ABSTRACT: In a scale building set there is provided a plurality of building elements dimensionally related to conform to a selected scale having interlocking socket and beaded joint portions which may be assembled into a wide variety of composite structures including scale model buildings. The socket joint portion is slotted for insertion of the beaded joint portion and firmly grips the beaded joint portion to hold the elements in particular angular relation while at the same time permitting substantial forced rotational and sliding movement between elements. One of the elements is a flat panel which may be of a variety of geometric shapes and another of the elements is a connector of preselected lengths having plural joint portions arranged in angular spaced relation to one another about a common midpoint.
SCALE BUILDING SET AND ELEMENTS

SPECIFICATION

This invention relates to new and improved scale building sets and elements. A variety of structural building sets composed of basic structural elements have heretofore been provided which permit the user to produce toy or scale model composite structures. In the past, these elements have sometimes been lacking in durability and mechanical strength and also have not afforded a great degree of versatility in composite structures as is sometimes desired. In addition they have not been entirely satisfactory for all applications and particularly in the construction of scale model architectural buildings.

Accordingly it is an object of this invention to provide a novel set of scale building elements which are easily assembled and disassembled and form a variety of composite structures with full harmony between the assembled elements.

Another object of this invention is to provide a new and improved set of scale building elements which include cooperative joint portions on the elements arranged to firmly join together, while permitting substantial forced rotation and slidable movement therebetween.

It is still another object of this invention to provide interlocking elements dimensionally related to conform to a selected scale for making scale composite structures which may be easily and economically produced in a wide variety of geometrical shapes to form composite structures of a variety of configurations.

Yet a further object of this invention is to provide scale building elements for forming scale model architectural buildings and the like which provide a wide versatility in the shape and configuration of the built-up units.

In accordance with the present invention there is provided a basic elements dimensionally related to conform to a selected scale arranged with joint portions which interlock firmly to hold the elements in a particular angularly disposed relationship to one another, and yet will rotate and slide in relation to one another. Panel elements are formed of any of a variety of geometric shapes such as squares, rectangles, triangles, polygons and the like which when connected together will make two- and three-dimensional composite structures, with complete harmony between all elements. The connector elements between the panels are preferably of an extruded plastic material and may be arranged with several joint portions, either socket or beaded, on a central body which provides either right-angle, two-way, three-way and four-way connections as required for a particular structure.

Other objects, advantages and capabilities of the present invention will be more apparent as the description proceeds taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a perspective view of a partially completed scale model building made up of a set of building elements embodying features of the present invention.

FIG. 2 is an upper corner of one room of the building shown in FIG. 1 illustrating a typical three-dimensional composite structure.

FIG. 3 is a fragmentary end elevation view of the room shown in FIG. 2 with portions broken away to show interior parts.

FIG. 4 is an end view of a roof of the building shown in FIG. 1.

FIG. 5 is a cross-sectional view taken along lines 5-5 of FIG. 4 showing a trim element.

FIG. 6 is an enlarged cross-sectional view of a four-way connector used in the building shown in FIG. 1 having socket joint portions connected to beaded joint portions on the panel members.

FIG. 7 is a cross-sectional view of a three-way connector and panels connected thereto of the type shown in FIG. 6.

FIG. 8 is a cross-sectional view of a two-way connector and connected panels of the type shown in FIG. 6.

FIG. 9 is a cross-sectional view of a right-angle connector and connected panels of the type shown in FIG. 6 with the direction of pivotal movement indicated by arrows.

FIG. 10 is a cross-sectional view of another form of two-way connector having socket portions arranged about a central hinged-type body.

FIG. 11 is a cross-sectional view of a three-way connector similar to that shown in FIG. 10.

FIG. 12 is a fragmentary elevation view of another form of structure including a panel element having socket joint portions formed along each side shown interconnected to a second similar panel element by a two-way connector having beaded joint portions.

FIG. 13 is a sectional view taken along lines 13-13 of FIG. 12.

FIG. 14 is a cross-sectional view of an alternative form of four-way connector element having beaded joint portions fastened thereon.

FIG. 15 is a cross-sectional view of a three-way connector of the type shown in FIG. 14.

FIG. 16 is a cross-sectional view of a right-angle connector of the type shown in FIGS. 14 and 15.

FIG. 17 is a cross-sectional view of a modified form of male four-way connector having a central hinged-type body.

FIG. 18 is a cross-sectional view of a three-way connector of the type shown in FIG. 17.

FIG. 19 is a cross-sectional view of a two-way connector of the type shown in FIGS. 17 and 18.

FIG. 20 is an enlarged top plan view of the straight stairway with portions broken away to show interior parts.

FIG. 21 is a side elevational view of the stairway of FIG. 20 with portions broken away.

FIG. 22 is an enlarged fragmentary front elevation view of the spiral stairway with portions broken away to show interior parts and;

FIG. 23 is a sectional view taken along lines 23-23 of FIG. 22.

Referring now to the drawings in FIG. 1 the scale model building 10 comprises composite structures represented as first- and second-story rooms 11 and 12, an overhanging roof 13, a balcony 14 and a handrail 15, a straight stairway 16 and a spiral stairway 17. The basic elements shown in FIGS. 2 through 9 are a panel referred to generally by numeral 21, four-way connector 22, a three-way connector 23, a two-way connector 24 and a right-angle connector 25. Suffix letters are applied to these numerals to distinguish between the same type of elements in the composite structures shown in FIGS. 2 through 5.

As shown in FIGS. 2 and 3 the lower story room is formed of a flat rectangular top panel 21A and flat rectangular side panels 21B and 21C arranged with adjacent edges held together in a spaced relationship at right angles to each other by elongated connectors designated by numeral 25A between panels 21A and 21B, elongated connector 25B between panels 21B and 21C and elongated connector 25C between panels 21A and 21C. The manner of connecting a panel member 21 to a corner of a closed, oblong-shaped room is similar so that the illustration in FIG. 2 applies equally to all closed corners of the rooms shown.

Each panel 21 has a beaded joint portion 26 along side edges thereof and a beveled edge at each corner designated by numeral 27. As is more clearly shown in FIGS. 2 and 3 this beveled edge at the corner of a three-dimensional structure permits the connector, such as 25A, joining the other adjacent two panel members, to extend over the juncture of the three panels to position essentially flush with the third panel 21C to cover this juncture.

The overhanging roof 13 is shown to include a flat rectangular top panel 21D and downturned rectangular panels 21E and 21F rotated to an acute angle in relation to the top panel 21D and secured together by elongated right-angle connectors designated by numeral 25D. The end wall represents a composite structure of several interconnected flat panels shown as three triangular-shaped panels 21G, 21H and 21I held
together by elongated two-way connectors 24A and 24B. The rearward triangular panel 21G is connected to downturned panel 21E by an elongated right-angle connector 25E and the forward triangular panel 21I is connected to downturned panel 21F by elongated connector 25F. An elongated trim member 28 is shown extending across the bottom joint portions of the three triangular panels to connect them together and to align them in an essentially common plane. Each triangular shape panel is shown to have a ball-shaped bead 29 at the apex. This corner may also be of the beveled type as are the rectangular panels shown in FIG. 2. The connectors that are generally coextensive with the associated beaded portions are cut on the ends to accommodate a particular geometric configuration of the composite structure and yet essentially close the sides thereof.

Referring to FIG. 6, the details of the joint portions will now be described. The connector includes a central body 31 having a hollow portion 32 extending throughout its length to save material and reduce the weight. The socket joint portion has arcuate, flexible side extensions 33 and 34 which extend outwardly and beyond the central body 31 and turn inwardly at the ends to extend a semicircular section of the bead portion and define a restricted entrance or slot 35 communicating with an open generally circular socket area therebetween. The arrangement shown has each side extension projecting beyond the semicircular portion of the bead portion designated 31E and, as shown, is approximately 24°. Preferably the connectors are composed of a resilient material and are preferably extruded from a thermoplastic material or may be composed of a molded rubber or rubberlike substance. If they are molded from a flexible plastic or rubber material, the extensions from the body increase in flexibility toward the entrance and are sufficiently pliable at the entrance to permit forcible, but removable, lateral insertion of the bead portion through the entrance into the socket. The panel 21 is a generally thin flat member with flat outer faces 36 and 37 having enlarged beaded joint portions 26 along each outer peripheral edge. The thinness of the panel inwardly of the beaded portion increases the degree of rotation between elements so that the extent of rotation of the thin panel with respect to the connector is in excess of 90°. The contact surfaces of the connector and the beaded portion are correspondingly shaped and generally circular in cross section and concentrically arranged with frictional engagement throughout the circumferential extent of the socket portion. The socket joint portion is of a lesser cross-sectional dimension than the beaded portion and will thereby grip or frictionally engage the beaded portion throughout the circumferential extent of the socket portion. This arrangement holds the members at a particular angularly disposed relationship and may be forcibly rotated one relative to the other. In addition the ends of the extruded connector are open so that the beaded portion may be forcibly slid out of either end of the socket portion if desired.

Referring now to the four basic connectors illustrated in FIGS. 6 to 9, the four-way connector has four identical socket joint portions arranged in an angularly spaced relation on a central body 31; each being disposed at an angle of 90° to an adjacent one and each extending in length in a parallel relation to one another. The length of these socket portions will vary according to the particular structure being formed and may have beveled ends as is apparent from FIGS. 2 and 4. The three-way connector 23 has the same angular spacing for the socket portions as connector 22 with one being removed and the body being rounded for a smooth contour. The two-way connector 24 has two oppositely disposed socket portions similar to that of connector 22 with two rounded sides. The right-angle connector 25 is essentially half of the connector 22, and the panels 21 inserted therein are arranged at an intermediate angular relation but it is apparent that these panels may be rotated form a position where they are parallel to one another or where they are in an end-to-end relation to one another.

The above-described elements have certain dimensional relationships which permit them to conform to a selected scale and provide complete harmony between the elements which make the present invention particularly suitable for scale model buildings and the like.

At the outset a basic unit of length or scale is selected which will herein be referred to as L. In considering the assembly of a composite structure to a particular size or dimension the first reference is to the width of the extrusion as measured at its innermost point between oppositely disposed socket portions and designated X in FIG. 6. Then X is the distance from the midpoint M of the extrusion to the innermost point of the socket portions. When two panels 21 are inserted into the opposite socket portions as shown their innermost edges will be a distance of X apart. The length of a panel for a structure of a particular length L as measured from the midpoint of one extrusion to the midpoint of the next extrusion will be L-X. If two panels of an equal length are to fit in place of one, the length of this panel would be L/2- X and the connector on each side makes the total length L/2. In this manner whatever fraction or multiple of L of a panel is to be the length of the panel will be the structural length as related to L minus the width of the extrusion, as for example 4/4 = -X or 2L-X. This dimensional relationship may be applied to two- and three-dimensional structures shown in the model building of FIG. 1. In practice the dimensional outline for any shape may be made and then the actual panels are formed from the outlines by drawing lines parallel to the dimensional lines but toward the inside of the figure at a perpendicular distance of X/2. For square and rectangular shapes the lengths and widths are reduced by a distance equal to the connector width X. For triangles, polygons and such the determination of panel size must be made from calculations based on trigonometric relationships. For circular shapes or curves, the panel size is determined by a normal to each point on the curve and decreasing or increasing the radius of curvature at that point by X/2. For concave curves, the radius must be increased and for convex curves it must be decreased.

In the model building shown the elements may be easily connected together and disassembled to build a variety of sizes and shapes and portions may easily be lifted off for interior inspection.

Another form of extruded connector is shown in FIGS. 10 and 11 wherein the central body portion 41 tapers inwardly from each socket joint portion 42 to a common midpoint M to provide a hinging movement between the joint portions. A preferred material for this hinge is a polypylene. The two-way socket joint portion of FIG. 10 is in the same position as that of FIG. 8 as would be a four-way socket of this type so that the dimensional relationships above-described are also applicable to these forms. The three-way socket joint portion of FIG. 11 has the socket joint portions 42 angularly spaced at 120° intervals from one another. This construction is particularly useful when the end portion panels are joined at other than right angles to one another because the resilient hinge connection permits a degree of flexibility to allow for other angular arrangements.

FIGS. 12 through 16 show a reversal of the joint portions between the panel and connector elements. FIGS. 12 and 13 show a pair of panel members 43 and 44 connected together by a male connector. The panels shown are flat and of a square shape and have socket portions extending along each side edge. The two-way connector 48 shown has two socket portions 45 angularly spaced at various angles by a central body portion 46 which snaps or slides into adjacent socket portions of the panels and holds them in the manner shown. The relationship of the beaded and socket joint portions of this arrangement are similar to that described above so that there is a firm clamping engagement and may be forced rotational and slidable movement between elements.

FIG. 14 shows a four-way connector 48 of the type suitable for use with panels 43 and 44 including a central body portion having four beaded portions on a central body 51 arranged at
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A three-way connector 52 and a right-angle connector 53 similar to that of connector 48 is also shown in FIGS. 15 and 16. FIGS. 17, 18 and 19 show a four-way male connector 54, a three-way male connector 55 and a two-way connector 56, respectively, having the beaded portions 57 in an angularly spaced relation on a hinge-type central body portion which tapers inwardly from each beaded portion to the midpoint M and joint at the midpoint between the beaded portions in a manner above-described with reference to FIGS. 10 and 11.

Referring now to FIGS. 20 to 23, the stairway structures 16 and 17 of the model building are each shown in more detail and each include a plurality of stair tread elements. Those stair tread elements are in the form of a flat rectangular panel 61 having a recessed portion 62 on each face. A pair of identical, generally spherical beaded portions 63 are arranged on the panel in an opposing relation on opposite ends adjacent one side and a pair of identical socket joint portions 65 are arranged in opposing relation on opposite ends adjacent the other side. These socket portions are disposed in a transverse relation to the edge of the panel as distinguished from the parallel relation of the elements previously described.

The straight stairway structure 16 is shown as supported from a composite roof structure 67 which has a pair of three-way female connectors 23A at adjacent corners. The construction of the stairs is the same so that a description of one side applies to both. An outwardly projecting socket portion 68 of connector 23A holds a beaded portion 69 of a triangular-shaped panel 21J in an upright position. The upper inclined beaded portion 71 of the panel 21J has one socket portion 72 of angle connector 25D fitted thereon. The other socket portion 73 receives and holds the beaded portion 63 to support the stair tread in a generally horizontal manner. In this manner a number of tread elements may be disposed along the socket portion 73. Each of the socket portions 65 on the tread element of FIGS. 20 and 21 have a rod 74 supported in an upright manner thereon.

The spiral stairway structure 17 has an upright rod 75 secured to the building having one of the socket portions 65 fitted thereon to hold the tread element 61 in a horizontal position. These tread elements are rotated on the rod at different angles to form the spiral staircase as shown. Again a short length of rod 74 is disposed in the socket portions 65.

As shown in FIG. 1, the handrail structure 15 is supported at one end on an upright rod 75. Another connector element 77 has a socket portion 77A fitted on the rod and another socket portion 77B at right angles to socket portion 77A holding a horizontal rod 78 which forms the handrail. This socket portion of connector 77 is generally of the same shape as the previously described socket portions only they extend at right angles to one another rather than parallel. As noted in FIGS. 1 and 22, a pair of connectors 77 holds the other handrail rod 78 in a horizontal position of the building.

Although the present invention has been described with a certain degree of particularity, it is understood that the present disclosure has been made only by way of example and that changes in details of structure and system components may be made without departing from the spirit thereof.

What we claim is:

1. In a scale building set, a flat panel element of a selected geometric shape and scale dimension having a beaded, generally circular joint portion along each peripheral edge thereof, and a narrowed weblike panel portion extending inwardly of the beaded joint portion, a connector element having a peripheral socket joint portion for joining a side of said panel element with an adjacent side of another panel element, said socket portions being slotted to form an entrance for insertion of said beaded joint portion and being formed of a yieldable extruded material, said socket portions having opposing side extensions projecting outwardly from a central body and turning inwardly toward one another at their ends to extend beyond a semicircular section of the beaded joint portion, said panel and connector elements being geometrically and dimensionally interrelated to conform to a selected scale wherein smaller panels are interconnected by connector elements to form an assembly having the same external dimensions as a larger panel element, said joint portions having correspondingly shaped mating contact surfaces concentrically arranged and in frictional engagement substantially throughout the circumferential extent of the socket portion to provide uniform frictional engagement between said mating surfaces when one element is rotated relative to the other for clampingly joining said panel and connector elements while permitting forced rotational and slidable movement therebetweeen, said panel element being beveled across each corner, the sides of said joint portions being spaced apart and said panel portion being sized to permit at least 90° of rotation between said elements.

2. In a scale building set as defined in claim 1 wherein said socket portion is open at each end to permit slidable insertion and removal of the beaded portion throughout in the assembly and disassembly of said elements.

3. In a scale building set as defined in claim 1 wherein said connector element is extruded from a plastic material.

4. In a scale building set as defined in claim 3 wherein said connector element has a pair of joint portions arranged in an angularly spaced, generally perpendicular relation to one another.

5. In a scale building set as defined in claim 3 wherein said connector element has plural elongated joint portions arranged for extension in spaced parallel relation to one another about a common midpoint.

6. In a scale building set as defined in claim 3 wherein said connector element includes a central hollow body for outwardly projecting joint portions.

7. In a scale building set as defined in claim 3 wherein said connector element includes a central body formed of a yieldable material which tapers inwardly from each joint portion to a midpoint to provide a hinging movement between said joint portions.

8. In a scale building as defined in claim 1 wherein said side extensions are generally arcuate in shape and are of increased flexibility at said entrance.

9. In a composite structure formed of elements of a scale building set, a plurality of flat panel elements each having an enlarged beaded joint portion along each outer peripheral edge thereof and a flat weblike panel portion extending inwardly of the beaded joint portion, connector elements each having a plurality of slotted socket joint portions for insertion of said beaded joint portions in joining said panel and connector elements to form a three-dimensional composite unit, said panel and connector elements being geometrically and dimensionally interrelated to conform to a selected scale wherein smaller panel elements are interconnected by connector elements to form an assembly having the same external dimensions as a larger panel element, each said socket joint portion having opposing sides extending substantially beyond a semicircular section of an associated beaded joint portion, said joint portions having correspondingly shaped mating contact surfaces concentrically arranged in a frictional engagement throughout substantially the circumferential extent of the socket portion to provide uniform frictional engagement between the mating contact surfaces when one element is rotated relative to the other, each said flat panel element being beveled across the corner to permit extension of a connector element on one of the panel elements past the corner of said composite unit, the sides of said joint portions being spaced apart and said panel portion being sized to permit at least 90° of rotation between said elements.