wherein the port hole 18 is formed in a sheet 16 wherein the port hole has mesh covering the port hole. The mesh allows the user to look out of the port holes without easily being seen and provides safety by preventing the users from putting their heads through the port holes. FIG. 132 shows the sheet 16 with the port hole 18 attached to one or more structural members in accordance with the invention.

In an alternative embodiment of the port hole 18 shown in FIG. 1A, the port hole 18 may further comprise a clear portion 20 and a skin portion 22 surrounding the clear portion. The port holes foster creative expression. When the alternate embodiment of the port hole 18 is used, the toy 10 may further comprise a set of picture cards 24 that can be slid into the clear portion 20 of the port hole 18 from the inside to customize the playscape and enhance the visual experience. For example, the set of picture cards may include a set with view of the inside of an aircraft/helicopter in the air, a set for an outer space fantasy, a set for an underwater fantasy, a set for a castle/medieval fantasy and a set for a science fiction instrument panel. The clear portions 20 may also act as a see-through pocket where pictures, drawings and precious items can be stored.

FIG. 2A is a diagram illustrating a preferred embodiment of a landscape mat 30 that may be used with the structure building toy 10. An alternative embodiment of the landscape mat 30 is shown in FIG. 2B and described below. The landscape mats shown in FIGS. 2A or 2B may or may not be used to build a structure using the structure building toy 10. The landscape mats may provide additional stability for building larger structures as well as can be connected in a grid pattern to ease construction of certain structures. Returning to FIG. 2A, the preferred embodiment of the landscape mat 30 may be a bendable wire frame encased in fabric that fold out and may be connected together using base connectors 36. In a preferred embodiment, the toy 10 may have two landscape mats 30 wherein each landscape mat has a wire frame 31 that is 0.09375 inch thick formed spring steel wire and the fabric of the landscape mat is a 185T polyester fabric with a fire retardant treatment.

In order to use the landscape mat 30 shown in FIG. 2A, the user opens the landscape mat so that it is flat and then the user attaches a base connector 36 to each corner of the landscape mat 30 by sliding the corner of the landscape mat into the edge of the base connector 36. The corner of the landscape mat has rigidity due to the wire frame. The base connector has one or more pliable projections with ridges on the underside wherein the projections are positioned above a parallel platform of plastic so that a friction/pressure fit is achieved when the landscape mat is slid between the projection and the parallel platform. Next, a connector 42 is connected to the base connector 36 and then a structural member 14 may be connected to the connector 42. This process is repeated until the desired structure using the structural members 14 is formed. In this embodiment, the structure building toy may include a bag (with Velcro) into which the landscape mat (when folded up like a sunshade), the structural members and the remainder of the components may be transported and stored.

FIG. 2B is a diagram illustrating details of a top side of the alternative embodiment of the landscape mat 30 that is part of the structure building toy. The mat is the base of which the structure is built. The mat 30 may comprise one or more attachment mechanisms 32, such as Velcro tabs or a suction
cup in a preferred embodiment, that secure the mat 30 to the surface on which the structure is to be constructed. The surface on which the structure may be constructed in typically a floor, but may also be a wall. FIG. 2B illustrates an example of the mat 30 having particular dimensions, but the mat is not limited to any particular size or shape. The mat 30 further comprises one or more connection points/areas 34 having a base connector mechanism 36 into which a structural member is connected. The mat may further comprise a top portion 38 and a bottom portion 40 wherein the base connector mechanisms 36 are located in between the top portion 38 and bottom portion 40 so that the base connector mechanisms 36 are relatively fixed with respect to each connection area 34. However, the base connector mechanisms may move within its connection area to provide an almost limitless number of variations on the position of the base connector. In a preferred embodiment, the top portion 38 may be a fine mesh material with perforated fabric and the bottom portion 40 may be fabric.

[0037] FIGS. 3A1-3A3 are diagrams illustrating details of a set of connector devices that may be part of the structure building toy. The set of connectors may include the base connector 36 and the six-way connector 42. The base connector 36 may be made of an ABS material and may preferably include a metal tip portion 37 that fits into the base connector 36 as shown. Each base connector may further include one or more projections 39 on each side of the base connector that are used to connect the landscape mat to the base connector. The base connector 36 may also have textured regions 41. As described above, the projections may have ridges on the underside so that the landscape mat is friction fit into the base connector.

[0038] As shown in FIG. 3A2, the connector 42 may connect up to six structural members or five structural members and the base connector 36 of the landscape mat. The connector 42 may be preferably made of an ABS material and have textured outer bumps 42a. In a preferred embodiment, the connector 42 may have an upper portion 42b and a lower portion 42c that are secured to each other (preferably by sonic welding) with a magnetic portion 42d within the interior of the connector.

[0039] FIG. 3A3 illustrates the magnetic portion 42d in more detail wherein the magnetic portion preferably comprises a magnet (preferably neodymium) 42d that is sandwiched between a first plate 42f, preferably stamped nickel-plated steel and a second plate 42g. Each plate may have a hole in the middle. The plates with the holes distribute the magnetic field of the magnet along the X, Y, and Z axes and the size and configuration of the hole controls the amount of the magnetic field that is redistributed along the Z axis. Thus, the combination of the magnet with the plates causes the magnetic field of the magnet to be redistributed to the edges of the plates so that the magnetic portion 42d provides a magnetic field that is distributed along the X, Y, and Z axes.

[0040] FIG. 3B is diagram illustrating details of an alternate embodiment for the set of connector devices that are part of the structure building toy. The structure building toy may be implemented using other or additional connector devices not described herein but that would be known alternative connectors that perform the same function as the connector devices shown. In particular, the set of connector devices may include the base connector mechanism 36, a six-way connector mechanism 42 and a five way floor connector mechanism. More details of each of these mechanisms is described with reference to FIGS. 6, 7 and 8, respectively. Each connector in this alternative embodiment of the invention, has a magnet 46 captured within the connector to achieve the desired magnetic coupling. An exemplary magnet may be a neodymium magnet, but other types of magnets are within the scope of the invention. The base connector mechanism 36 is used to magnetically couple and attach a structural member to the mat, the six-way connector mechanism 42 is used to connect up to six structural members to each other and the five way floor connector mechanism 44 is used to connect the mat and up to five structural members to each other. The alternative embodiment of the base connector mechanism 36 and the five way floor connector mechanism 44 may also have a magnet located at the bottom that connects these connectors to the alternative embodiment of the landscape mat. In this manner, the set of connectors provide the user with great flexibility in that a structural member may be connected to each other and to the mat in various different orientations. Furthermore, since the mat shown in FIG. 2B has a plurality of connection areas, the building structures that may be constructed using the toy 10 is almost limitless.

[0041] In the two embodiments described above, each connector may be a magnetic connector although other types of connectors, such as various types of mechanical connectors, are within the scope of the invention. For example, a mechanical connector or friction fit connector is also within the scope of the invention. As an example, the connector 42 may be a connector with four tubes wherein the diameter of each tube is slightly smaller than the diameter of the plastic tip of each structural member so that the plastic tip of a structural member may be inserted into the tube to create a friction fit between the structural member and the tube.

[0042] FIG. 4 is a diagram illustrating details of the bottom portion 40 of the alternative embodiment of the landscape mat 30 shown in FIG. 2B. A bottom surface of the mat 30 may have one or more storage units 50, such as pockets, into which some or all of the part of the toy, including the structural members and connectors may be stored. In a preferred embodiment, there may be one large pocket and two small pockets with Velcro closures 52. Alternatively, the storage units may hold the connectors only. Thus, the mat 30 also functions as a roll-up storage system where all of the pieces can be inserted and simply stowed away.

[0043] FIG. 5 is a diagram illustrating details of the structural member 14 that is part of the structure building toy. In accordance with the invention, the structural member may include a rigid structural member 54 and a flexible structural member 56. In a preferred embodiment, the structural members may be made of a foam material, such as expanded polyethylene (EPE) foam that has good flexibility and limited memory so that the structural member returns to its original shape although other materials for the structural members are also within the scope of the invention. For example, each structural member may also be made out of rubber, injection molded plastic (ABS) or some form of metal. The rigid structural member 54 may include a rigid core 58, such as a plastic (ABS plastic tube) or a metal rod. The flexible structural member 56 does not have the rigid core. Each structural member further comprises a connector insert 60 that permits the structural member to be connected to the mat or other structural members using the connectors shown in FIG. 3. In a preferred embodiment, the connector insert 60 may include an insert 62 (that may be inserted into the end of the structural member), such as a plastic insert, with a magnetizable tip 64,
such as a metal tip, so that the structural member may be magnetically coupled/connected to one of the connectors shown in FIG. 3. In some embodiments, the plastic insert may be made of an ABS plastic material and may be glued into the end of the structural member. In other embodiments, the plastic insert may be made of an ABS plastic material and may have a set of threads so that the plastic insert may be screwed into the end of the structural member.

[0044] FIG. 6 is a diagram illustrating more details of the alternative embodiment of the base connector mechanism 36 that is part of the structure building toy. In the example shown in FIG. 6, the rigid structural member 54 is inserted into and magnetically coupled to the six-way connector 42 which is in turn inserted into and magnetically coupled to the base connector mechanism 36. FIG. 7 is a diagram illustrating more details of the alternative embodiment of the five way floor connector mechanism 44 that is part of the structure building toy wherein the five way connector is magnetically coupled to the mat 50 and one or more structural members 14 as shown. FIG. 8 is a diagram illustrating more details of the alternative embodiment of the six-way connector mechanism 42 that is part of the structure building toy wherein the six-way connector mechanism is magnetically coupled to one or more structural members 14 that have the insert 62 and the magnetizable tip 64.

[0045] For the preferred embodiment of the invention that uses the landscape mat 30 shown in FIG. 2A, the structure building toy provides many advantages. For example, the landscape mat 30 shown in FIG. 2A provides a good foundation for the structure since the base connectors are hard to tip over since they have a wide bottom and a low center of gravity. In addition, since the base connectors are connected to the corners of the landscape mat 30, the mat stabilizes the base connectors. The landscape mat 30 shown in FIG. 2A also helps the user to start a structure since it often hard for a user to start building without some starting point. The landscape 30 shown in FIG. 2A can also be connected together to create a variety of base layouts.

[0046] For the alternative embodiment of the structure building toy 10 that uses the landscape mat shown in FIG. 2B, the structure building toy provides many advantages. For example, the mat allows for true “analog” structure. Most typical construction systems have a rigid “grid” of some kind that is imposed upon the child. Legos is an example of a typical system in that, once the first brick is set down, all other brick possibilities are pre-determined. Unlike these typical systems, each structural member of the structure building toy has truly infinite movement, and therefore all subsequent pieces can actually occupy any place so that there is no limit to what can be constructed using the inventive system. Furthermore, since the structural members of the construction system are flexible, the structural members can be used to create both rectilinear and organic constructions (frame based, or curved/circular). In addition, the mat may be used on any 2 dimensional surface including the floor, wall or any other surface. The clip system allows for pre cut pieces of fabric 16 with simple geometries to form fit to an infinite number of construction shapes.

[0047] The structural members in accordance with the invention are both flexible, but also sufficiently rigid to form a connection point. In a preferred embodiment, each structural member has a flexible foam member with a solid mechanical joint at each end. In a preferred embodiment, the solid mechanical joint is a plastic tip with a metal tip that enables the structural members to be magnetically coupled. In accordance with the invention, the mechanical coupling may also be a friction or interference (snap) fit.

[0048] As described above, the mat has the base connectors encapsulated in the mat so that the base connectors can slide around within their quadrants and enable a nearly infinite number of floor connector positions. The mat may also be used as a storage bag and the mat can be affixed (Velcro, suction cups) to the floor. The windows in the material may be used as pockets for interchangeable images to help decorate the inside of the space. (i.e.: if the kid builds a helicopter, the image in the window looks like she is peering out of the window from the cockpit).

[0050] FIGS. 9A-9D are diagrams illustrating an example of a clip mechanism of the structure building toy. A clip mechanism 100 is a resilient material so that it can be attached around a structural member to secure a piece of fabric to the structural members as shown in FIG. 9D wherein the fabric sheet may be laid over the structural member and then the clip mechanism is slid over the fabric sheet and structural member to hold the sheet on the structural member. FIGS. 9B and 9C show the clip mechanism in a top view and sectional view along line A-A. In a preferred embodiment, the clip mechanism may be injection molded polypropylene. FIGS. 9B and 9C illustrate the dimensions of a preferred embodiment of the clip mechanism. In accordance with the invention, the clip mechanism may be implemented using other known techniques for attaching a piece of fabric sheet to a structural member and those other known techniques are within the scope of the invention.

[0051] As shown in FIGS. 10-19, an alternate embodiment of the structure building toy uses connector members 110 in conjunction with various connectors 130, 160, 190, and 220 to removeably couple the structural members 14 to each other. Two or more structural members 14 are coupled to each other by securing at least one connecting member 110 to each structural member 14 and then coupling the respective connecting members 110 to a common connector 130, 160, 190, and 220.

[0052] Referring to FIG. 10, one embodiment of a connector member 110 includes an insert portion 112 at one end to secure the connector member 110 to a structural member 14. The insert portion 112 includes a cylindrical pin 114 with external threads 116 formed thereon. The insert portion 112 is coupled to the structural member 14 by threadedly engaging the insert portion 112 of the connector member 110 with the structural member 14. In one embodiment, the structural member 14 includes a preformed aperture with internal threads to engage the insert portion 112. In an alternate embodiment, the threads 116 of the insert portion 112 are “self tapping” threads that can be secured to any portion of the structural member 14 by simply screwing the insert portion 112 into a surface of the structural member 14. The threads are optionally formed to have a frustoconical arrangement to more securely couple the insert portion 112 to the structural member 14. Further, the insert portion 112 may optionally include one or more bars 124 extending radially from the threads 116 to further secure an installed insert portion 112 to the structural member 14.

[0053] The connector member 110 also includes a pin portion 118 located opposite the insert portion 112 to secure the connector member 110 to any one of a variety of connectors 130, 160, 190, and 220, which are described in detail later.
The pin portion 118 includes a shaft 120 and a retention element 122. The central axis of the shaft 120 is preferably coincident with the central axis of the cylindrical pin 114 of the insert portion 112, although embodiments in which the shaft 120 and the cylindrical pin 114 are oriented at an angle relative to each other are contemplated. In the embodiment shown in FIG. 10, the shaft 120 has a generally octagonal cross-section. As described in detail later, the aperture of the connector into which the shaft 120 is inserted has a shape similar to the cross-section of the shaft 120. As a result, when the pin portion 118 is inserted into the aperture, the aperture engages the faces of the shaft 120 to prevent the shaft 120 from rotating relative to the aperture. In the illustrated embodiment, the faces of the shaft 120 are formed to be slightly concave. The apertures of the connectors have a complementary shape to provide better engagement between the shaft 120 and the aperture, further constraining the shaft 120 against rotation relative to the aperture and thus, the connector 130, 160, 190, and 220. Preventing relative movement between the connector member 110 and the connector 130, 160, 190, and 220 in this manner allows for a more stable structure that is less prone to racking. While a shaft 120 having an octagonal cross-section with slightly concave faces is disclosed, it should be appreciated that the shaft 120 may have a cross-section of any suitable shape, including round, square, triangular, clover-shaped, and figure-8, etc., without departing from the scope of the disclosure.

As best shown in FIG. 12, the six-way connector 130 has an upper portion 136 and a lower portion 138, which cooperate to define the outer surface of the connector 130. The upper portion 136 and the lower portion 138 are preferably made from a polymeric material, such as acrylonitrile butadiene styrene (ABS), but any suitable material, such as metal, wood, or composites, may be used. The upper portion 136 and lower portion 138 are secured to each other using any suitable means known in the art, such as adhesives, mechanical fasteners, interference fit, snap-fit, ultrasonic welding, etc. Depending upon the method used to secure the upper portion 136 and lower portion 138 to each other, the upper portion 136 may be identical to the lower portion 138, i.e., a single part may be used for both portions.

Still referring to FIG. 12, a retainer insert 140 is disposed between the upper portion 136 and the lower portion 138 of the connector 130. The retainer insert 140 includes a plurality of detent members 142 arranged so that one detent member 142 is positioned adjacent to each aperture 132 in the interior portion of the connector 130. Each detent member 142 includes two flexible elongated locking elements 144 extending inwardly from the aperture. The locking elements 144 are oriented substantially parallel to and on opposite sides of the central axis of the pin portion 118 of a connector member 110 when the pin portion 118 is inserted into the adjacent aperture 132. A protrusion 146 is located on each locking element 144 and extends inward toward the central axis of pin portion 118 so that the protrusion 146 interferes with the shaft 120 of the pin portion 118 when the pin portion 118 partially inserted into the aperture 132. While the disclosed retainer insert 140 is preferably made from a flexible, durable polymer, such as acetal, any material having sufficient strength, flexibility, and durability may be used without departing from the scope of the disclosure.

It should be appreciated that various embodiments of the retainer insert 140 are contemplated and are within the spirit and scope of the disclosure. For example, although the illustrated embodiment shows each detent member 142 having two locking elements, alternate embodiments of the retainer insert 140 may include a different number of locking elements 144, as well as differently positioned locking elements 144. In another alternate embodiment, the locking elements 144 may be integral with the upper portion 136 and lower portion 138, eliminating the need for a separate retainer insert 140.

FIG. 13 shows a partial cross-sectional view of a six-way connector 130 being used to connect two structural members 14 at right angles to each other. The insert portion 112 of a connector member 110 inserted into the end of each structural member 14 so that the threads 116 of the insert portion 112 secure the connector member 110 to the structural member 14.

The pin portion 118 of each connector member 110 is inserted into an aperture 132 of the connector 130. As the pin portion 118 is inserted into the aperture 132, the pin portion 118 engages the detent member 142 adjacent to that aperture 132. More specifically, the end of the pin portion 118 contacts the protrusion 146 on each of the locking elements 144, which causes the locking elements 144 to temporarily deform outward, away from the central axis of the pin portion 118. The axial force required to deform the locking members 144 outward can be increased or decreased by varying the radius or chamfer on the end of the pin portion 118. The pin portion 118 continues to move into the connector 130 until the...
retention element 122 is positioned next to the protrusions 146 on the detent member 142. When the retention element 122 reaches the protrusions 146, the deformed locking elements 144 move back towards their undeformed, i.e. neutral, position, which causes the protrusions to engage the groove that forms the retention element 122. The engagement of the retention element 122 by the protrusions 146 of locking elements 144 is accompanied by a audible signal, such as a click or snap, as well as a tactile sensation that lets the user know that the connector member 110 is lockingly engaged to the connector 130.

[0062] When a connector member 110 is lockingly engaged to the connector 130, the detent member 142 constrains the pin portion 118 against axial movement. At the same time, the surface of the pin portion 118 cooperates with the aperture 132 to constrain the pin portion 118 against rotational movement about the central axis of the pin portion 118. Constraining the relative motion between the connector members 110 and the connectors 130 in this manner provides stable connections between structural members 14, which in turn enables a user to build a structure having improved stability.

[0063] To disengage a structural member 14 from the connector 130, an axial force is applied to the connector member 110. The axial force disengages the detent member by causing the protrusions 144 to contact a side surface of the retention element 122, i.e. the groove, which forces the locking elements 144 apart until the protrusions 144 no longer extend into the groove. The axial force required to disengage the locking members 144 from the groove can be increased or decreased by varying the radius of chamfer on the side surface of the groove. With the detent member 142 disengaged, the pin portion 118 can be freely removed from the aperture 132 to decouple the structural member 14 from the connector 130.

[0064] Numerous embodiments of connectors utilizing the previously described detent members are contemplated to provide a variety of different connections between structural members 14. While several such connectors are described hereinafter, these embodiments should be viewed as exemplary and should not be considered to limit the scope of the disclosed subject matter.

[0065] FIGS. 14 and 15 show a “Y” shaped connector 160 in accordance with one embodiment of the disclosure. The connector 160 includes five outer bumps 164, three of which are located to form a triangle. The remaining two outer bumps 164 are located on opposite sides of the triangle formed by the first three bumps 164. Apertures 162, which are adapted to receive the pin portion 118 of a connector member 110, are located on four of the five outer bumps 164. The fifth outer bump 164 has a shaft 170 extending therefrom. The shaft 170 has a size and shape similar to the pin portion 118 of a connector member 110 and includes a retention element 172. Similar to the pin portion 118 of a connector member 110, the shaft 170 of the “Y” shaped connector 160 can be inserted into an aperture of another connector 130, 160, 190, and 220 to lockingly engage the “Y” shaped connector 160 to the other connector. In an alternate embodiment, the connector 160 has a fifth aperture 162 adapted to receive the pin portion 118 instead of the above-described shaft 170. This allows a fifth connector member 110, and therefore a fifth structural member 14, to be removably coupled to the connector 160.

[0066] A forward portion 166 and a rear portion 168 cooperate to define the outer surface of the connector 160. A retainer unit 174 is disposed within the connector 160 and includes four detent members 176, each detent member 176 being similar to the detent members 142 of the six-way connector 130 and being positioned adjacent to an aperture 162 to lockingly engage the pin portion 118 of a connector member 110 inserted into the aperture 162. The forward portion 166, rear portion 168, and retainer insert 174 are made and assembled with materials and methods similar to their corresponding parts in the six-way connector 130.

[0067] FIGS. 16 and 17 illustrate another embodiment of a connector, wherein the connector is a “C” shaped connector 190 capable of providing lateral support to a structural member 14. The “C” shaped connector 190 includes a front portion 194 and a rear portion 196 that cooperate to define the outer surface of the connector 190. An aperture 192 is located on a bottom portion of the connector 190 and is sized to receive the pin portion 118 of a connector member 110. A retainer insert 200 is disposed within the connector 190 and has a detent member 202 positioned adjacent to the aperture 192 to lockingly engage a pin portion 118 inserted therein. The upper portion of the connector 190 forms in a “C” shaped channel 198 having an inner diameter sized to be approximately the same as the outer diameter of a structural member 14. As a result, the channel 198 is selectively attachable to a central portion of a structural member 14 to provide lateral support thereto. A plurality of protrusions 206 are located on the inner surface of the channel 198 to constrain a structural member 14 attached thereto against rotation.

[0068] Referring to FIGS. 18 and 19, another embodiment of the disclosed connector is a base connector 220. The base connector 220 includes five apertures 222, each aperture 222 being adapted to receive the pin portion 118 of a connector member 110 to lockingly engage a structural member to the connector 220. One of the apertures 222 is positioned to receive a pin portion 118 so that the associated structural member 14 is maintained in a substantially vertical position. The remaining four apertures 222 are positioned so that the attached structural members 14 extend radially from the connector 14 in a substantially horizontal orientation. Although the disclosed apertures 222 are described to be orthogonal to each other, alternate embodiments of the base connector 220 may include any number of apertures 222, which may in turn have various different orientations.

[0069] An upper portion 226 and a lower portion 228 define the outer surface of the base connector 220. A retainer insert 230 is disposed within the connector 220 and includes a detent member 232 positioned adjacent to each aperture 222. A plurality of extensions 238 extend radially from the lower portion 220 of the connector 230 and define a generally flat bottom surface 236. In use, the base connector 230 rests on the flat bottom surface to provide a base to which structural members 14 can be lockingly engaged. The extensions 238 are sized and positioned to provide sufficient stability to a building structure supported by the base connector 220. Pads formed from an elastic polymeric material, such as rubber, may optionally be attached to the bottom surface 236 of the connector 230, including the extensions 238. The pads increase the stability of the connector and also provide greater traction between the connector 230 and floor, thereby reducing the likelihood that the connector 230 will slide on a floor surface.

[0070] While the foregoing has been with reference to particular embodiments of the disclosed subject matter, it will be
appreciated by those skilled in the art that changes in these embodiments may be made without departing from the spirit and scope of the disclosure.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A toy structure building apparatus, comprising:
   (a) a plurality of structural members;
   (b) a plurality of connector members, each of the plurality of connector members comprising a pin portion with a central axis and a retention element located on an external surface of the pin portion; and
   (c) a plurality of connectors, each of the plurality of connectors comprising:
      (i) an aperture adapted to receive the pin portion; and
      (ii) a detent member disposed within the aperture and adapted to lockingly engage the retention element, the detent member comprising a flexible elongated locking element extending in a direction substantially parallel to the central axis of the pin portion when the detent member lockingly engages the retention element, wherein the pin portion is selectively insertable into the aperture to removably couple the structural members to each other to build a toy structure.

2. The apparatus of claim 1, wherein the retention element comprises a recess in the external surface of the pin portion of the connector member.

3. The apparatus of claim 2, wherein the recess is a circumferential groove.

4. The apparatus of claim 1, wherein the detent member further comprises a protrusion positioned to extend into the recess in the external surface of the pin portion of the connector member.

5. The apparatus of claim 1, wherein the flexible elongated locking element of the connector is adapted to temporarily deform to receive the pin portion of the connector member into the aperture of the connector and to resume its original shape thereafter to lockingly engage the retention element of the connector member.

6. The apparatus of claim 1, wherein the connector member further comprises a threaded insert portion, the threaded insert portion being adapted to attach the connector member to one of the plurality of structural members by threadedly engaging the structural member.

7. The apparatus of claim 1, wherein at least one of the plurality of connectors is a base connector, the base connector having a substantially flat bottom surface.

8. The apparatus of claim 7, wherein the substantially flat bottom surface is defined by a plurality of protrusions extending laterally from the base connector.

9. The apparatus of claim 1, wherein the connector further comprises a C-shaped portion, the C-shaped portion being adapted to receive one of the plurality structural members and to provide support to a lateral portion of the received structural member.

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