

[54] **CELLULAR STRUCTURE FOR ELECTRICAL MODULES OR THE LIKE**
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[56] **References Cited**

UNITED STATES PATENTS		
811,158	1/1906	Maddux..... 217/31
901,999	10/1908	Perry..... 220/22
1,174,844	3/1916	Fukumura..... 217/32
1,186,967	6/1916	Brown..... 217/31
1,630,140	5/1927	Sibbald..... 220/21
1,987,108	1/1935	Inman..... 229/28 R
3,654,675	4/1972	Peterson..... 27/1
3,724,889	4/1973	Doolex..... 292/87

3,744,105	7/1973	Laurita.....	24/266
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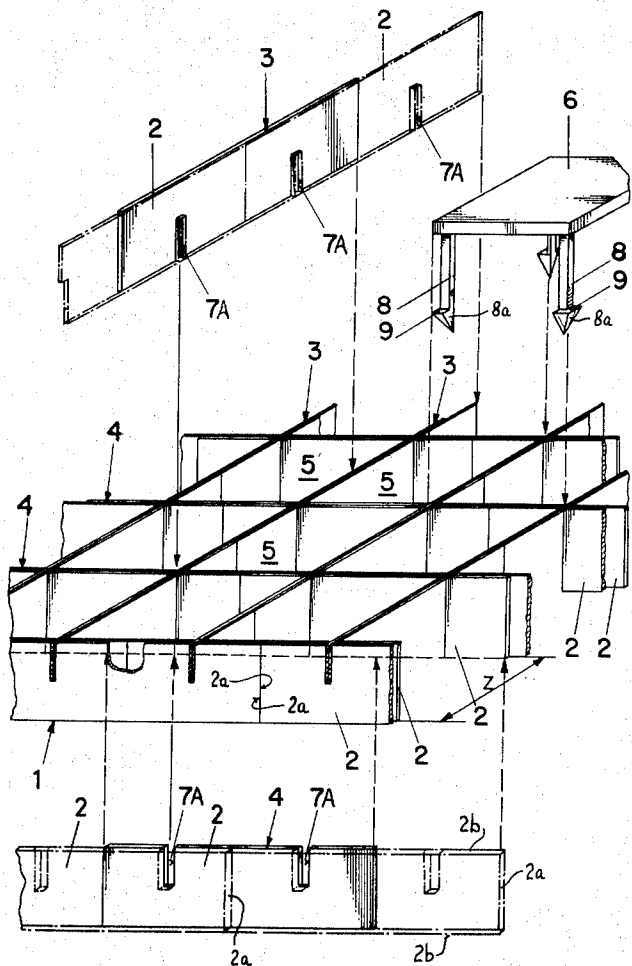
FOREIGN PATENTS OR APPLICATIONS

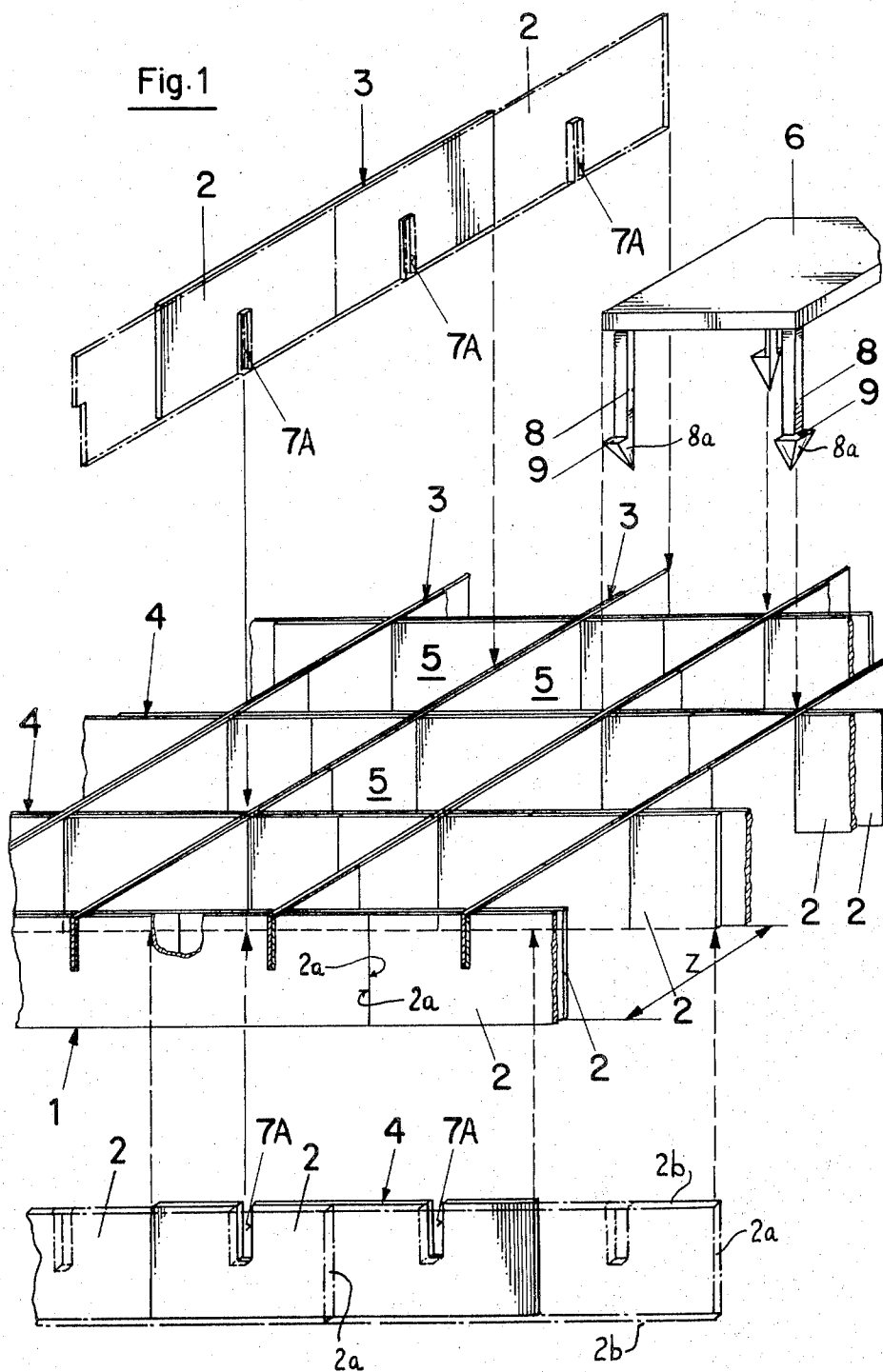
895,122	5/1962	Great Britain.....	220/22.1
1,117,704	6/1968	Great Britain.....	220/21
709,473	6/1966	Italy.....	220/21
874,693	8/1961	Great Britain.....	220/60 R
222,340	10/1924	Great Britain.....	220/22

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[57] **ABSTRACT**
A cellular skeleton frame for separable modules has intersecting and interfitted longitudinal and transverse walls each of which consists of two rows of panels having registering cutouts for reception of portions of walls. The walls are assembled without screws or bolts in a manner known from egg-crates or boxes for storage of bottles, and their panels may be provided with detent means for yieldably or releasably holding the walls against separation from each other. The modules have elastic legs or grooves which can engage with the panels surrounding the respective cells and the frame can be reinforced by annular springs which can support apertured plates for lamp sockets or analogous parts. The panels of each wall can be provided with elastic parts to engage and hold threaded carriers for electrical or electronic components.

22 Claims, 25 Drawing Figures





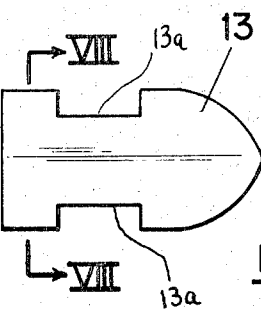
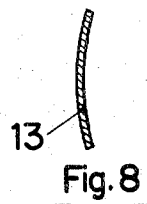
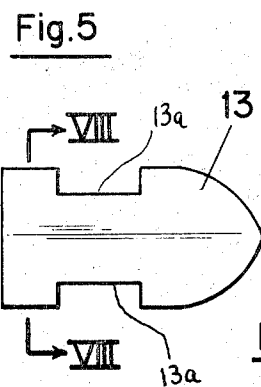
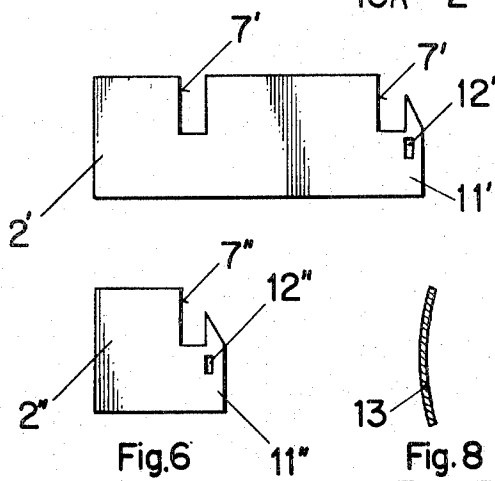
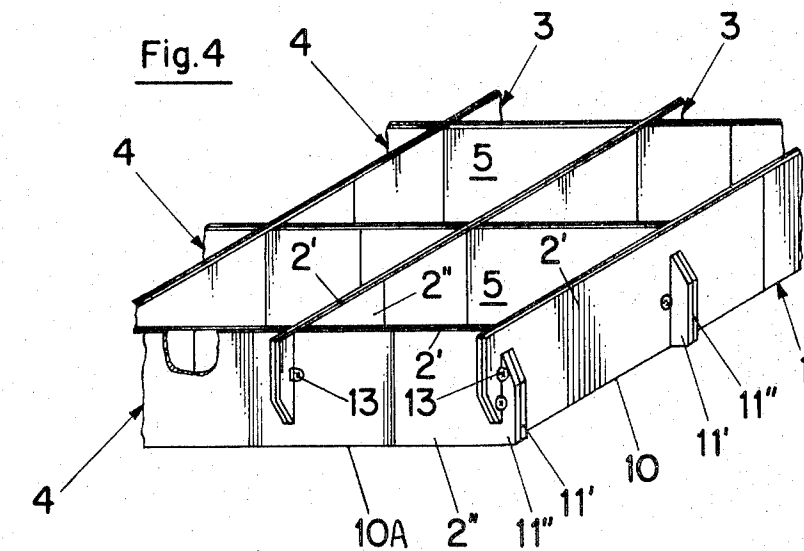
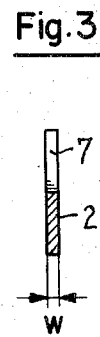
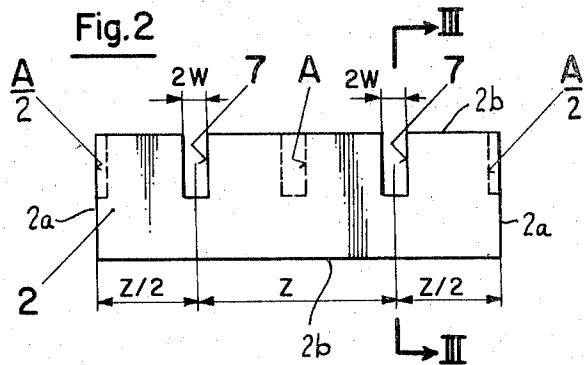


Fig.13

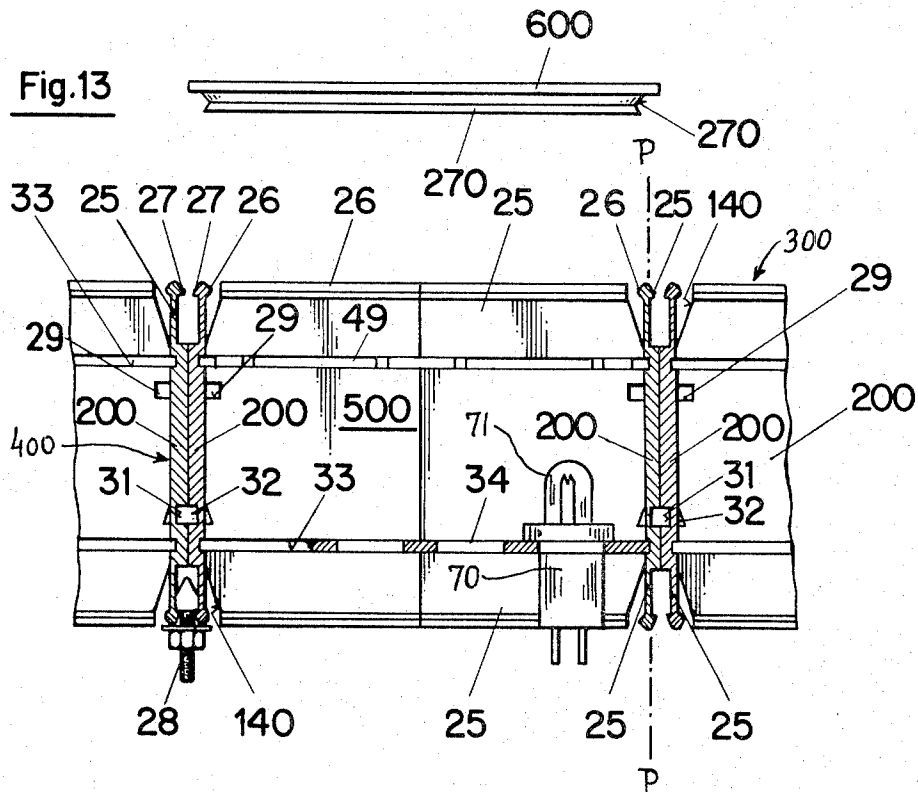


Fig.14

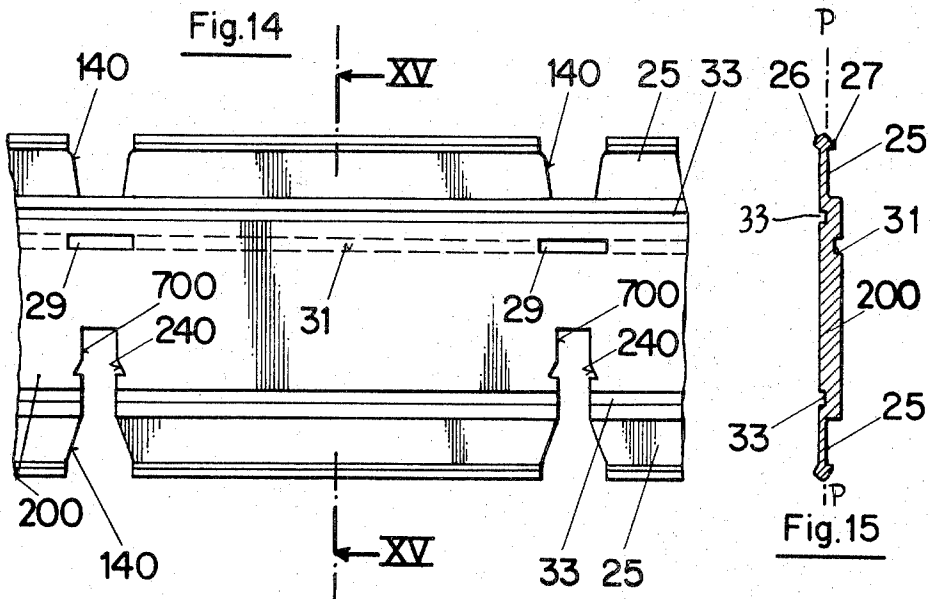
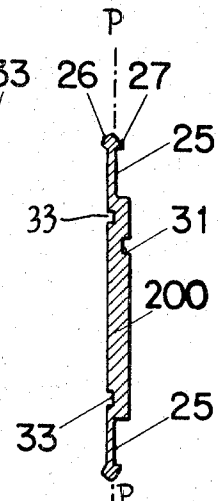


Fig.15



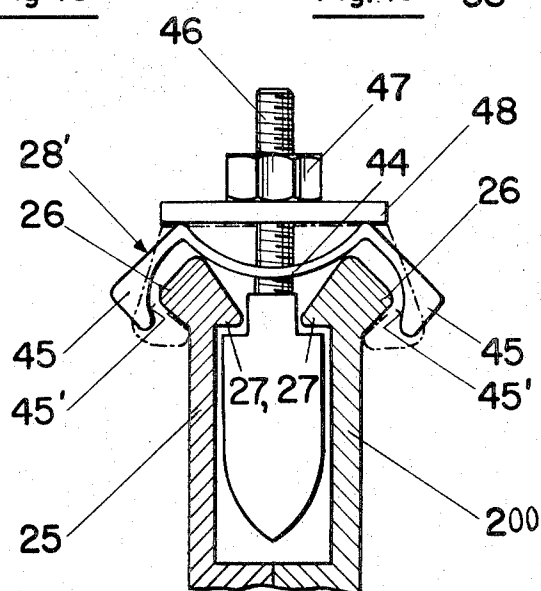
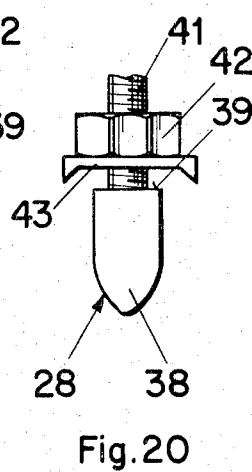
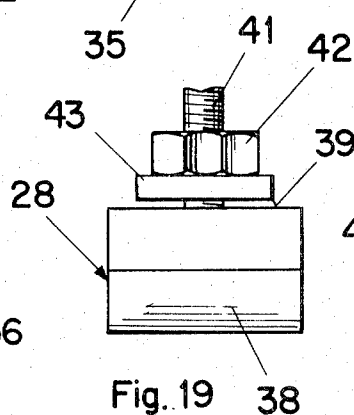
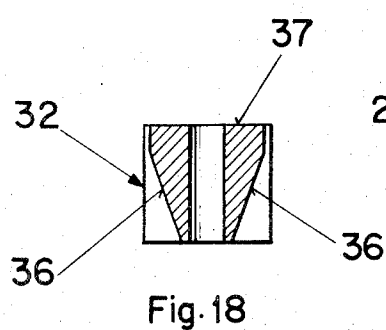
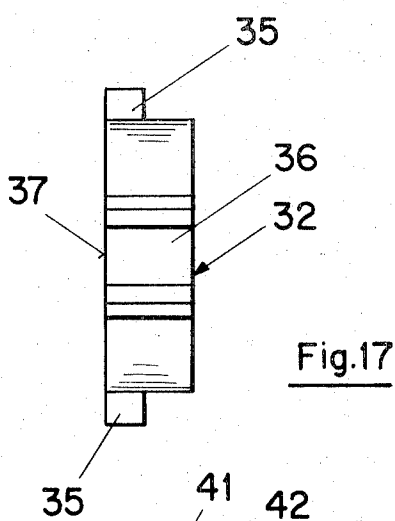
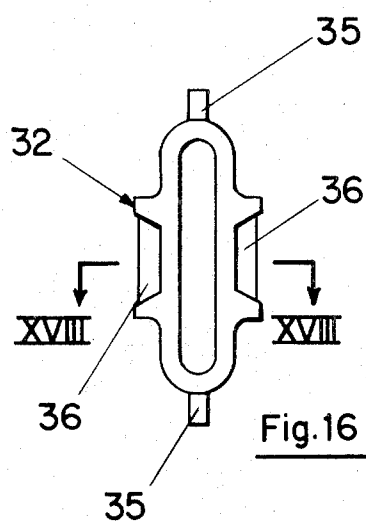


Fig. 22

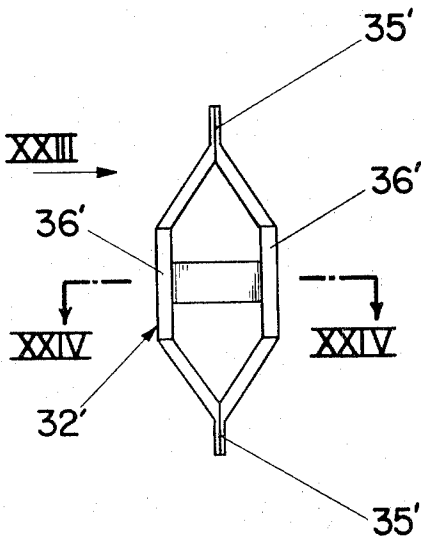


Fig. 23

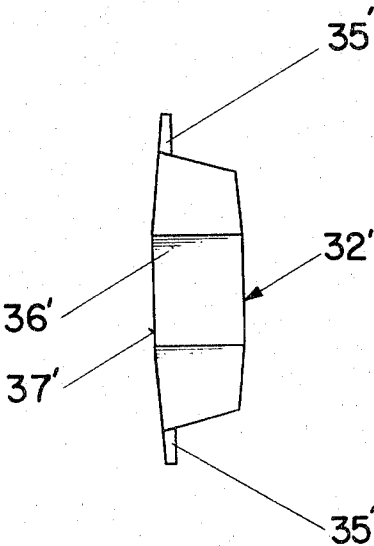


Fig. 24

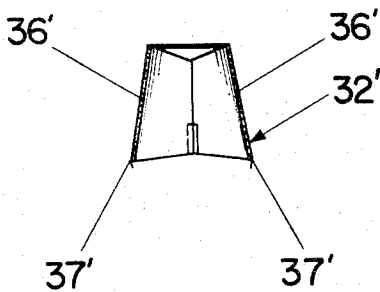
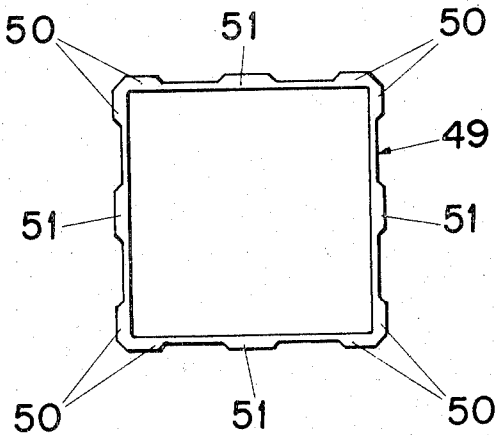


Fig. 25



CELLULAR STRUCTURE FOR ELECTRICAL MODULES OR THE LIKE

BACKGROUND OF THE INVENTION

The present invention relates to improvements in cellular structures which are assembled of intersecting and interfitted longitudinal and transverse walls forming rectangular or square compartments or cells for reception of modules, such as groups of electrical or electronic components, signal generating devices and/or others which together form a modular circuit assembly. More particularly, the invention relates to improvements in cellular structures or skeleton frames of the general type known as eggcrates whose walls have recesses so that the recesses of longitudinal walls receive portions of transverse walls and vice versa.

It is already known to assemble a cellular structure from a number of separable walls which render it possible to import to the cellular structure a desired size and/or shape and which further allow for dismantling and reassembly of the cellular structure. A fully assembled cellular structure can support a number of modules which can constitute simple covers or lids or groups of electrical, electronic and/or similar parts. A drawback of presently known cellular structures for such modules is that their walls must be held together by screws or analogous fasteners whose application or removal consumes much time and necessitates the use of tools. Moreover, the walls must be provided with tapped holes or the screws must be replaced with bolts, nuts and washers which render the structure even more expensive and whose attachment or removal is even more time consuming than the attachment or removal of simple screws.

SUMMARY OF THE INVENTION

An object of the invention is to provide a novel and improved eggcrate type cellular structure or skeleton frame with square or rectangular compartments or cells which is simpler and less expensive than but just as reliable and just as versatile as presently known cellular structures.

Another object of the invention is to provide a cellular structure with intersecting and interfitted longitudinal and transverse walls which can be assembled or dismantled without necessitating the use of any tools, whose size can be increased or reduced with little loss in time, which consists of simple and inexpensive parts, and which can be assembled by unskilled or semiskilled persons without resorting to templates, patterns or the like.

A further object of the invention is to provide novel means for reinforcing or stiffening the walls of the improved cellular structure and to provide novel and improved means for facilitating the mounting of modules on the walls.

An additional object of the invention is to provide a cellular structure which can be used to support a wide variety of modules of selected size or shape and wherein any module can be rapidly mounted in an optimum position and rapidly detached from the adjacent walls.

A further object of the invention is to provide a cellular structure wherein the walls can be held against movement relative to each other without necessitating the use of screws, bolts and/or analogous threaded fas-

teners and whose parts can be assembled in a number of ways so as to provide rectangular or square compartments of selected length and/or width.

The invention is embodied in an eggcrates type cellular structure or honeycomb which is particularly suited for use as a support or skeleton frame for detachable modules. The structure comprises a plurality of intersecting and interfitted longitudinal and transverse walls defining square or rectangular compartments or cells and having longitudinally extending edge faces provided with spaced-apart recesses. Portions of longitudinal walls extend into the recesses of the transverse walls, and vice versa. Each wall is assembled of two rows of elongated panels with the panels of one row adjacent and parallel to the panels of the other row. At least the majority of panels have at least two spaced-apart cutouts each of which forms part of a recess in the respective wall. The thickness of each longitudinal wall is equal to or closely approximates the width of recesses in the transverse walls, and vice versa. Each edge face of each longitudinal wall may but need not be flush with an edge face of each transverse wall. As a rule, each panel is longer than the distance between two neighboring intersections of a longitudinal wall with two parallel transverse walls or vice versa.

The modules can be inserted into or may be caused to overlap the selected compartments and may be provided with legs, grooves or analogous male or female parts which preferably engage portions of the adjacent panels by snap action so that the modules can be separated from the cellular structure.

The novel features which are considered as characteristic of the invention are set forth in particular in the appended claims. The improved cellular structure itself, however, both as to its construction and its mode of operation, together with additional features and advantages thereof, will be best understood upon perusal of the following detailed description of certain specific embodiments with reference to the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a fragmentary partly exploded perspective view of a cellular structure which embodies one form of the invention, a portion of a module being shown in detached position at a level above a selected compartment;

FIG. 2 is a side elevational view of a panel which forms part of the cellular structure shown in FIG. 1;

FIG. 3 is a transverse vertical sectional view as seen in the direction of arrows from the line III—III of FIG. 2;

FIG. 4 is a perspective view of a corner portion of the cellular structure shown in FIG. 1;

FIG. 5 is a side elevational view of a panel which forms part of the corner portion shown in FIG. 4;

FIG. 6 is a side elevational view of a second panel forming part of the corner portion shown in FIG. 4;

FIG. 7 is a side elevational view of a separable elastic fastener which is used in the corner portion of FIG. 4;

FIG. 8 is a sectional view of the fastener as seen in the direction of arrows from the line VIII—VIII of FIG. 7;

FIG. 9 is a fragmentary perspective view of a second cellular structure, a clamp and a rivet for the intersect-

ing longitudinal and transverse walls being shown in detached positions;

FIG. 10 is a side elevational view of a panel forming part of the cellular structure shown in FIG. 9;

FIG. 11 is a sectional view as seen in the direction of arrows from the line XI—XI of FIG. 10;

FIG. 12 is a fragmentary exploded view of a third cellular structure;

FIG. 13 is a fragmentary sectional view of a fourth cellular structure with a module shown at a level above the walls;

FIG. 14 is a fragmentary side elevational view of a panel in the structure of FIG. 13;

FIG. 15 is a sectional view as seen in the direction of arrows from the line XV—XV of FIG. 14;

FIG. 16 is a plan view of an elastic reinforcing element which can be used in the cellular structure of FIG. 13;

FIG. 17 is a side elevational view of the elastic reinforcing element of FIG. 16;

FIG. 18 is a sectional view as seen in the direction of arrows from the line XVIII—XVIII of FIG. 16;

FIG. 19 is a side elevational view of a detachable carrier which can be used in the cellular structure of FIG. 13;

FIG. 20 is an end elevational view of the carrier;

FIG. 21 is an enlarged sectional view of a detail in the cellular structure of FIG. 13, further showing a carrier which constitutes a modification of the carrier shown in FIGS. 13, 19 and 20;

FIG. 22 is a side elevational view of an elastic reinforcing element which constitutes a modification of the element shown in FIGS. 16 to 18;

FIG. 23 is an end elevational view of the modified elastic reinforcing element as seen in the direction of arrow XXIII in FIG. 22;

FIG. 24 is a sectional view as seen in the direction of arrows from the line XXIV—XXIV of FIG. 22; and

FIG. 25 is a plan view of an annular spring which can be utilized in the cellular structure of FIG. 13.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. 1 illustrates a cellular structure 1 of the type known as eggcrate and including intersecting and inter-fitted longitudinal walls 3 and transverse walls 4. Each of the walls 3, 4 consists of two rows of discrete plate-like elements 2 (hereinafter called panels). In the embodiment of FIG. 1, the walls 3, 4 define square compartments or cells 5 which can be overlapped by square modules 6 in the form of covers or by similarly configured modules constituting parts of electronic or electric circuits or indicating instruments.

The two rows of panels 2 which form a wall 3 or 4 are adjacent to each other and the short edge face 2a of each panel of a given row abuts against the edge face 2a of the neighboring panel of the same row. As shown in FIG. 2, each panel 2 has two longitudinally extending edge faces 2b one of which is provided with two spaced-apart cutouts 7. The length of a panel 2 equals twice the length or width z of a compartment 5 and the distance between the center line of each cutout 7 and the nearer short edge face 2a is $z/2$. Thus, the distance between the center lines of the two cutouts 7 in a panel 2 equals z . The width of a cutout 7 equals or closely approximates the thickness of a wall 3 or 4, i.e., twice the thickness w of a panel 2.

The depth of each cutout 7 is half the width of a panel 2, i.e., half the shortest distance between the two longitudinally extending edge faces 2b.

Referring again to FIG. 1, it will be seen that, in assembling a wall 3 or 4, the two rows of panels 2 are placed against each other in such a way that the cutouts 7 of the panels of one row register with the cutouts 7 of the panels of the other row whereby two registering cutouts 7 form a recess 7A which can receive a portion of the other wall. When the cellular structure 1 is assembled, the longitudinal edge faces 2b of panels 2 of the walls 3 are coplanar with the edge faces 2b of panels 2 of the walls 4. This is due to the fact that the depth of each cutout 7 (and hence of each recess 7A) is half the width of a panel 2 (and hence half the width of a wall 3 or 4). The assembling of panels 2 into the walls 3, 4 of the cellular structure 1 can be effected without resorting to any tools, and the same applies for dismantling of the structure 1. By lengthening or shortening the walls 3 and/or 4 (i.e., by adding or removing panels 2), a person can change the overall dimensions of an existing cellular structure.

FIG. 2 shows by broken lines that the panels 2 can be provided with additional cutouts A and A/2 which alternate with the cutouts 7. The dimensions of a cutout A are identical with those of a cutout 7. The provision of cutouts A and A/2 in addition to the cutouts 7 renders it possible to assemble the panels 2 into a cellular structure with compartments having a length or width $z/2$ or into compartments some of which have a length z and the others of which have a length $z/2$.

It is further clear that the panel 2 of FIGS. 2 and 3 can be provided with additional cutouts which alternate with the cutouts A/2, 7 and A and render it possible to assemble a cellular structure with compartments having a length or width z , $z/2$, $z/4$ and/or $z/8$. Thus, the panels 2 can be designed for assembly into a cellular structure having cells 5 with a width $z/2^n$ wherein n is a whole number including zero.

If the standard distance between the center lines of neighboring cutouts in a panel 2 is $z/2$, the length of the panel is $4z$. It has been found that panels having a length which is three times the standard distance between the center lines of neighboring cutouts are suited for use in the improved cellular structure. It is clear, however, that the walls 3 and/or 4 can be assembled of panels whose overall length (between the shorter edge faces 2a) is four or more times the standard distance between the center lines of two neighboring cutouts.

In accordance with a presently preferred embodiment of the invention, each of the walls 3 and 4 is assembled of two rows of elongated panels 2 having four cutouts including two cutouts 7 and two cutouts A/2. The cutouts A/2 are provided in the edge faces 2a of the panel and the cutouts 7 are spaced apart from each other a distance which equals the distance between a cutout 7 and the nearer cutout A/2. Thus, the cutouts 7 and A/2 form two groups which are mirror symmetrical to each other with reference to a plane which halves the panel and is located midway between its edge faces 2a. The distance between the centers of the two cutouts 7 or between the center of a cutout 7 and the nearer edge face 2b is the standard length and equals one-third the overall length of the panel. The width of each cutout A/2 (as considered in the longitudinal direction of the panel) is one-half the width of a cutout 7, i.e., the same as in FIG. 2. The only difference between the just

described presently preferred panel and the panel 2 of FIG. 2 is that the preferred panel does not have the central cutout A and that the distance between the center lines of the cutouts 7 in the panel 2 of FIG. 2 is twice the distance between the center line of a cutout 7 and the nearer edge face 2a.

The module 6 is assumed to consist of a synthetic plastic material and comprises four elastic legs or anchoring means 8, one at each of its corners. The free end of each leg 8 is provided with a hook-shaped substantially pyramidal or wedge-like locking or retaining portion 8a having an L-shaped or V-shaped shoulder 9 which can snap behind the lower edge faces 2b of panels 2, as viewed in FIG. 1, when the legs 8 are introduced into a selected compartment 5 of the cellular structure 1. The distance between a shoulder 9 and the underside of the module 6 shown in FIG. 1 equals the width of a panel 2, i.e., the depth of a compartment 5. The direction in which the module 6 of FIG. 1 can be inserted into the cell 5 therebelow is indicated by broken-line arrows. During insertion, the legs 8 undergo some deformation but reassume their normal positions relative to the plate-like top of the module 6 when the underside of the top comes into abutment with the upper edge faces 2b of the neighboring panels 2. This takes place when the shoulders 9 move slightly beyond the lower edge faces 2b. The legs 8 further serve as a means for centering the module 6 with respect to the corresponding compartment 5 so that a similar module can be mounted in each of the eight compartments 5 which are immediately adjacent to the compartment 5 for the illustrated module.

FIG. 4 illustrates a corner portion of the cellular structure 1. Those portions of the panels 2' and 2'' which extend outwardly beyond the outermost walls 3 and 4 (such outermost walls are respectively denoted by the characters 10 and 10A) are respectively trimmed by the characters 10 and 10A) are respectively trimmed, as at 11' and 11'', to form claws each of which is adjacent to a cutout in the respective cutouts 7' and 7''. As shown in FIGS. 5 and 6, each of the claws 7', 7'' can be provided with a rectangular opening 12', 12'' for reception of an elastic fastener or connector 13 in the form of a leaf spring the details of which are illustrated in FIGS. 7 and 8. Each opening 12', 12'' is positioned in such a way that an elastic fastener 13 which extends therethrough abuts against the outer side of an outermost wall 10 or 10A.

FIG. 4 further shows that the panels 2 and 2' of one row of panels of a wall 3, 4, 10 or 10A are staggered relative to the panels 2 and 2'' of the other row of panels of the same wall. Thus, the panels 2 and 2' which form one row of panels of a wall 3, 4, 10 or 10A are shifted relative to the panels 2 and 2'' which form the other row of the respective wall in such a way that, though each cutout 7' registers with a cutout 7'', the short edge faces of the panels 2 and 2' are not in register with the short edge faces of the panels 2 and 2''.

If the trimmed panels 2' and 2'' of FIG. 4 are replaced with panels 2, all panels of each of the walls of the cellular structure 1 have the same length. Since the panels 2', 2'' constitute a relatively small fraction of the total number of panels (2 plus 2' plus 2''), the majority of panels in the cellular structure 1 do have the same length.

The notches 13a in the fastener 13 of FIGS. 7 and 8 render it possible to shift a properly inserted fastener sideways so that one of the notches 13a receives por-

tions of the respective claws 11', 11'' whereby the fastener is less likely to fall out of the respective openings 12' and 12''. Each of the fasteners 13 is preferably curved (see FIG. 8) so that it bears against the claws 11', 11'' and/or against the outer sides of the walls 10, 10A and cannot change its selected position due to vibration or for other reasons.

FIGS. 9 to 11 illustrate a portion of a modified cellular structure having longitudinally extending walls 30 and transverse walls 40. The length of each panel 20 is twice the length or width of a square compartment and the dimensions of each cutout 70 are the same as those of the cutouts 7, i.e., the width of each cutout 70 is 2w and its depth is half the width of a panel 20. In addition, each longitudinally extending edge face 20b of each panel 20 is provided with spaced apart auxiliary cutouts or indentations 14. The center lines of indentations 14 in one of the edge faces 20b coincide with the center lines of indentations in the other edge face 20b and the indentations 14 in the upper edge faces 20b, as viewed in FIGS. 9-11, merge into the cutouts 70. The depth of the indentations 14 is less than the depth of cutouts 70.

Each panel 20 is further provided with a centrally located circular bore 15 and with two bores or notches 16 bounded by semicircular surfaces and provided in the edge faces 20a. Each of the bores 15 and notches 16 is located midway between the edge faces 20b of the respective panel 20. When two panels of a row of panels 20 are placed end-to-end, the respective notches 16 together form a circular bore having the same dimensions as a bore 15.

The indentations 14 serve to receive portions of four-pronged clamps 17 which are provided at the intersections of the walls 30 and 40. The prongs 18 of the clamp 19 shown in the upper portion of FIG. 9 extend downwardly from a block-shaped head 19 and their free ends are provided with hooks 21 which can snap into the indentations 14 provided in the lower edge faces 20b of the panels 20 shown in FIG. 9. The head 19 then extends into the indentations 14 provided in two pairs of intersecting panels 20 at the junction or crossing point of two walls 30, 40. The clamps 17 may consist of a synthetic plastic material and the prongs 18 are preferably elastic so that they can yield during attachment of the clamp and thereupon move toward each other to snap their claws 21 into the adjoining indentations 14. The length of each side of the head 19 equals or closely approximates the width of an indentation 14 (which exceeds the width of a cutout 70). The distance between the head 19 and the shoulders of the claws 21 equals or slightly exceeds the distance between two registering indentations 14 in a panel 20. The clamps 17 not only serve to prevent uncontrolled dismantling of the cellular structure but also stiffen the structure and insure that the walls 30 and 40 extend at right angles to each other. Additional strengthening or stiffening of the cellular structure can be achieved by employing rivets 22 which are inserted into and through pairs of registering bores 15 (each such bore may have a circular outline as shown in the central portion of the panel 20 of FIG. 10 or it may consist of two matching notches 16). Each rivet 22 preferably consists of elastomeric synthetic plastic material so that its conical head 22a can be readily forced into and through a pair of registering bores 15.

Referring to FIG. 12, there is shown a portion of a third cellular structure having intersecting and interfit-

ted walls 30', 40' each assembled of two rows of panels 20'. The upper longitudinal edge faces 20b' of panels 20' forming the wall 40' and the lower longitudinal edge faces 20b' of panels 20' forming the wall 30' are provided with registering cutouts 70'. The width of the outer end portion of each cutout 70' is less than the width of the inner portion so that the panels 20' are provided with internal abutments or shoulders 24 to be engaged by projections 23 which are provided in each panel 20' in alignment with the respective recesses 70'. When the wall 30' of FIG. 12 is moved downwardly, the abutments 24 of its panels 20' are engaged by the projections 23 of panels forming the wall 40' and vice versa so that the walls 30' and 40' are automatically held against separation unless the projections 23 are deformed sufficiently to allow for separation of the panels 20'. Each projection 23 is preferably an elastic lug which is obtained by forming the respective panel 20' with a substantially U-shaped slit and by thereupon ending laterally the portion which is surrounded by the U-shaped slit. The abutments 24 and the associated projections 23 can be said to constitute a simple detent structure which holds the panels 20' of the wall 30' against unintentional or accidental separation from the panels 20' of the wall 40'.

FIGS. 13 to 15 illustrate a portion of a fourth cellular structure which is assembled of panels 200 each having two cutouts 700. The longitudinally extending marginal portions 25 of each panel 200 are of reduced thickness (see particularly FIG. 15) and are at least slightly elastic. Each such elastic marginal portion is provided with a longitudinally extending rib 26 of triangular outline whose mutually inclined facets make an angle of approximately 90 degrees. Each rib 26 further comprises two shoulders 27 which are normal or substantially normal to the plane of the respective elastic marginal portion 25. It will be noted that each marginal portion 25 is offset from the central plane P—P of the respective panel 200 so as to be immediately adjacent to the respective compartment 500 of the cellular structure.

The module 600 (shown in the upper part of FIG. 13) has as its underside a complementary circumferential groove 270 which can receive one-half of each adjacent rib 26 so that a properly mounted module 600 is held in position by snap action. The ribs 26 which extend into the groove 270 of a properly mounted module 600 perform the additional function of centering the module.

Those portions of the ribs 26 which face the respective planes P—P can be used as a means for holding in position carriers or holders 28 for switches, signal lamps or analogous parts of a control panel. Each carrier 28 can be inserted between two panels 200 of a longitudinally or transversely extending wall of the cellular structure. The carrier 28 of FIG. 13 has a wedge-like head 38 (FIGS. 19-20) which snaps between the lower ribs 26 of two adjoining panels 200 of the wall 400 and a threaded shank 41 which meshes with a nut 42 and carries a washer 43. Since the marginal portions 25 of two neighboring panels 200 are laterally offset relative to the respective planes P—P, the space between such marginal portions suffices for reception of the head 38.

The marginal portions 25 of the panels 200 are further provided with indentations 140 and the central or median portion of each panel 200 is formed with two

parallel slots 29 extending in parallelism with the ribs 26 and registering with the cutouts 700 (each of which communicates with two notches 240). The slots 29 communicate with an elongated groove 31 which is provided in one side of the central portion of each panel 200 and is parallel to and located between two grooves 33 which are provided in the other side of the central portion of each panel.

The groove 31 and the slots 29 serve for reception of an annular elastic supporting or reinforcing element 32 (see FIGS. 16 to 18). Portions of a properly inserted elastic supporting element 32 extend into the slots 29 in the regions of cutouts 700 of the neighboring panels 200. In this way, the supporting element 32 is properly anchored at the intersections of the walls 300 and 400.

The grooves 33 in the central portions of panels 200 serve for reception and retention of indicating instruments (not shown) and/or apertured plates 34 of sheet metal or the like. The apertures of a plate 34 can receive sockets 70 for light bulbs 71 or the like. The plate 34 further serves to stiffen the assembled cellular structure which embodies the panels 200 of FIGS. 13 to 15.

The upper grooves 33 of the structure shown in FIG. 13 receive a substantially ring-shaped spring 49 the details of which are illustrated in FIG. 25. The material of the spring 49 is preferably an elastomeric synthetic plastic substance and this spring comprises four corner lugs or protuberances 50 and four centrally located lugs or protuberances 51 which alternate with the lugs 50, as considered in the circumferential direction of the spring 49. The lugs 50 and 51 extend into the adjacent grooves 33 of panels 200 which surround the respective compartment 500. Once a spring 49 is properly inserted into a compartment 500, the corner lugs 50 hold the respective panels 200 against uncontrolled movement in directions at right angles to the general plane of the cellular structure. Such positioning of the panels 200 by the spring 49 renders it possible to omit the indentations 140, the slots 29, the grooves 31 and/or the elastic reinforcing elements 32. In other words, the parts numbered 29, 31, 32 and 140 are optional once the cellular structure of FIGS. 13-15 employs springs 49 of the type shown in FIG. 25. The centrally located lugs 51 serve to properly align those panels 200 which abut against each other between a pair of parallel walls 300 or 400. Thus, the lugs 51 serve as a simple substitute for the bores 15, 16 and rivets 22 of the cellular structure shown in FIGS. 9 to 11.

In accordance with a slight modification of the structure which is shown in FIGS. 13 to 15, each panel 200 can be provided with two grooves 33 for reception of two springs 49 which flank an apertured plate 34 so that the latter need not extend into the grooves 33 but is held exclusively by the two springs 49.

The annular elastic reinforcing element 32 of FIGS. 16 to 18 has two projections or ears 35 which extend into the slots 29 in the grooves 31 of the neighboring panels 200 so that the element 32 is properly held in position. The ears 35 also prevent improper insertion of the elastic element 32. This element is further provided with two wedge-like flanks 36 whose thickness diminishes in a direction toward the adjacent cutouts 700. The material of the element 32 is preferably an elastomeric synthetic plastic substance. The surface 37

of the element 32 is flat and portions thereof extend into the adjacent notches 240.

The holder or carrier 28 of FIGS. 19 and 20 comprises the aforementioned wedge-like head 38 one end of which is provided with a flat surface 39 normal to the axis of the threaded shank 41 for the nut 42 and washer 43. The head 38 is insertable between two elastic marginal portions 25 (FIG. 13) so that the surface 39 engages the shoulders 27 of the adjacent ribs 26. The nut 42 is then rotated in a direction to move toward the adjacent panels 200 so that the washer 43 bears against the ribs 26 and urges the surface 39 against the respective shoulders 27 of such ribs. The part which is to be supported by the carrier 28 is thereupon brought into mesh with the shank 41 or is secured thereto by one or more additional washers and nuts, not shown.

FIG. 21 illustrates a modified carrier or holder 28' which consists of elastomeric material and has an arcuate central portion or web 44 disposed between two jaws 45 having concave internal surfaces 45' complementary to the adjacent external surfaces of ribs 26 on the panels 200. The web 44 has a centrally located aperture for the shank of a screw 46 which meshes with a nut 47 and is surrounded by a washer 48. When the nut 47 is rotated in a direction to move downwardly, as viewed in FIG. 21 (i.e., toward the ribs 26 of the panels 200), the washer 48 flattens the web 44 so that the jaws 45 assume the phantom-line positions and become interlocked with the adjacent ribs 26.

FIGS. 22 to 24 illustrate an elastic annular element 32' which constitutes a modification of the element 32 shown in FIGS. 16 to 18. The element 32' is a stamping made of sheet metal which is deformed to assume a conical shape. This element also comprises two projections or ears 35' which extend into the grooves 31 of two adjacent panels 200. The wedge-like flanks 36' taper in such a way that, when the element 32' is properly inserted in a cellular structure of the type shown in FIGS. 13-15, the edges 37' snap into the notches 240 of the adjacent panels 200.

The improved cellular structure is susceptible of many additional modifications. For example, the panels 2 or 20 can be provided with elastic marginal portions 25, the same as the panels 200; the indentations 14 or 140 can be provided in the panels 2; the elastic projections 23 can be provided on the panels 200 and/or 2; the grooves 31, 33 and/or the slots 29 can be provided in the panels 2 and/or 20; the abutments 24 can be provided in the panels 2 or 200; and the notches 240 can be provided in the panels 2 and/or 20. Also, each of the cells or compartments may have a rectangular outline and the panels 2, 20 or 200 can be provided with openings and/or depressions to reduce their weight, bulk and cost. All such modifications will be readily comprehended upon perusal of the preceding disclosure.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can, by applying current knowledge, readily adapt it for various applications without omitting features which fairly constitute essential characteristics of the generic and specific aspects of my contribution to the art and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the claims.

What is claimed as new and desired to be protected by Letters Patent is:

1. An eggcrate type cellular structure, particularly for use as a skeleton frame for detachable modules, comprising a plurality of intersecting and interfitting longitudinal and transverse walls defining square or rectangular compartments and having longitudinally extending edge faces provided with spaced-apart recesses, said longitudinal walls having portions extending into the respective ones of said recesses of said transverse walls and vice versa, each of said walls being composed of two rows of elongated panels with the panels of one row being located adjacent to the panels of the other row, the panels of each of said rows being aligned in the longitudinal direction thereof whereby the panels of a respective row may be made to longitudinally overlap respective ones of the panels of the respective other row, and at least the majority of said panels having at least two spaced-apart cutouts each of which forms a part of a respective one of said recesses in the respective wall, the thickness of said portions of said longitudinal walls being substantially equal to the width of said recesses in said transverse walls and vice versa.

2. The structure of claim 1, wherein the panels of one row in each of said walls are staggered relative to the panels of the other row and wherein the thickness of each panel of one of said rows equals the thickness of each panel of the other row so that the thickness of each of said walls is the sum of thicknesses of two panels.

3. The structure of claim 1, wherein said majority of panels have identical predetermined lengths.

4. The combination of claim 3, wherein each of said majority of panels is provided with $2n$ cutouts wherein n is a whole number including one, the cutouts of each pair of neighboring cutouts being separated from each other by identical distances.

5. The structure of claim 1, wherein the panels of said majority of panels have identical lengths, each of said lengths being three times a standard length and said cutouts of said majority of panels being mirror symmetrical to each other with reference to a plane which is normal to and halves the respective panel.

6. The structure of claim 5, wherein the cutouts of each of said majority of panels two outermost cutouts provided in the shorter edge faces of the respective panel and at least two additional cutouts each having a width which is twice the width of said outermost cutouts.

7. The structure of claim 1, wherein said walls include two outermost transverse walls and two outermost longitudinal walls and the panels which form part of said outermost walls include claw-shaped portions with the claw-shaped portions of panels of said outermost longitudinal walls outwardly adjacent to the respective outermost transverse walls and vice versa.

8. The structure of claim 7, wherein each of said claw-shaped portions is immediately adjacent to a recess in the respective wall.

9. The structure of claim 1, wherein the panels of one row in each of said walls are staggered lengthwise with respect to the panels of the other row, each of said panels having two short edge faces and being provided with a circular bore midway between said short edge faces and a semicircular notch in each of said short edge faces, the notches of adjoining panels in each of said rows together forming circular bores and the bores in one row of panels being in register with the bores in the

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other row of panels, and further comprising rivets extending through at least some of said registering bores.

10. The structure of claim 9, wherein said rivets consist of elastomeric material.

11. The structure of claim 1, wherein each of said panels has two longitudinally extending edge faces of said cutouts are provided in one of said last mentioned edge faces, each panel further having indentations provided in each of said longitudinally extending edge faces, the width of said indentations exceeding the width of said cutouts and the indentations in said one edge face of each panel being in communication with said cutouts, the indentations in the other edge face of each panel being aligned with indentations in said one edge face.

12. The structure of claim 11, wherein the depth of said indentations is less than the depth of said cutouts.

13. The structure of claim 11, further comprising clamps provided at the intersections of said longitudinal and transverse walls and having heads received in indentations which communicate with said cutouts and prongs having portions extending into the indentations in said other edge faces of the respective panels.

14. The structure of claim 1, wherein each of said panels comprises abutments provided in the separate cutouts and elastic projections aligned with said cutouts, the projections of panels in said longitudinal walls engaging the abutments of panels in said transverse walls and vice versa.

15. The structure of claim 1, wherein each of said panels is further provided with longitudinally extending slots aligned with the respective cutouts, and further comprising at least one annular reinforcing element lo-

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cated in one of said compartments and having projections extending into the slots of neighboring panels.

16. The structure of claim 15, wherein said reinforcing element consists of elastomeric material.

17. The structure of claim 15, wherein each of said panels is further provided with notches communicating with the respective cutouts and said reinforcing element further comprises portions extending into the notches of said neighboring panels.

18. The structure of claim 1, wherein each of said panels comprises two longitudinally extending integral elastic marginal portions provided with longitudinally extending ribs in the region of said edge faces, and further comprising at least one module overlying one of said compartments and having a circumferential groove receiving portions of ribs on the adjacent marginal portions.

19. The structure of claim 18, wherein each of said ribs has two facets making an angle of substantially 90 degrees and at least one shoulder normal to the plane of the respective marginal portion.

20. The structure of claim 18, wherein the ribs on the marginal portions of adjoining panels in each of said walls are spaced apart from each other and further comprising at least one carrier having a portion held between the ribs of two adjoining panels.

21. The structure of claim 1, wherein each of said panels has at least one longitudinally extending groove adjacent to the respective compartment and further comprising at least one annular member received in one of said compartments and having projections extending into the grooves of adjacent panels.

22. The structure of claim 21, wherein said annular member is a spring.

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