United States Patent

Mullen

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[45] **Dec. 19, 1972**

[54] **STRUCTURAL MODULE AND FURNITURE OR OTHER STRUCTURES FORMED THEREFROM**

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[22] Filed: **June 10, 1971**

[21] Appl. No.: **151,841**

[52] **U.S. Cl.**.....**297/456,** 5/345 R, 5/352, 5/357, 5/348, 297/DIG. 1, 297/118, 297/440, 297/445

[51] **Int. Cl.**.....**A47c 7/02,** A47c 27/08

[58] **Field of Search** 46/17, 19, 29, 31; 5/352, 357; 297/453–456, 440

[56] **References Cited**

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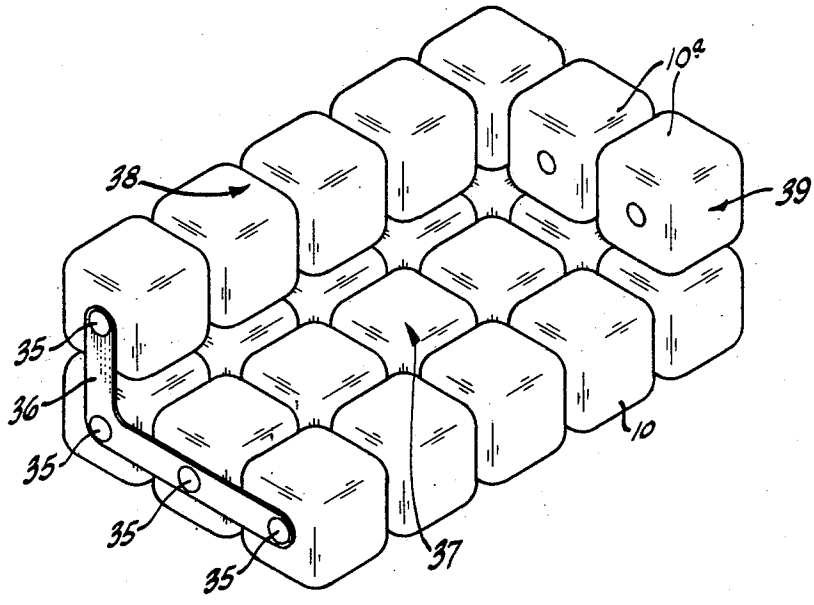
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Attorney—E. Hastings Ackley

[57] **ABSTRACT**

A structural module and furniture constructed using the same, wherein preformed blocks of resilient or elastomeric material, preferably having rounded edges, with openings for connecting the blocks to others into structural assemblies are utilized to form seating or reclining furniture structures. The blocks are also preferably formed with a smooth exterior skin or a plastic film coating which may be applied by immersion or by spraying. Rods or flexible members may be used to join the blocks. The blocks may be formed as cubes with the openings disposed along one axis, two axes or three axes passing through substantially the center of the cube, or may be blocks elongated along one or two axes, with suitable openings formed therein.

19 Claims, 15 Drawing Figures



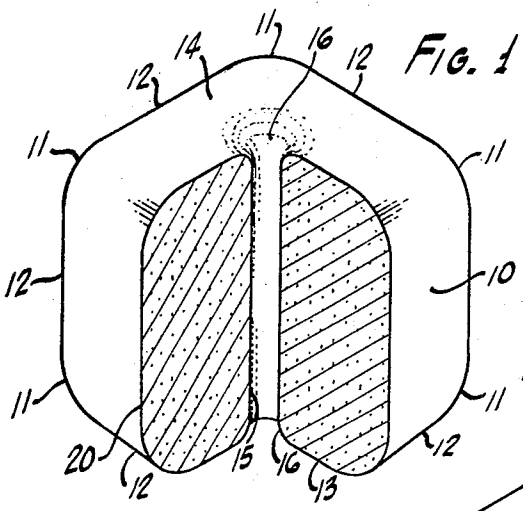
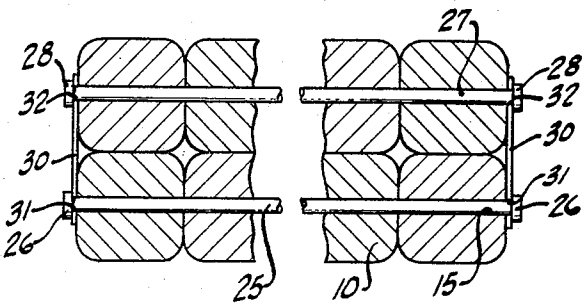


FIG. 1

FIG. 2



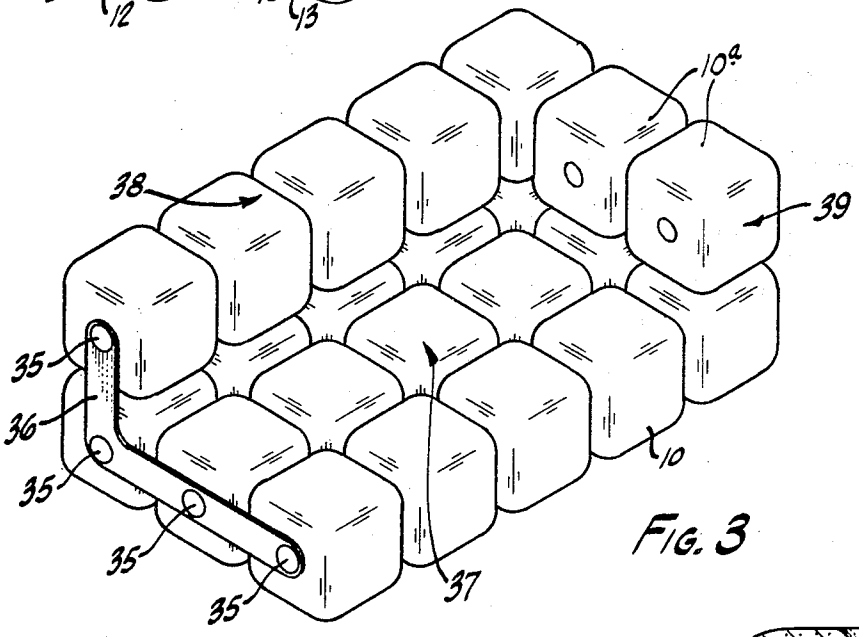


FIG. 3

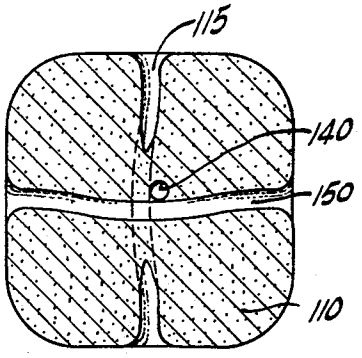


FIG. 5

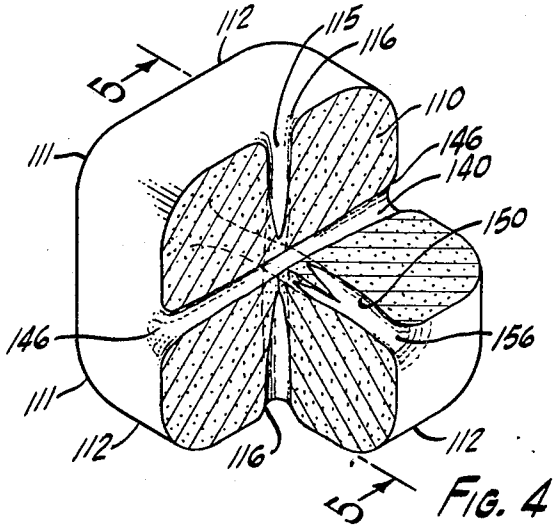


FIG. 4

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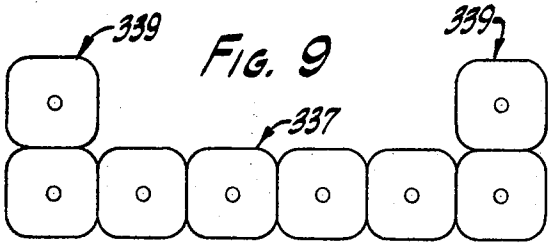


FIG. 9

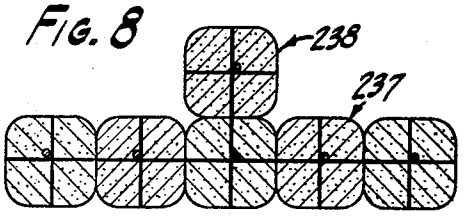


FIG. 8

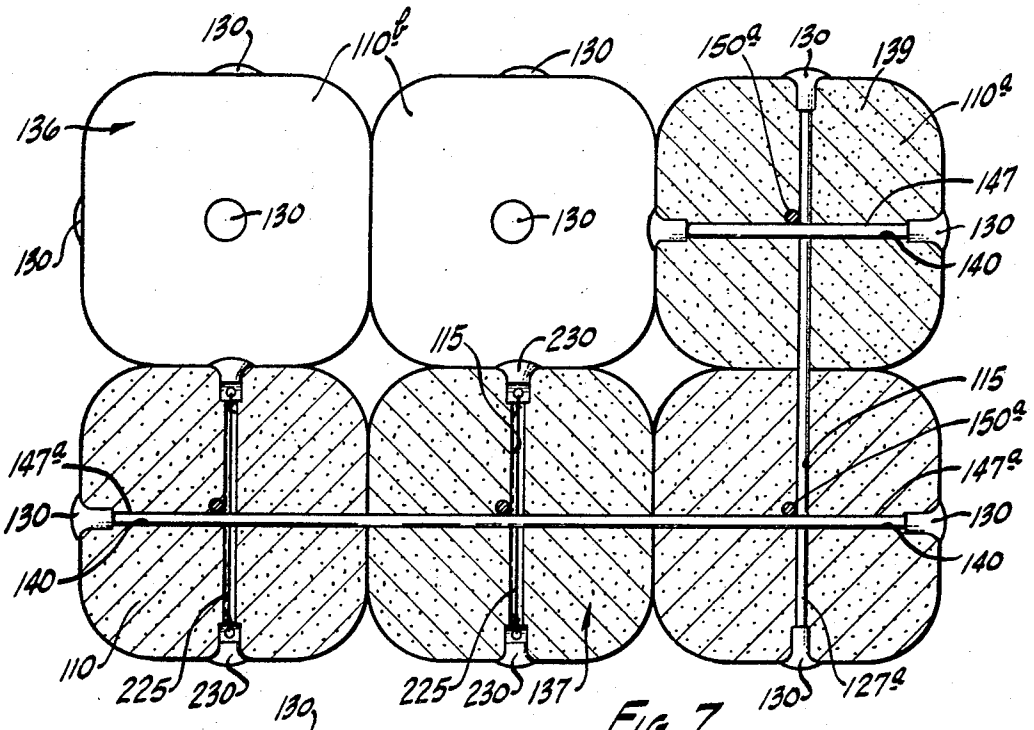


FIG. 7

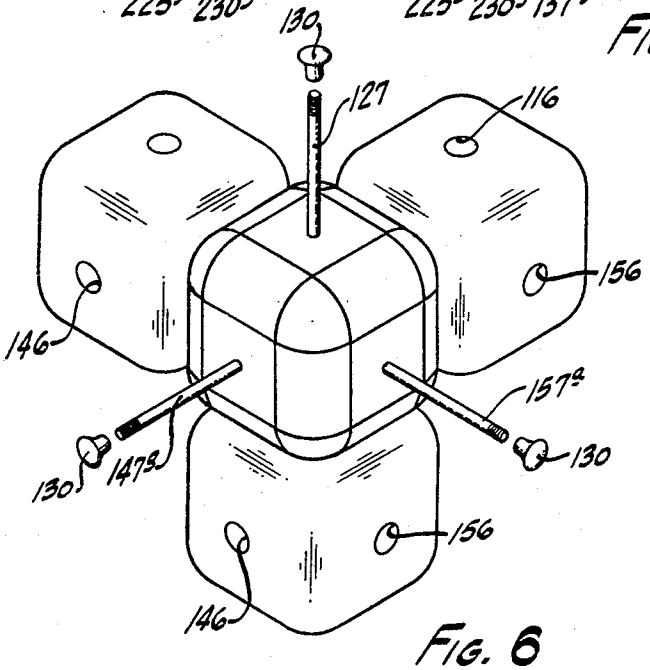


FIG. 6

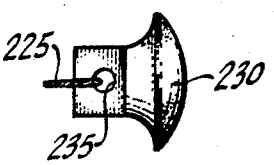


FIG. 10

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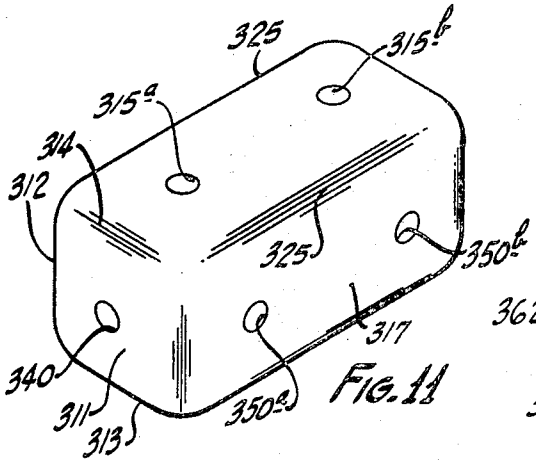


FIG. 11

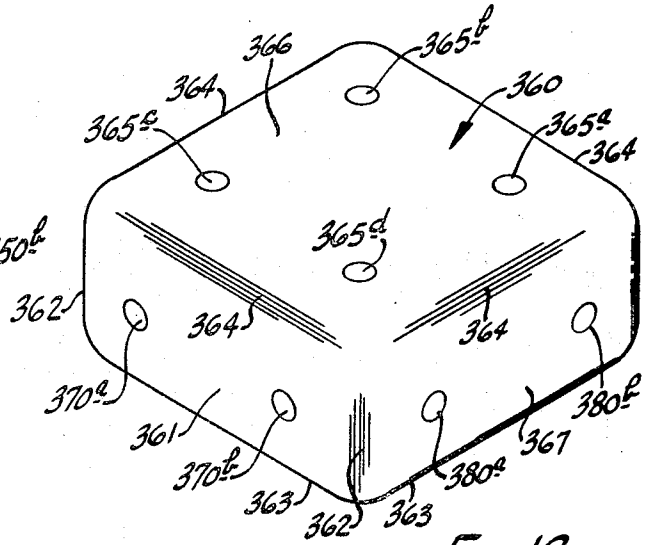


FIG. 12

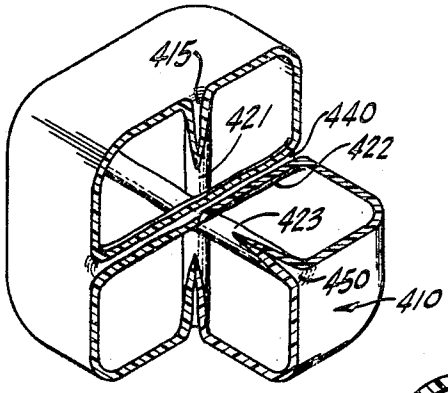


FIG. 13

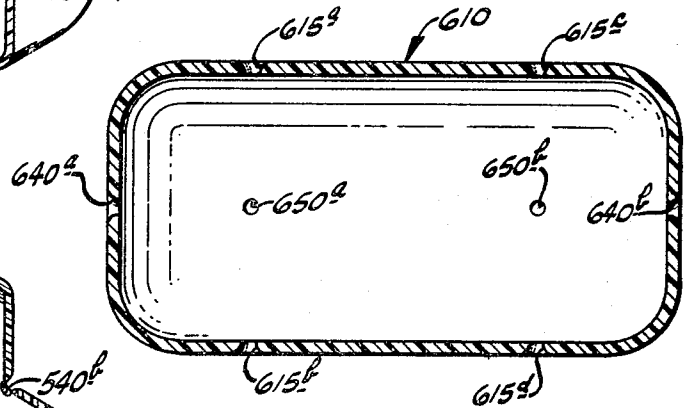


FIG. 15

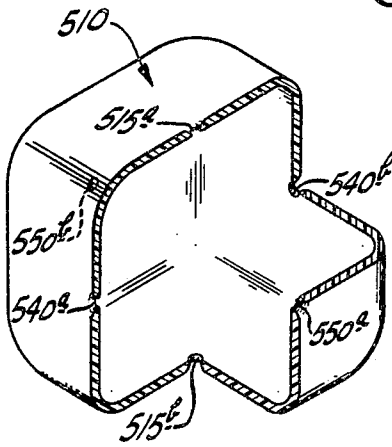


FIG. 14

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STRUCTURAL MODULE AND FURNITURE OR OTHER STRUCTURES FORMED THEREFROM

This invention relates to structural modules and furniture furniture or other structures constructed by use thereof.

It is one object of the invention to provide a structural module, such as a cube or block, formed of a resilient or elastomeric material having a smooth coating applied thereto and provided with one or more transverse openings by means of which the module may be joined to other modules to form a structural unit such as a divider, a seating structure such as a couch or chair, a bed or the like, by means of rigid rods or flexible stringers extending through aligned axial openings in adjacent abutting modules to provide the desired structure, with suitable retaining means provided on the ends of the connecting members to hold the connecting members in place and the modules interconnected.

It is an important object of the invention to provide a structural module which lends itself to the ready formation of substantially any desired configuration of furniture unit, or other structure by joining a plurality of such modules together in the configuration desired by the user.

Still another object of the invention is to provide a structural unit, such as a divider, wall panel, or the like, or an item of furniture such as a chair, couch, bed, or the like, formed of a plurality of the modules joined together by a connecting means and securely held connected together to retain the desired configuration.

A particular object of the invention is to provide a structural module formed of a high density flexible polyurethane foam or other elastomeric material for use in constructing furniture or other structural units.

Still another object of the invention is to provide in combination with a structural module of the character set forth means for securing the modules together in a desired configuration and for retaining said modules in such configuration during use.

Additional objects and advantages of the invention will be readily apparent from the reading of the following description of a device constructed in accordance with the invention, and reference to the accompanying drawings thereof, wherein:

FIG. 1 is an isometric view, partly in elevation and partly in section, of a module constructed in accordance with the invention and showing a single axial connecting opening extending through the module;

FIG. 2 is a fragmentary view, in section, showing a plurality of modules of the character illustrated in FIG. 1 joined together by connecting means to form a structural unit, such as a divider;

FIG. 3 is an isometric view of a plurality of structural modules joined together to form a seat of furniture having one arm rest;

FIG. 4 is an isometric view, partly in elevation and partly in section, of a modified form of the structural module showing the same provided with three axial connecting apertures extending therethrough;

FIG. 5 is a cross-sectional view, taken on the line 5 — 5 of FIG. 4 and further illustrating the manner in which the axial apertures are formed in the modules;

FIG. 6 is an exploded isometric view showing a plurality of the modules and connectors in position to be connected together to form a structural unit;

FIG. 7 is a view, partly in elevation and partly in section, of a structural unit formed from a plurality of the modules of FIGS. 5 and 6, showing a base or supporting section and an arm portion and an upstanding back portion;

FIG. 8 is a schematic view, in section, showing a plurality of structural elements joined together to form a modified form of furniture unit for back-to-back seating;

FIG. 9 is a front elevational view of a piece of furniture such as a couch formed by means of the modules of the invention;

FIG. 10 is an enlarged elevational view of a modified form of retainer member or cap and flexible connector;

FIG. 11 is an isometric view, in elevation, of a modified form of module;

FIG. 12 is an isometric view, in elevation, of a further modified form of module;

FIG. 13 is an isometric view, partly in elevation and partly in section, of a hollow cubical module having connector conduits therein;

FIG. 14 is a view, similar to FIG. 13, of a hollow cubical module without the connector conduits; and,

FIG. 15 is a cross-sectional view of an elongate hollow module, similar to those of FIGS. 11 and 12.

In the drawings, in FIG. 1 is shown a structural module or cube 10 preferably formed of a mass of high density resilient poly-urethane foam or other elastomeric material, having rounded corners 11 and edges 12 on all the corners and edges thereof. The cube is formed in a mold in substantially the shape shown, and has uniform height, width and depth. A transverse bore or axial opening 15 extends through the cube perpendicularly from the bottom 13 to the top 14 of the cube, and is rounded or flared as at 16 at each end for a purpose which will be hereinafter more fully explained. The exterior surfaces of the cube may be formed with a skin or coating 20, which may be produced by the molding process and is smooth, uniform and relatively imperforate, or an added film of plastic such as a vinyl plastic may be applied to the exterior of the cube by immersion of it in a body of vinyl, or by spraying the same, or otherwise, to produce such coating. This coating provides a uniform imperforate skin for the cube.

The cube shown in FIG. 1 is utilized in forming structural units, such as dividers, or furniture, as shown in FIGS. 2 and 3. In FIG. 2 a divider is shown, consisting of a pair of parallel superposed rows of the cubes secured in such superposed condition by a transverse lower connector bar 25 extending through the transverse openings or apertures 15 of a plurality of the modules 10 forming the bottom row of the divider and having a retainer flange or head 26 on each of its opposite ends to secure the rod in place in the several modules. A pair of tie bars, braces or straps 30 having apertures 31 and 32 therein extend between the lower connector bar and an upper connector bar 27 which has retaining heads or flanges 28 on its opposite ends extending through the apertures 32 in the braces or straps 30. The braces or straps 30 space the modules vertically and provide means for tying the rods 25 and 27 together to form a unit in which the modules are held in proper parallel spaced position to form the desired structure. It is believed readily apparent that, if desired or necessary, braces such as the braces 30 may

be provided between abutting modules **10** intermediate the ends of the rods **25** and **27** for added rigidity or bracing of the structure.

In FIG. **3** a plurality of parallel abutting modules **10** are shown to be joined together by rods **35** extending through the apertures **15** of such modules and connected at their ends to an L-shaped strap or brace member **36** to tie three parallel rows of the modules together to form a supporting base or seat portion **37**, and a rear upper row of modules disposed along and above the rear row of modules of the seat portion in position to form a back portion **38** to the furniture element. The right hand end of the structure may have a solid plate or an O-shaped strap (not shown), similar to the L-shaped strap member **36**, in which extra upper arm (not shown) holds the two modules **10***a* forming the arm rest portion **39** of the structure in properly spaced position overlying the end modules of the group forming the seat or supporting section **37** of the piece of furniture.

Obviously, any desired configuration may be formed by means of the modules and suitable connecting rods, braces and straps.

It is believed readily apparent that the modules may be formed with two or more transverse axial openings or apertures therein, and in FIG. **4** is shown a module **110** which has a vertical aperture **115**, a horizontal aperture **140** extending from one side to the other and another horizontal aperture **150** extends at right angles to the aperture **140** and at right angles to the aperture **115**. The apertures **115**, **140** and **150** do not intersect, but extend closely adjacent each other through substantially the center of the module and perpendicular to the opposed faces of the cube between which each aperture extends. Actually, the ends of the apertures may extend directly to the center of the face of the module through which they open, with the apertures being slightly curved as they pass each other in the central portion of the module, as is shown in FIG. **5**. The curvature of the central portion of the apertures is exaggerated in FIG. **5** to clearly illustrate the fact that the apertures may be curved to pass each other without intersecting. The corners **111** and the edges **112** of the module are rounded in the same manner as the form first described, and the openings of the apertures through the faces of the cubical module are flared as at **116**, **146** and **156**, respectively, in the same manner as the first form. Other details of the structure are identical except that three transverse axial openings or apertures **115**, **140** and **150** are formed in the cubical module.

It is also believed readily apparent that the edges and corners of the modules need not be rounded, but may be square to form perfect cubes, if desired.

This form of the module also lends itself to more varied structural assemblies, as shown in FIGS. **6** through **9**, the connecting members may be rods of plastic or flexible metal **127**, **147** and **157** having securing means, such as threads, at their ends to which button, cap or other retaining members **130** may be secured to connect the several modules together. Also, in some cases, as when there is a longitudinal axial t' rust or force applied to the connecting members, such members may be flexible or flaccid, as when formed of a chain, wire, cord or the line, **225**, connected to a retaining member or knob **230** provided with an eye or aperture **235** for receiving the end of the connecting member, as shown in FIG. **10**.

As shown in FIG. **7**, the modified modules of FIGS. **4** and **5** may be more simply connected to form a piece of furniture than those of the form first described, since no external brace or strap member is required. As will be seen, the longer connecting members or rods **127***a*, **147***a* and **157** extend through the aligned apertures **115**, **140** and **150** of abutting modules, and the flange headed securing button, cap or end members **130** are secured to the ends of the rods, and that such end members fit in the flared openings at the surfaces of the modules to provide a smooth pleasing appearance.

The three modules on the lower portion of the structure shown in FIG. **7**, connected by the elongate connecting members or rods **147***a*, form a supporting or seat section **137** of a piece of furniture similar to the seat section of the piece of furniture shown in FIG. **3**. The right hand upper module **110***a* is secured by means of the elongate securing rod **127***a* above the next adjacent lower module at one end of the supporting or seat section to form an arm section **139** and the aperture **140** is closed by means of the shorter rod **147** extending therethrough and having the retaining cap members **130** secured to the ends of the rods to close the aperture and provide a smooth uniform surface. The two back section modules **110***b* disposed above the two rear left hand modules **110** of the seating section **135** are connected by means of vertically extending rods such as the elongate connecting rods **127***a*, extending upwardly through the aligned vertical apertures **115** in the modules and held in place by means of the retaining caps **130**. The caps are provided on the ends of the rods in the flared openings in all of the exposed faces of the modules, being secured to the ends of the rods for closing the apertures and presenting a uniform attractive external appearance. Of course, a flexible or flaccid connector member such as the cord **225** of FIG. **10** may be used to secure the caps **130** in the flared openings of the apertures of single modules.

It is believed readily apparent that the modules may be formed into structures of any desired suitable configuration, such as those shown in FIGS. **8** and **9**. In FIG. **8**, a back-to-back seating arrangement is shown in section, wherein parallel rows of five modules form a supporting or seating surface **237** and a central row of modules disposed above the medial module provides a common arm rest or back rest **238** for the piece of furniture. Similarly, in FIG. **9** a supporting section **337** has a pair of arm rests **339** at its opposite ends, secured in position thereon in the manner already described. Obviously, any other modified arrangement of the modules may be constructed which is desired, depending only upon the length of the connecting members or rods, which may be lengthened still more by joining two or more rods by means of intermediate couplings, and the ingenuity of the user or designer.

As has been explained, while the modules have been shown as principally connected by flexible metal or plastic rods, suitable flexible or flaccid connecting members such as a chain, wire or the like may be utilized to secure the several modules together or to close the apertures subject to longitudinal thrust, held in place by means of retaining members or knobs **230** pro-

vided with an eye or aperture **235** for receiving the flexible or flaccid connecting member **225**, which may extend through the eye or aperture in the knob and be twisted, tied, or otherwise fastened in place.

Since the modules are preferably formed of foamed or expanded elastomeric materials such as polyurethane, or foam rubber or the like, and the exterior surfaces are molded to form a smooth impervious surface, or are coated with a plastic film or coating to provide such an exterior surface, that a comfortable, easily cleanable, structural module has been provided which may be assembled to produce dividers, pads, chairs, lounges, couches and the like as desired.

It is also readily apparent that the modules may be formed in any desired number and joined together to produce the desired furniture member or structure. It will also be apparent that the structure assembled will be soft, resilient, and comfortable to the user.

Further modified forms of the modules are shown in FIGS. **11** through **15**. In FIG. **11** the module is formed in an elongate substantially rectangular shape having a length equal to twice the dimension of the vertical and horizontal or transverse dimensions of the module. One end **311** of the module **310** is a substantial square having an upright side edge **312** equal to the horizontal bottom and top edges **313** and **314** in dimension. The longitudinal dimension **325** of the top surface is twice the length of the upright side edge **312** and the top and bottom edges **313** and **314**. Also, a longitudinal axial aperture or opening **340** is formed centrally of each of the opposed square ends of the module while two horizontal transverse openings **350***a* and **350***b* are aligned transversely of the elongate sides of the body from the right hand face **317** to the left hand face (not shown). Vertical apertures **315***a* and **315***b* are formed in the top surface **316** and aligned with complementary apertures in the bottom surface (not shown), for use in the same manner as the apertures **115**, **140** and **150** of the form shown in FIGS. **4** and **5**. If desired, also, the apertures in the elongate faces **316** and **317** may be omitted, or those extending from one of the faces to the other may be omitted to produce a desired surface effect. Otherwise this module may be identical in construction to the form first described, and may be coated with plastic film or coating to form a smooth and impervious surface in the same manner.

In FIG. **12** is shown a module **360** which has a rectangular top surface **366** and four elongate sides, the vertical corner edge **362** at each corner being one-half the length of the horizontal edges, so that the upper surface **366** is the equivalent of four of the cubes of FIGS. **4** and **5**, while the sides **361** and **367** are the equivalent of two of the cubes in horizontal dimension along the lower and upper edges **363** and **364**, respectively, of the side face. As has been pointed out, this module is the equivalent of four of the single modules of FIGS. **4** and **5** and is provided with the aligned vertical aperture sets **365***a*, **365***b*, **365***c* and **365***d*, the longitudinal apertures **370***a* and **370***b* and the transverse apertures **380***a* and **380***b*, any of which may be omitted, if desired, to provide a module having the desired configuration and surface appearance. The faces of this module may also be coated with plastic film or other coating to provide an exterior surface that is comfortable, easily cleanable, resilient and soft in use.

In FIG. **13** is shown a cubical module **410**, similar to the module of FIGS. **4** and **5**, which is hollow and has its outer load supporting walls formed of a foamed plastic or polyurethane or any other suitable resilient load supporting material. The apertures **415**, **440** and **450** m are in the form of tubular members **421**, **422** and **423**, respectively, which extend from the mid-point of each of the faces of the cubical module to the opposite face thereof and define the separate apertures. The tubular members may be integral with the skin or outer hollow walls of the body of the module and have their outer portions flared in the same manner as the apertures of the form of FIGS. **4** and **5** to receive the caps **30** or **130** or **230**, as the case may be.

In FIG. **14** is shown a slightly modified hollow cubical module **510** which is r provided with openings **540***a*, **540***b*, **515***a*, **515***b*, **550***a* and **550***b* formed centrally of the opposite walls of the hollow cube. There are no connecting tubular members in this form of the device, the strength of the resilient load supporting walls of the hollow body **510** being sufficient to retain the cubical shape.

In FIG. **15** an elongate hollow body **610** similar to that shown in FIG. **14** is illustrated, having resilient load supporting plastic side walls and a hollow interior. Aligned sets of apertures **615***a*, **615***b*, **615***c* and **615***d* are formed in the opposing upper and lower surfaces of the module while aligned apertures **640***a* and **640***b* are formed in the opposite ends of the module, and aligned sets of apertures **650***a* and **650***b* are formed in the elongate sides. This form of the module may take either the elongate rectangular two cube unit form of FIG. **11** or the rectangular form of FIG. **12** equal to four cubes. Otherwise, the module is the same in use as the module of FIG. **14** and equivalent to the modules of FIGS. **11** and **12**.

It will now be seen that various configurations may be utilized in forming the modules which are designed to be assembled to produce structural units or furniture or the like, and that the modules of the several forms may be joined together in any manner in any suitable arrangement and in any desired number to produce the desired furniture or structural members.

The foregoing description of the invention is explanatory only, and changes in the details of the constructions illustrated may be made by those skilled in the art, within the scope of the appended claims, without departing from the spirit of the invention.

What is claimed and desired to be secured by Letters Patent is:

1. A structural module comprising: a resilient body of elastomeric material in a substantially rectangular shape; at least one transverse aperture means opening between at least one pair of two opposed faces of said rectangular body and having slightly flared ends at the opposed faces, said ends of said aperture means opening through each of said opposed faces at a point spaced equidistant from at least three edges of each said opposed face, said aperture means comprising the sole aperture means opening between said opposed faces.

2. A structural module of the character set forth in claim **1**, wherein: a plurality of transverse aperture means are formed in said rectangular body opening between a plurality of pairs of opposing faces at points

on each of said opposed faces spaced equidistant from at least three edges of said faces.

3. A structural module of the character set forth in claim 1, wherein: the rectangular body is formed with a uniform dense exterior surface providing a substantially imperforate exposed skin on all exterior surfaces of the rectangular body.

4. A structural module of the character set forth in claim 1, wherein: the rectangular body is provided with a coating of thin resilient flexible plastic sealing the same and providing a relatively impervious exterior skin on the exposed surfaces of said body.

5. A structural module of the character set forth in claim 1 wherein said body is formed internally hollow with resilient load supporting walls defining its outer surfaces.

6. A structural module comprising: a body of foamed, resilient, high density elastomeric material in a substantially cubical shape; at least one transverse aperture aligned axially between two opposed faces of said cubical shape and having slightly flared ends at the opposed faces opening at a point on each of said faces spaced equidistant from all edges of each said face, said aperture comprising the only opening on each face.

7. A structural module of the character set forth in claim 6, wherein: a plurality of axially extending transverse apertures are formed in said cubical body extending between a plurality of pairs of opposing faces and passing adjacent each other in the central portion of the body without intersecting, each end of each of said apertures opening at a point on each of said pair of opposed faces spaced equidistant from all edges of said faces.

8. A structural module of the character set forth in claim 6, wherein: the cubical body is provided with three separate axially extending transverse apertures each extending between a separate pair of opposed faces and passing each other without intersecting at the mid-portion of the body and opening through the mid-portion of each of said pair of opposed faces of said cubical body at a point equidistant from the edges of said faces.

9. A structural module of the character set forth in claim 1 wherein the rectangular body is formed internally hollow with resilient load supporting walls forming its outer surfaces.

10. A structural module of the character set forth in claim 6, wherein: the cubical body is formed with a uniform dense exterior surface providing a substantially imperforate exposed skin on all exterior surfaces of the cubical body.

11. A structure comprising: a plurality of abutting substantially rectangular structural body modules each having at least one transverse aperture means opening between two opposed faces of said body module at a point spaced equidistant from at least three edges of each of said opposed faces and disposed to be aligned with the aperture means of the abutting modules; securing means extending through the aligned aperture means of a plurality of abutting structural modules and projecting from the opposed exterior surfaces of the outer modules of such plurality of rectangular structural body modules; and securing means on said connecting means securing the connecting means in place extending through the aperture means of the structural modules to hold said modules in connected condition.

12. A structure of the character set forth in claim 11, wherein: each of said structural modules is formed of a body of foamed, resilient, high density elastomeric material.

13. A piece of furniture comprising: a plurality of structural modules of the character set forth in claim 1 disposed in abutting relationship with at least one aperture means of each module aligned with at least one aperture means of the abutting modules to be joined together to provide a horizontal seating or reclining surface; and connecting means extending through the aligned aperture means of abutting modules to project from the exposed outer surfaces of the abutting plurality of modules for securing said modules in said abutting condition to hold the same connected together to provide such supporting surface.

14. A piece of furniture of the character set forth in claim 13 wherein: additional structural modules are disposed in abutting relationship with selected ones of the plurality of the modules forming the supporting surface with at least one aperture means of said additional modules aligned with at least one aperture means of said abutting seating surface modules to provide arm and back rests; and connecting means extending through the aligned aperture means of said additional structural modules and of said abutting seating surface modules to hold the same connected together.

15. A piece of furniture comprising: a plurality of structural modules each formed of a body of foamed resilient high density elastomeric material in a substantially cubical shape; each of said modules having at least one transverse opening extending between opposed exposed faces thereof and opening through said opposed faces at points equidistant from the edges of each said face, said modules being disposed in abutting relationship in a plurality of parallel rows with the transverse openings of of abutting modules aligned; connecting means in said aligned transverse openings of said abutting modules joining said plurality of modules in said plurality of parallel rows forming a supporting surface and back or arm rests; and securing means securing said connecting means against displacement from connecting position in said transverse openings to hold said cubical modules in such parallel rows.

16. A structural module of the character set forth in claim 1 wherein: a second pair of said opposed faces of said rectangular body have longitudinal dimensions twice the transverse dimension of said second pair of opposed faces; and at least one second aperture means opens between said second pair of opposed faces at a point spaced equidistant from at least three edges of each of said opposed faces of said second pair of opposed faces.

17. A structural module of the character set forth in claim 16 wherein said two opposed faces of said rectangular body through which said at least one transverse aperture means opens comprises a substantially square configuration having edges of equal length; and said second pair of said opposed faces of said rectangular body have two transverse aperture means opening between said faces, each aperture being spaced from the three edges of said opposed faces adjacent the transverse edges thereof a distance equidistant from said three edges.

18. A structural module of the character set forth in claim 16 wherein: said third pair of opposed faces comprising said substantially rectangular shaped body are formed with longitudinal and transverse dimensions each equal to the longitudinal dimension of said second pair of opposed faces of said rectangular body; and at least one transverse aperture means opens between said third pair of opposed faces at a point spaced from two adjacent convergent edges of said third pair of faces a distance equal to the distance which said at least one transverse aperture means is spaced from the three edges of said two opposed faces of said rectangular body.

19. A structural module of the character set forth in claim 18 wherein: said second pair of opposed faces is provided with two transverse aperture means opening between said second pair of opposed faces each spaced from the three edges of said opposed faces adjacent the transverse edges thereof a distance equidistant from said three edges; and said third pair of opposed faces is provided with four aperture means opening between said opposed faces and disposed at points adjacent the four corners of said faces spaced equidistant from the two convergent edges forming said corners a distance equal to the distance which said two transverse aperture means are spaced from said at least three edges of said second pair of opposed faces of said rectangular body.

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