United States Patent [19]

Edwards

[11] **3,821,868**

[45] **July 2, 1974**

[54] **GROOVED STRUCTURAL ELEMENT**

[75] Inventor: **Lindell N. Edwards,** St. Louis, Mo.

[73] Assignee: **Universal Modular Structures, Inc.,** St. Louis, Mo.

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[21] Appl. No.: **222,113**

[52] **U.S. Cl.** **52/241,** 52/282

[51] **Int. Cl.** **E04b 2/60**

[58] **Field of Search** 52/241, 242, 272, 280, 52/282, 474, 481, 494, 620, 627, 720, 729, 730, 731

[56] **References Cited**

UNITED STATES PATENTS

2,079,635	5/1937	Sharp	52/241
2,931,468	4/1960	Keller	52/481 X
2,962,133	11/1960	Kivett et al.	52/241 X
3,010,547	11/1961	Foster	52/731 X
3,125,194	3/1964	Kimmel et al.	52/282 X
3,125,785	3/1964	Conville	52/238
3,190,408	6/1965	Petterson	52/282 X
3,293,813	12/1966	Emmons et al.	52/627 X
3,310,926	3/1967	Brandreth et al.	52/731 X
3,316,041	4/1967	Nelson	52/281 X
3,348,349	10/1967	Petersen	52/731 X
3,487,598	1/1970	Lopina	52/241 X
3,553,915	1/1971	Passovoy	52/241 X

Primary Examiner—Price C. Faw, Jr.

[57] **ABSTRACT**

A structural element has elongated, parallel, transversely-spaced grooves which can accommodate the edges of transversely-spaced panels. That structural element coacts with other similar structural elements to constitute a plural-sided frame which has substantially-continuous, elongated, parallel, transversely-spaced, inwardly-directed grooves. A plurality of panels have their upper and lower edges extending into and held by one of those elongated, parallel, transversely-spaced, inwardly-directed grooves to define a structural plane; and a further plurality of panels have their upper and lower edges extending into and held by the other of those elongated, parallel, transversely-spaced, inwardly-directed grooves to define a second structural plane which is spaced transversely from the first structural plane. Connector members of generally H-shaped cross section have grooves which accommodate the side edges of the first plurality and second plurality of panels and which prevent transverse movement of those side edges relative to each other and relative to those structural planes.

3 Claims, 32 Drawing Figures

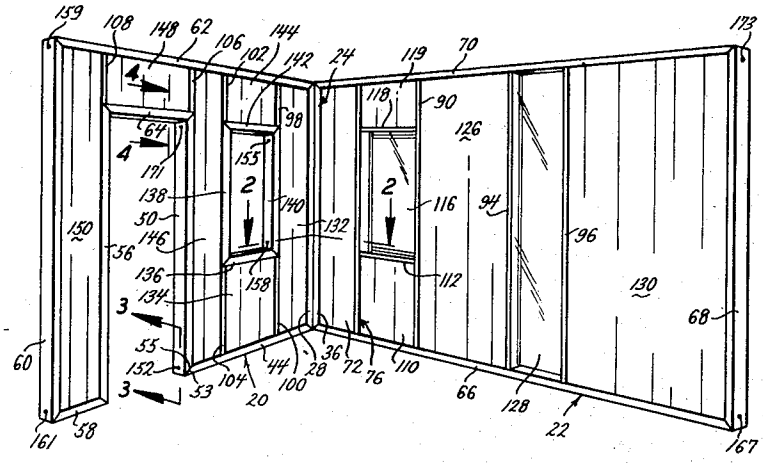


FIG. 1.

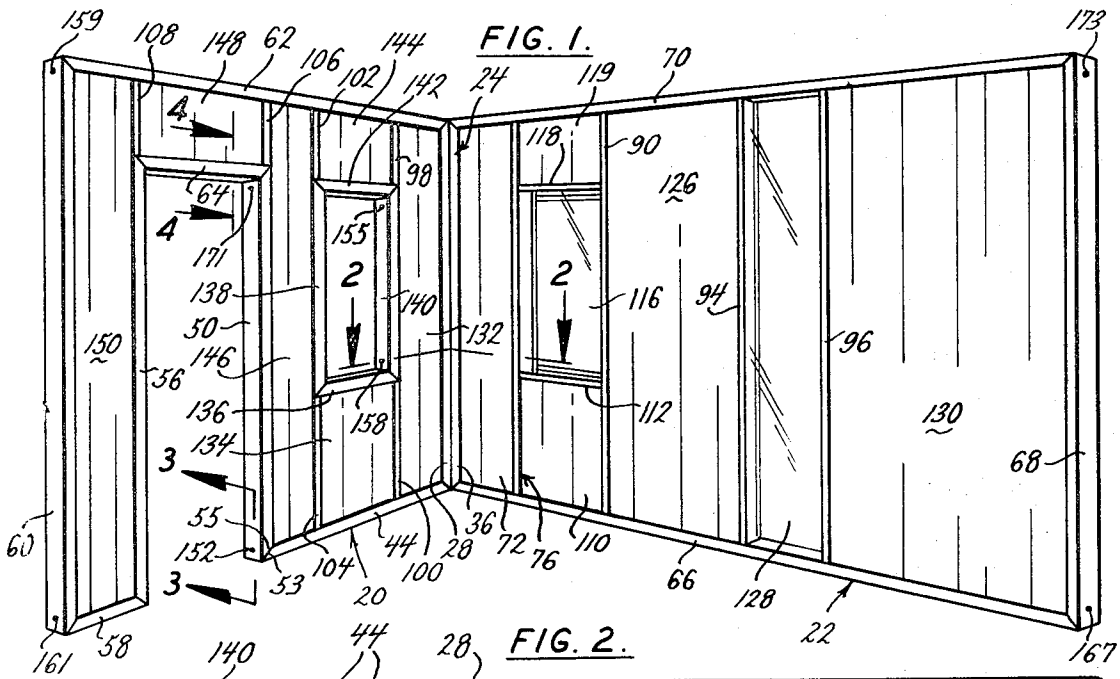


FIG. 2.

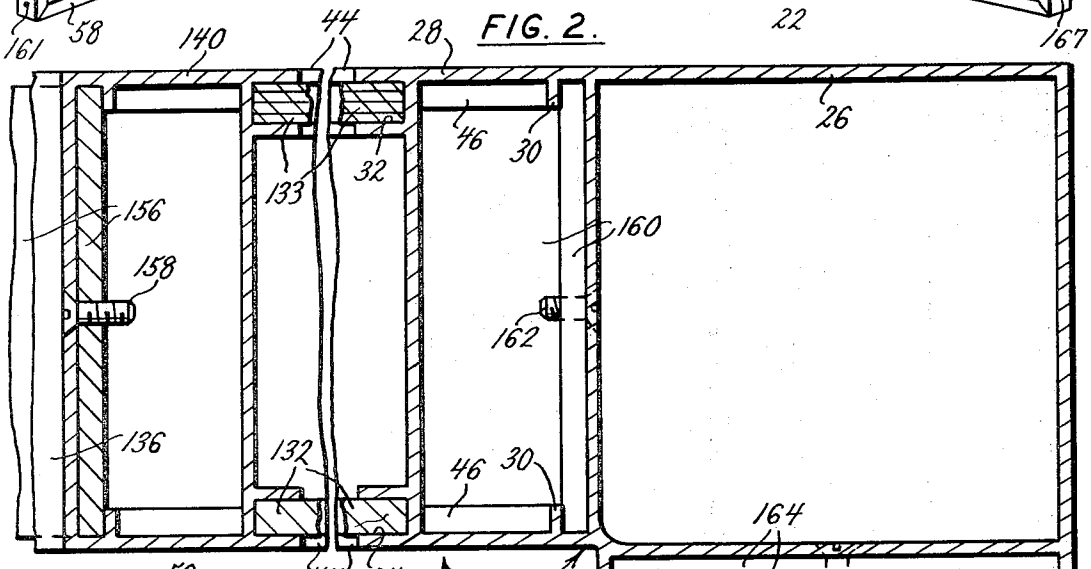
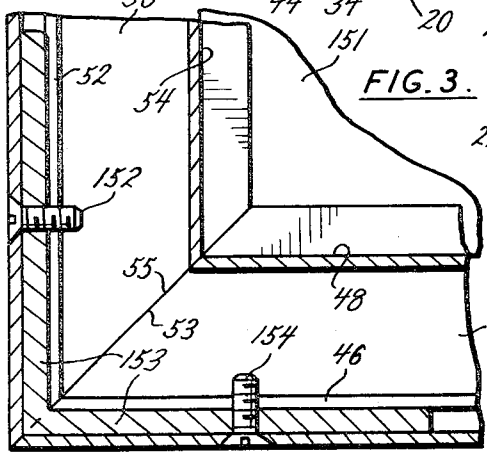


FIG. 3.



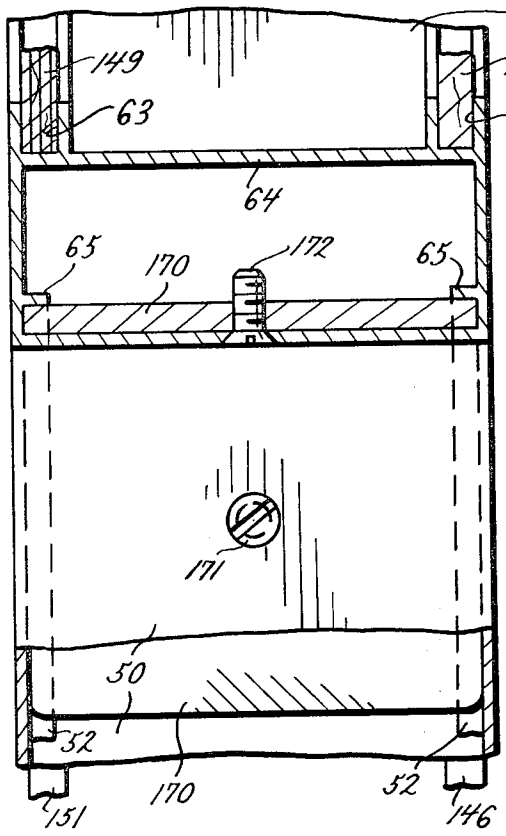


FIG. 4.

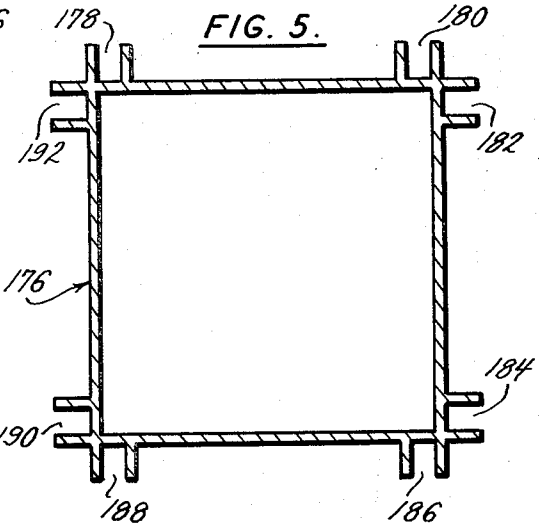


FIG. 5.

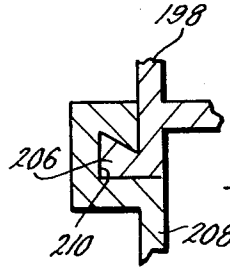


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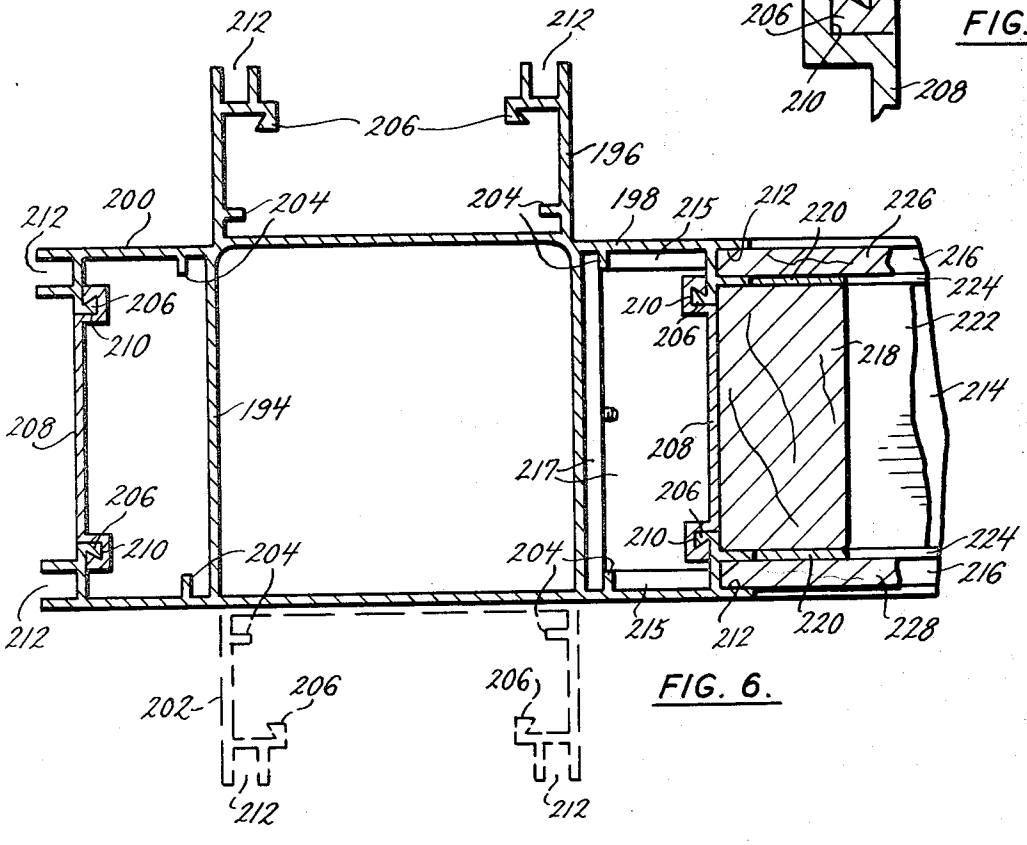


FIG. 6.

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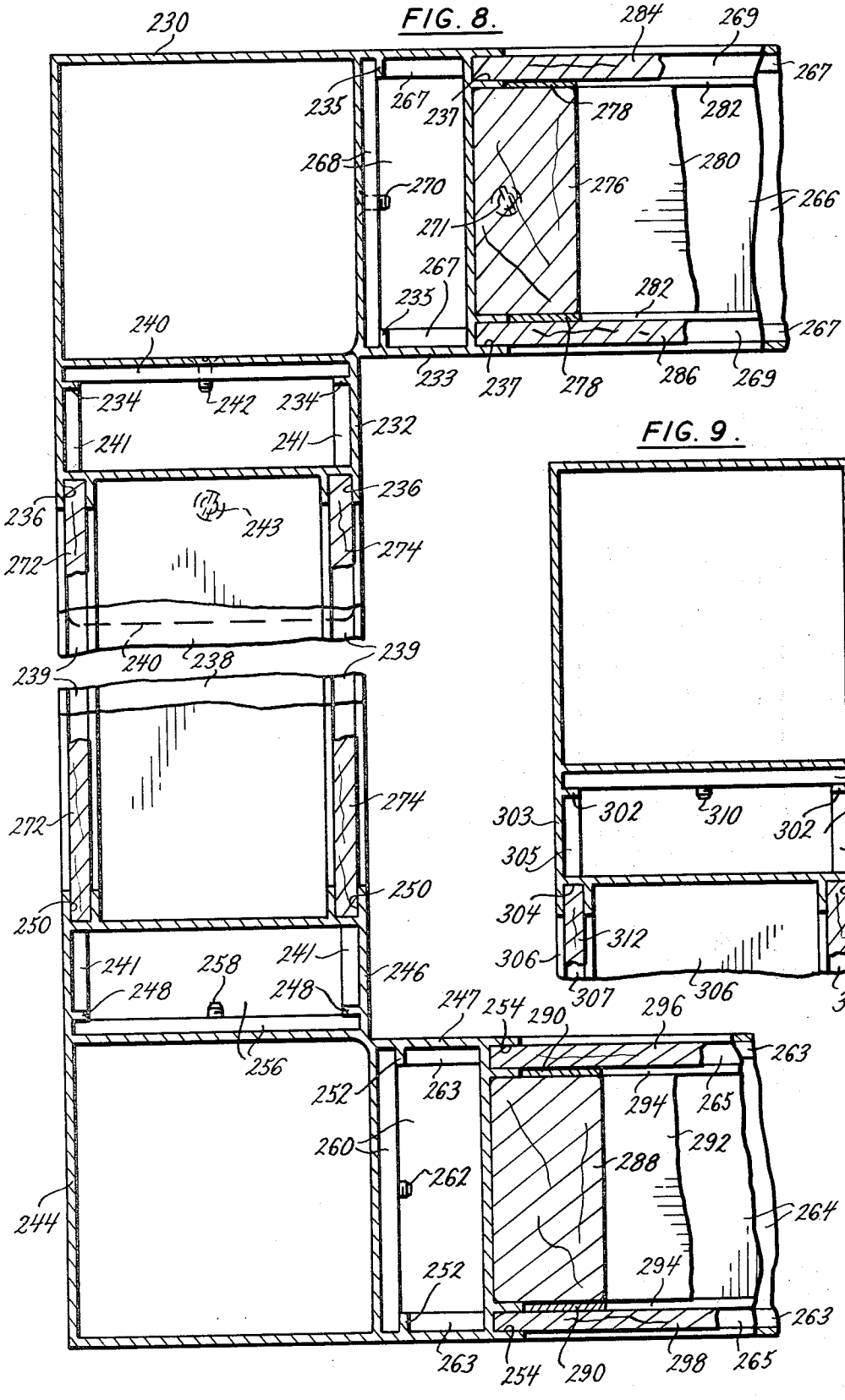

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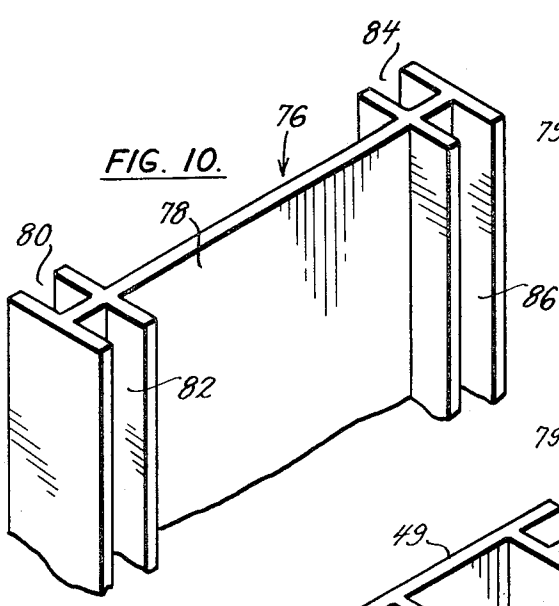


FIG. 10.

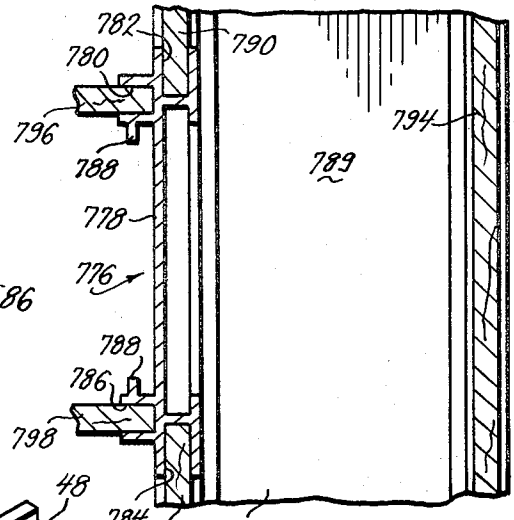


FIG. 31.

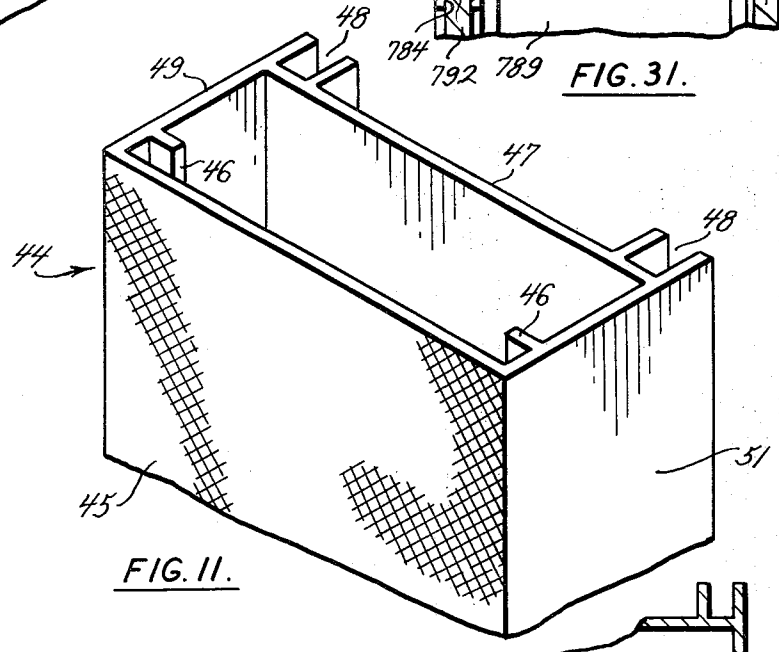


FIG. 11.

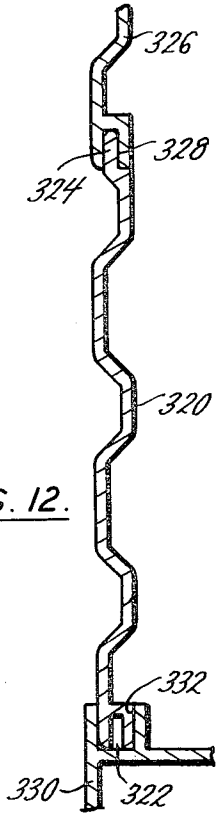


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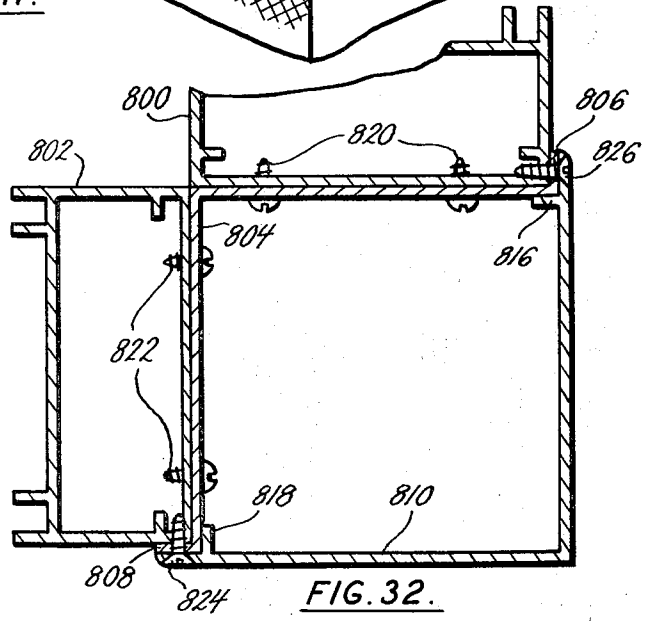


FIG. 32.

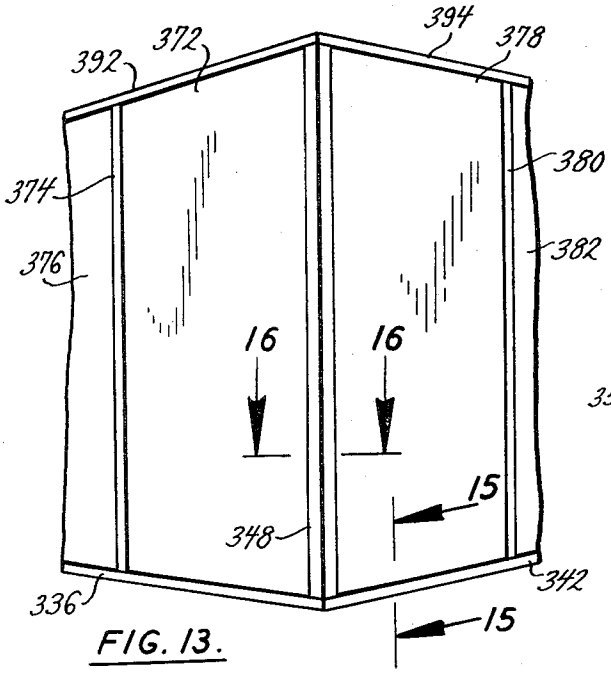


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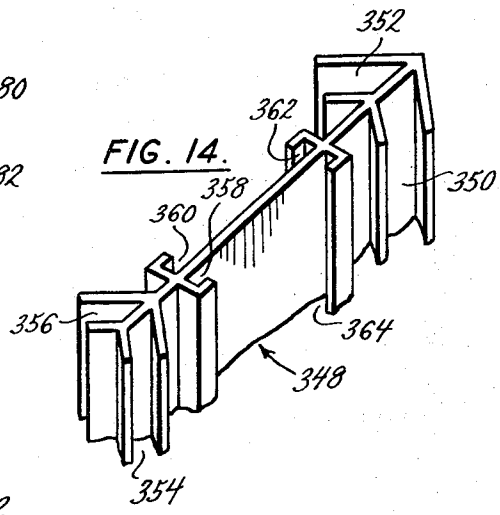


FIG. 14.

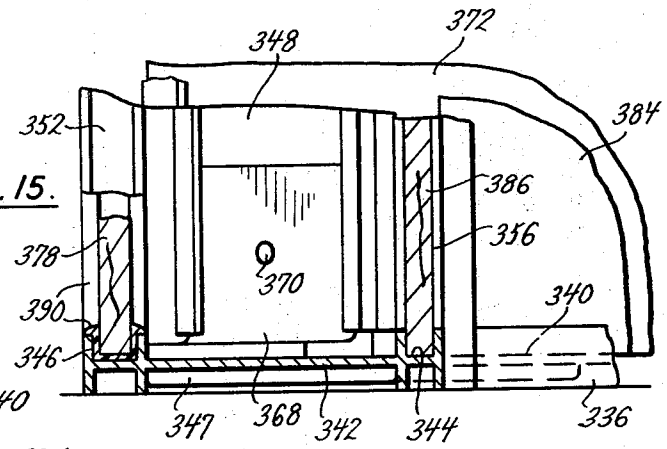


FIG. 15.

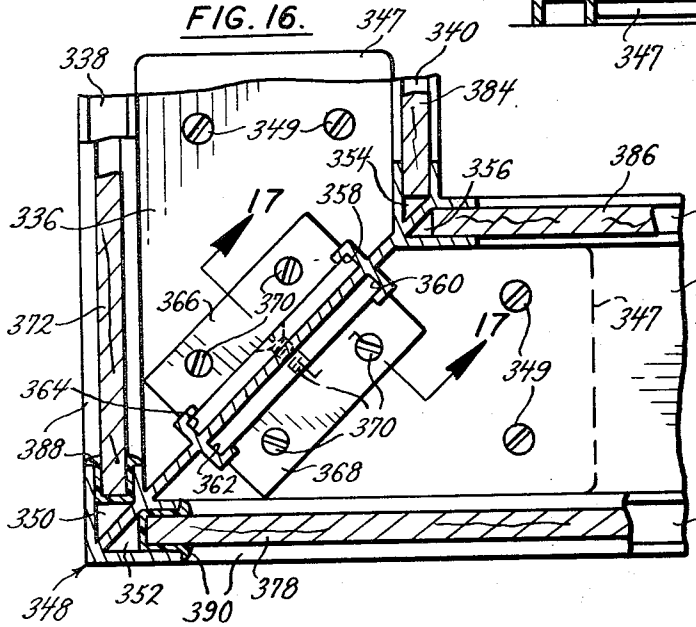


FIG. 16.

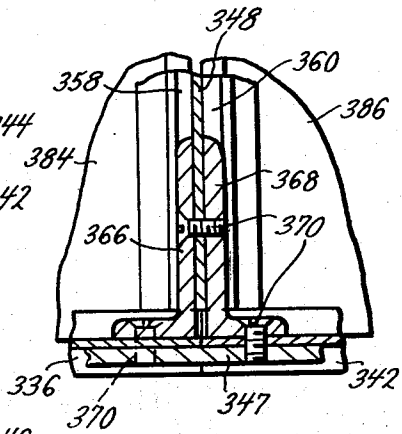
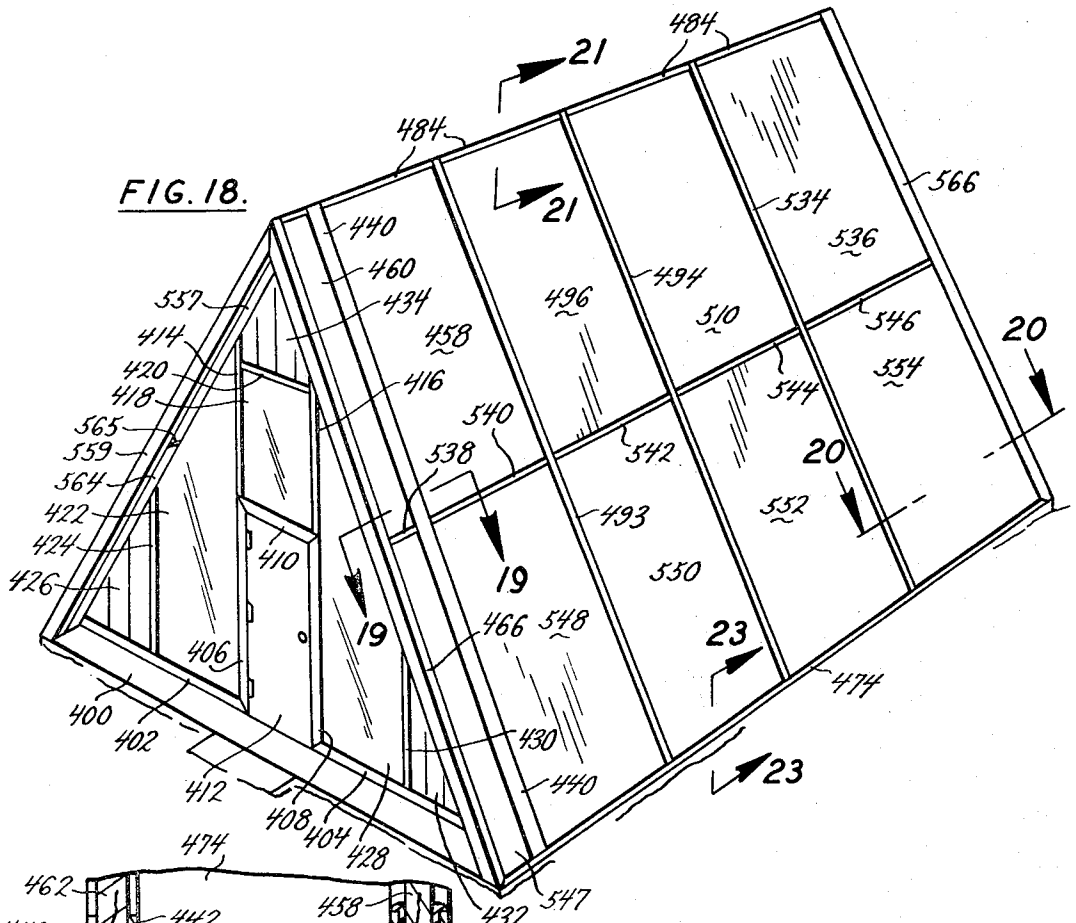


FIG. 17.

FIG. 18.



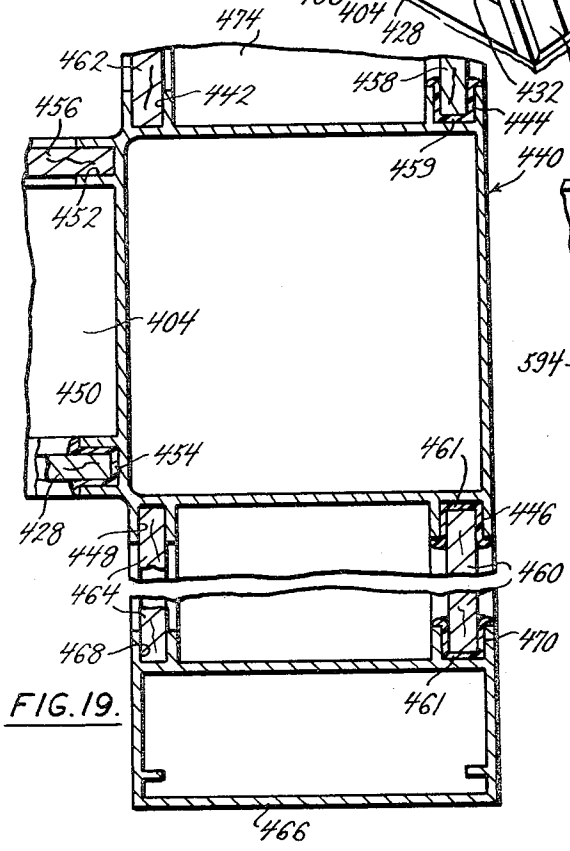
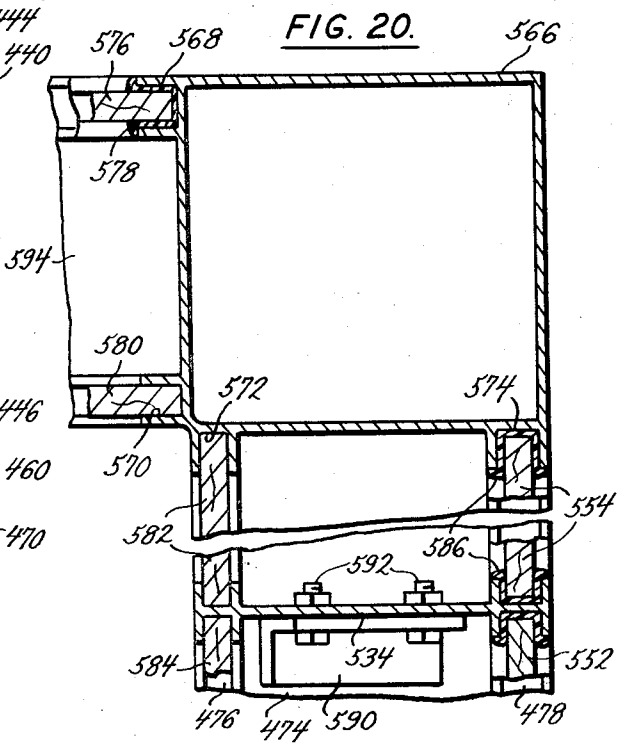


FIG. 19.

FIG. 20.



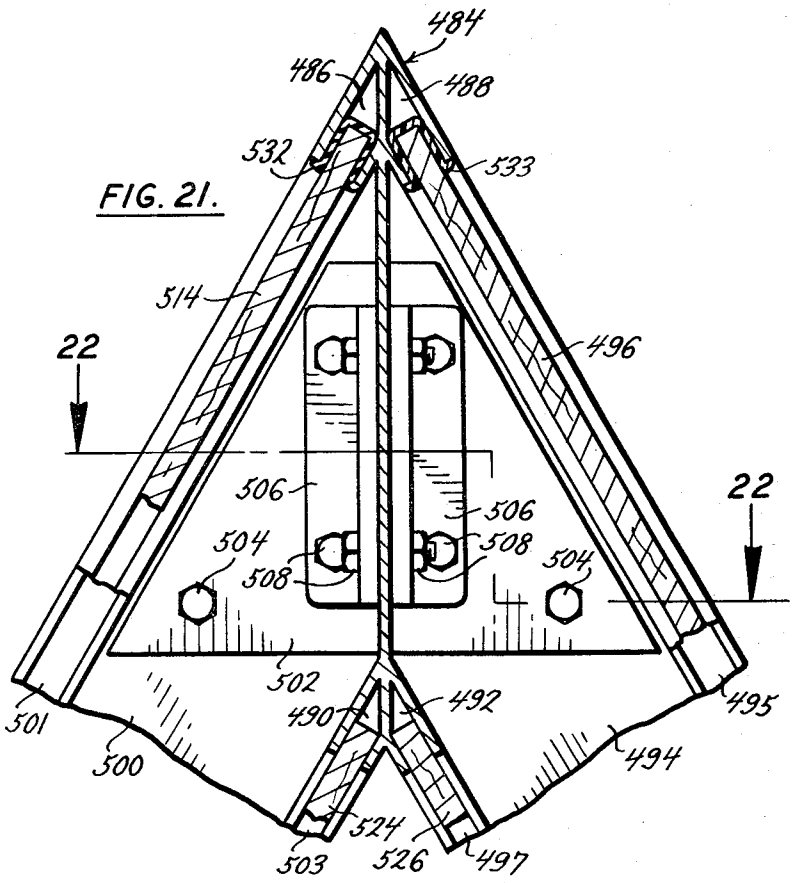


FIG. 21.

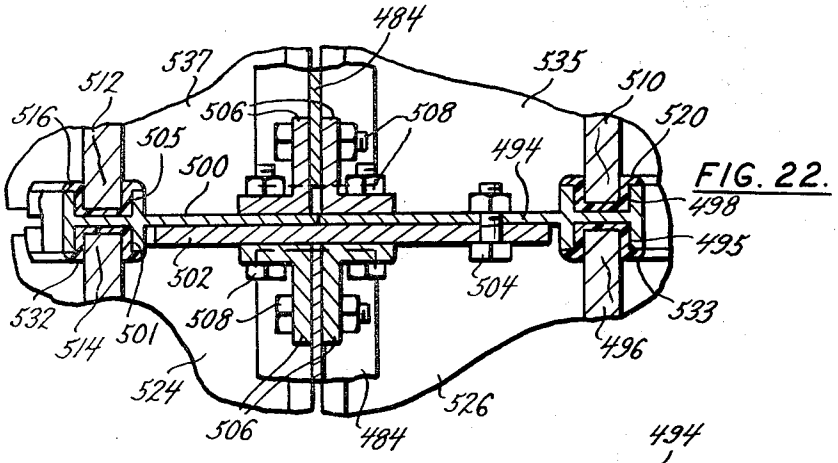


FIG. 22.

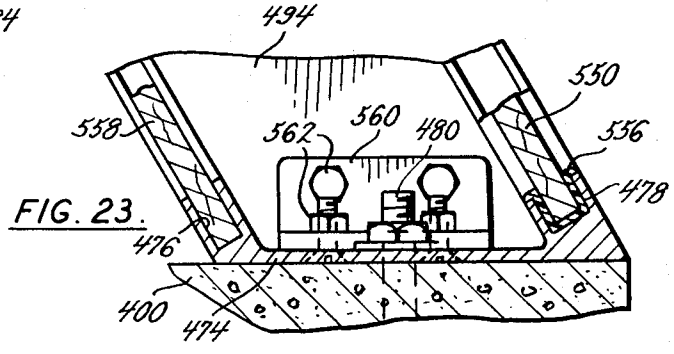


FIG. 23.

FIG. 24.

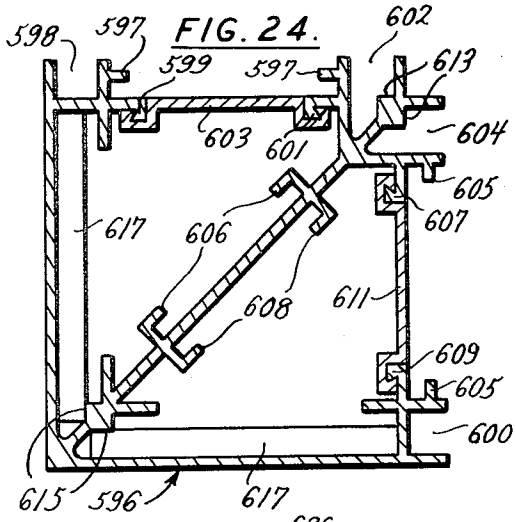


FIG. 25.

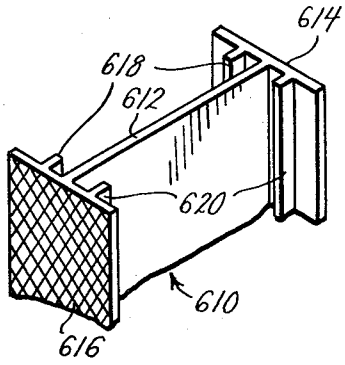


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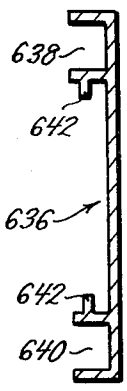
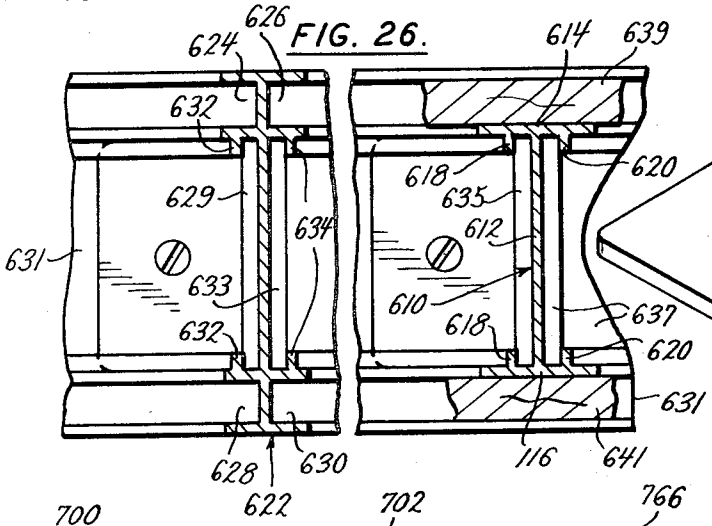


FIG. 26.



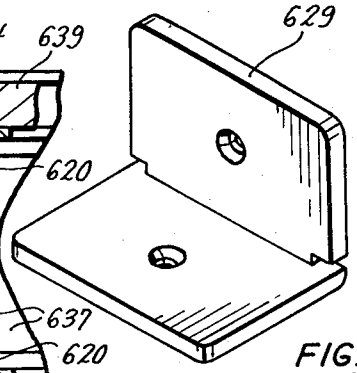


FIG. 27.

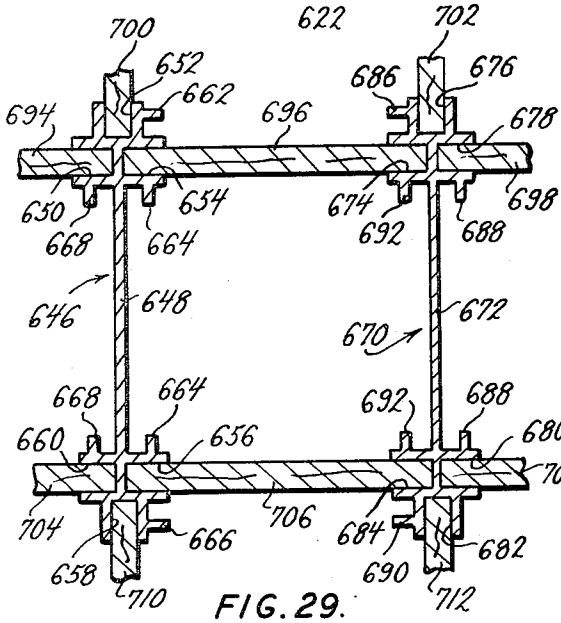


FIG. 29.

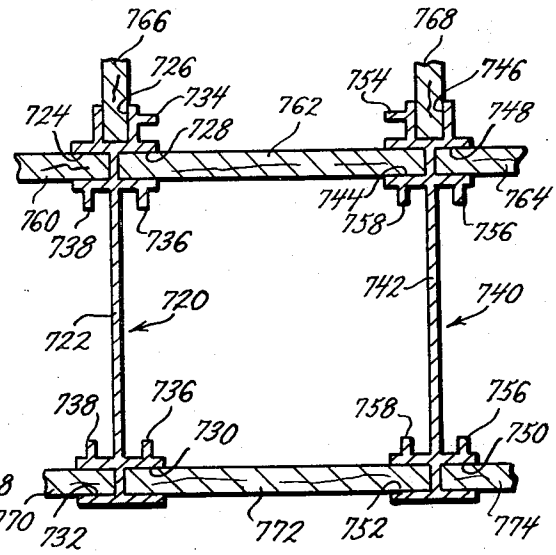


FIG. 30.

GROOVED STRUCTURAL ELEMENT

This invention relates to improvements in grooved structural elements. More particularly, this invention relates to improvements in grooved structural elements which can be combined with panels to form a structure.

It is, therefore, an object of the present invention to provide an improved grooved structural element which can be combined with panels to form a structure.

SUMMARY OF THE INVENTION

The structural element provided by the present invention has elongated, parallel, transversely-spaced grooves which can accommodate the edges of transversely-spaced panels. That structural element coacts with other similar structural elements to constitute a plural-sided frame which has substantially-continuous, elongated, parallel, transversely-spaced, inwardly-directed grooves. A plurality of panels have their upper and lower edges extending into and held by one of those elongated, parallel, transversely-spaced, inwardly-directed grooves to define a structural plane; and a further plurality of panels have their upper and lower edges extending into and held by the other of those elongated, parallel, transversely-spaced, inwardly-directed grooves to define a second structural plane which is spaced transversely from the first structural plane. Those structural elements coact with those panels to define a sturdy and rugged structure. It is, therefore, an object of the present invention to provide a structural element which has elongated, parallel, transversely-spaced grooves which can accommodate the edges of transversely-spaced panels.

Connector members of generally H-shaped cross section have sets of elongated, parallel, transversely-spaced grooves at one of the faces thereof and have further sets of elongated, parallel, transversely-spaced grooves at the opposite faces thereof. The grooves of the first set of elongated, parallel, transversely-spaced grooves of each connector member are in register with the grooves of the further set of elongated, parallel, transversely-spaced grooves of that connector member; and hence the side edges of the first plurality and second plurality of panels are held in alignment with each other and against transverse movement relative to each other by the first and further sets of grooves in the connector members of generally H-shaped cross section. It is, therefore, an object of the present invention to provide a connector member of generally H-shaped cross section which has a set of elongated, parallel, transversely-spaced grooves at one of the faces thereof and which has a further set of elongated, parallel, transversely-spaced grooves at the opposite face thereof.

One preferred embodiment of grooved structural element provided by the present invention has an elongated passage therein which can serve as a duct for electrical elements or insulated pipes. As a result, that grooved structural element can perform the dual functions of holding the edges of panels of spaced structural planes and also of accommodating electrical elements or insulated pipes. It is, therefore, an object of the present invention to provide a grooved structural element that has an elongated passage therein which can serve as a duct for electrical elements or insulated pipes.

Other and further objects and advantages of the present invention should become apparent from an examination of the drawing and accompanying description.

In the drawing and accompanying description, several preferred embodiments of the present invention are shown and described but it is to be understood that the drawing and accompanying description are for the purpose of illustration only and that the invention will be defined by the appended claims.

BRIEF DESCRIPTION OF THE DRAWING

In the drawing, FIG. **1** is a perspective view of two abutting walls which include grooved structural elements provided by the present invention,

FIG. **2** is a sectional view, on a larger scale, through the walls of FIG. **1**, and it is taken along the plane indicated by the line **2—2** in FIG. **1**,

FIG. **3** is a sectional view, on the scale of FIG. **2**, through one of the walls in FIG. **1**, and it is taken along the plane indicated by the line **3—3** in FIG. **1**,

FIG. **4** is another sectional view, on the scale of FIG. **2**, through the one wall of FIG. **1**, and it is taken along the plane indicated by the line **4—4** in FIG. **1**,

FIG. **5** is a horizontal section, on a scale intermediate those of FIGS. **1** and **2**, through a further grooved structural element provided by the present invention,

FIG. **6** is a horizontal section, on the scale of FIG. **5**, through a portion of a structure which incorporates another grooved structural element provided by the present invention,

FIG. **7** is a horizontal section, on a scale larger than that of FIG. **2**, through a portion of the structure shown in FIG. **6**,

FIG. **8** is a vertical section, on the scale of FIG. **5**, through portions of a floor, a ceiling, and a wall of a room made from grooved structural elements of the present invention,

FIG. **9** is a horizontal section, on the scale of FIG. **5**, through a further wall including grooved structural elements of the present invention,

FIG. **10** is a perspective view, on the scale of FIG. **2**, of the upper part of one of grooved structural elements of FIG. **2**,

FIG. **11** is a perspective view, on the scale of FIG. **2**, of the upper part of another of the grooved structural elements of FIG. **2**,

FIG. **12** is a vertical section, on the scale of FIG. **2**, through a portion of a grooved structural element and through a portion of a plural-section panel which could be used in forming a wall,

FIG. **13** is a perspective view, on the scale of FIG. **1**, of a corner defined by two walls,

FIG. **14** is a perspective view, on a scale intermediate those of FIGS. **1** and **2**, of the upper end of the corner fitting used in the wall of FIG. **13**,

FIG. **15** is a sectional view, on a scale somewhat larger than that of FIG. **14**, through one of the walls of FIG. **13**, and it is taken along the plane indicated by the line **15—15** in FIG. **13**,

FIG. **16** is a sectional view, on the scale of FIG. **15**, through both of the walls of FIG. **13**, and it is taken along the plane indicated by the line **16—16** in FIG. **13**,

FIG. **17** is a sectional view, on the scale of FIG. **15**, through the structure in FIG. **16**, and it is taken along the broken plane indicated by the broken line **17—17** in FIG. **16**,

FIG. 18 is a perspective view, on a scale smaller than that of FIG. 1, of an A-frame building which is made in accordance with the principles and teachings of the present invention,

FIG. 19 is a sectional view, on the scale of FIG. 15, through a portion of the A-frame building of FIG. 18, and it is taken along the plane indicated by the line 19—19 in FIG. 18,

FIG. 20 is a sectional view, on the scale of FIG. 15, through another portion of the A-frame building of FIG. 18, and it is taken along the plane indicated by the line 20—20 in FIG. 18,

FIG. 21 is a sectional view, on the scale of FIG. 15, through a further portion of the A-frame building of FIG. 18, and it is taken along the plane indicated by the line 21—21 in FIG. 18,

FIG. 22 is a sectional view, on the scale of FIG. 15, and it is taken along the broken plane indicated by the broken line 22—22 in FIG. 21,

FIG. 23 is a sectional view, on the scale of FIG. 15, through a still further portion of the A-frame building of FIG. 18, and it is taken along the plane indicated by the line 23—23 in FIG. 18,

FIG. 24 is a horizontal section, on the scale of FIG. 16, through a corner fitting which generally resembles the corner fitting of FIG. 14,

FIG. 25 is a perspective view of the upper end of a structural element which can be positioned between the panels of a wall, ceiling, or floor made in accordance with the principles and teachings of the present invention,

FIG. 26 is a horizontal section, on the scale of FIG. 16, through a wall which includes the grooved structural element of FIG. 25 and a grooved structural element which closely resembles the grooved structural element of FIG. 10, and it shows L-shaped braces securing those grooved structural elements to an underlying horizontally-directed grooved structural element,

FIG. 27 is a perspective view, on a scale larger than that of FIG. 16, of one of the L-shaped braces in FIG. 26,

FIG. 28 is a horizontal section, on the scale of FIG. 16, through a further grooved structural element provided by the present invention,

FIG. 29 is a horizontal section, on the scale of FIG. 16, through two grooved structural elements which coact with panels to define the corners of adjacent walls,

FIG. 30 is a horizontal section, on the scale of FIG. 16, through two further grooved structural elements which coact with panels to define the corners of adjacent walls,

FIG. 31 is a horizontal section, on the scale of FIG. 16, through a grooved structural element which connects a wall at right angles to an intermediate portion of a second wall, and

FIG. 32 is a horizontal section, on the scale of FIG. 16, through a corner fitting which is assembled from four separate elements.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Referring particularly to FIGS. 1–4 the numeral 20 generally denotes a wall which includes grooved structural elements that are made in accordance with the principles and teachings of the present invention. The numeral 22 generally denotes a second wall which is disposed at right angles to the wall 20, and which also includes grooved structural elements that are made in accordance with the principles and teachings of the present invention. The numeral 24 generally denotes a corner fitting which is a metal extrusion; and the cross section of that corner fitting is shown by FIG. 2. That corner fitting has a tubular portion 26 which is essentially square in cross section; and it has a connecting portion 28 that is provided with internal ribs 30, and it has a connecting portion 36 that is provided with internal ribs 38. The ribs 30 are spaced a short distance away from one of the four sides of the tubular portion 26 of the corner fitting 24; and those ribs are in register with each other. The ribs 38 are spaced a short distance away from another of the four sides of the tubular portion 26 of the corner fitting 24; and those ribs are in register with each other.

The connecting portion 28 is tubular and is rectangular in cross-section; and the area defined by that connecting portion is considerably smaller than the area defined by the tubular portion 26. Similarly, the connecting portion 36 is tubular and is rectangular in cross section; and the area defined by that connecting portion is considerably smaller than the area defined by the tubular portion 26. An elongated groove 32 is provided at the outer face of the connecting portion 28, and that groove extends longitudinally along that face. An elongated groove 34 is provided at that same face; and that groove extends longitudinally along that face. The grooves 32 and 34 are located adjacent the opposite sides of the outer face of the connecting portion 28, as shown by FIG. 2, and those grooves are parallel to each other. As a result, the grooves 32 and 34 constitute a set of elongated, parallel, transversely-spaced grooves on the corner fitting 24. An elongated groove 40 is provided at the outer face of the connecting portion 36, and that groove extends longitudinally along that face. An elongated groove 42 is provided at that same face; and that groove extends longitudinally along that face. The grooves 40 and 42 are located adjacent the opposite sides of the outer face of the connecting portion 36, as shown by FIG. 2, and those grooves are parallel to each other. As a result, the grooves 40 and 42 constitute a second set of elongated, parallel, transversely-spaced grooves on the corner fitting 24.

The upper end of the connecting portion 28 of the corner fitting 24 and the upper ends of the grooves 32 and 34 are cut away at an angle of 45° to provide a mitered upper left-hand corner for that corner fitting. The lower end of that connecting portion and the lower ends of the grooves 32 and 34 are cut away at an angle of 45° to provide a mitered lower left-hand corner for the corner fitting 24. The upper end of the connecting portion 36 of the corner fitting 24 and the upper ends of the grooves 40 and 42 are cut away at an angle of 45° to provide a mitered upper right-hand corner for that corner fitting. The lower end of the connecting portion 36 and the lower ends of the grooves 40 and 42 are cut away at an angle of 45° to provide a mitered lower right-hand corner for the corner fitting 24.

A grooved structural element is denoted by the numeral 44 in FIGS. 1–3 and 11; and it preferably is formed as a metal extension. That grooved structural element is shown in FIG. 11 before the ends thereof are mitered; and it includes a tubular portion of rectangular cross section which is defined by four sides 45, 47, 49 and 51, includes grooves 48 adjacent the side 47,

and includes ribs **46** which are disposed inwardly of the side **45** and which extend toward each other. The grooves **48** are parallel and are disposed adjacent the sides **49** and **51** of the grooved structural element **44.** As a result, those grooves constitute a set of elongated, parallel, transversely-spaced grooves on the grooved structural element **44.**

The outer face of the side **45** of the grooved structural element **44** is shown as being interrupted by knurling; but it could be interrupted by grooves, ribs, pockets, projections or the like. The interrupting of that outer face is desirable where that outer face is to be secured to an underlying surface by cement, adhesive, mastic, grout or the like. For example, where the outer face of the side **45** of the grooved structural element **44** is set in engagement with a floor, as shown in FIGS. **1–3,** the interruption of that outer face will enable cement, adhesive, mastic, grout or the like, placed between that outer face and that floor, to hold that grooved structural element against shifting relative to that floor.

In any instances where the outer face of the side **45** of the grooved structural element **44** was not to be secured to anything, that outer face could be left free of interruption, or it could be suitably ornamented by forming a pleasing design on it. Similarly, the other outer faces of that grooved structural element, and the outer faces of various of the other grooved structural elements of the present invention, could be suitably ornamented by forming pleasing designs on them.

The numeral **58** denotes a further grooved structural element; and that grooved structural element will preferably have the same cross section as the grooved structural element **44** in FIG. **11.** Further, the numeral **66** denotes a grooved structural element at the bottom of the wall **22** in FIG. **1**; and that grooved structural element will preferably have the same cross section as the grooved structural element **44** in FIG. **11.** As indicated by FIG. **1,** the ends of the grooved structural elements **44, 58** and **66** are mitered; and one of the mitered ends of the grooved structural element **44** abuts the mitered lower left-hand corner of the corner fitting **24,** while one of the mitered ends of the grooved structural element **66** abuts the mitered lower right-hand corner of the corner fitting **24.** Consequently, the groove **32** of the corner fitting **24** will be in register with and will abut the outer groove **48** of the grooved structural element **44,** the groove **34** of that corner fitting will be in register with and will abut the inner groove **48** of that grooved structural element, the groove **40** of that corner fitting will be in register with and will abut the inner groove of the grooved structural element **66,** and the groove **42** of that corner fitting will be in register with and will abut the outer groove of the grooved structural element **66.** In addition, the ribs **30** in the connecting portion **28** of the corner fitting **24** will be in register with and will abut the ribs **46** of the grooved structural element **44**; and the ribs **38** in the connecting portion **36** of that corner fitting will be in register with and will abut the ribs **67** of the grooved structural element **66.**

Each of the grooves **32** and **42** in the corner fitting **24** will preferably have the same width and depth as the particular groove in the grooved structural element **44** or **66** which is contiguous with that groove. Where the thickness of each of the walls **20** and **22** is 5 inches, the groove depth will preferably be in the range of one-half to three-quarters of an inch; and the groove width will preferably be in the range of three-eighths to five-eighths of an inch. Each of the grooves **34** and **40** in the corner fitting **24** will preferably have the same width and depth as the particular groove in the grooved structural element **44** or **66** which is contiguous with that groove. That depth will preferably be in the range of one-half to three-quarters of an inch; and the groove width will preferably be in the range of three-eighths to five eighths of an inch. FIG. **2** shows the grooves **32, 34, 40** and **42** in the corner fitting **24** as having the same depths and widths; and hence the grooves within the grooved structural elements **44** and **66** will have the same depths and widths. However, if desired, the width and depth of the groove **32** could differ from the widths and depths of one or more of the grooves **34, 40** and **42**; but the width and depth of the groove **32** will preferably be the same as those of that groove of the grooved structural element **44** which is contiguous with it. Similarly, if desired, the width and depth of any of the grooves **34, 40** and **42** could differ from the depth and width of one or more of the other grooves in the corner fitting **24**; but each groove in that corner fitting **24** will preferably have the same width and depth as the contiguous groove in the grooved structural element **44** or **66.**

The numeral **50** denotes a vertical element of the wall **20**; and that element has the same cross section as the grooved structural element **44** in FIG. **11.** As indicated by FIG. **3,** the ribs of the element **50** are denoted by the numeral **52,** and the grooves of that element are denoted by the numeral **54.** The ends of the element **50** are mitered by parallel mitering cuts; and the lower end of that element abuts the mitered left-hand end of the grooved structural element **44.** As a result, the grooves **48** in the grooved structural element **44** abut and are in register with the grooves **54** of the element **50.** Further, the ribs **46** of the grooved structural element **44** abut and are in register with the ribs **52** of the element **50.** As shown by FIG. **1,** the element **50** is parallel to the corner fitting **24.**

The numeral **56** denotes a vertical element of the wall **20**; and that element is a mirror image of the vertical element **50.** The grooved faces of those vertical elements are directed away from each other, and the plane faces of those vertical elements confront each other to define the sides of a doorway for the wall **20.** The ends of the vertical element **56** are mitered; and the mitered lower end of that element abuts the mitered right-hand end of the grooved structural element **58.** As a result, the grooves, not shown, in the elements **56** and **58** will abut and be in register with each other. Similarly, the ribs, not shown, in those elements will abut and be in register with each other.

The numeral **60** denotes a vertical element which serves as the left-hand end of the wall **20**; and that element has the same cross section as the grooved structural element **44** in FIG. **11.** The vertical element **60** is longer than the vertical element **50**; and the mitering cuts at the ends of the former vertical element are angularly displaced, whereas the mitering cuts at the ends of the latter vertical element are parallel to each other. The mitered lower end of the vertical element **60** abuts the mitered left-hand end of the grooved structural element **58.** As a result, the grooves, not shown, in the elements **58** and **68** will abut and be in register with each other.

The numeral **62** denotes a horizontal element which serves as the cap of the wall **20**; and that element has the same cross section as the grooved structural element **44** in FIG. **11**. The ends of the element **62** are mitered; and the left-hand mitered end of that element abuts the mitered upper end of the vertical element **60**, while the mitered right-hand end of that element abuts the mitered upper end of the connecting portion **28** of the corner fitting **24**. As a result, the grooves, not shown, in the elements **60** and **62** will abut and be in register with each other. Similarly, the ribs, not shown, in those elements will abut and be in register with each other.

The numeral **64** denotes a horizontal element of the wall **20**; and that element has the same cross section as the grooved structural element **44** in FIG. **11**. The ends of the element **64** are mitered by mitering cuts which incline outwardly and upwardly from the plane face of that element as shown by FIG. **1**. Those mitered ends abut the mitered upper ends of the vertical elements **50** and **56**, and hence the element **64** coacts with those elements to define the top and sides of the doorway in the wall **20**. The grooves **63** of the element **64** will abut and be in register with the grooves **54** of the vertical element **50**, and also will abut and be in register with the grooves, not shown, of the vertical element **56**. Similarly, the ribs **65** of the element **64** will abut and be in register with the ribs **52** of the vertical element **50**, and also will abut and be in register with the ribs, not shown, of the vertical element **56**.

The elements **44**, **58**, **60** and **62** essentially define three sides of the frame of the wall **20**; and the connecting portion **28** of the corner fitting **24** defines the fourth side of that frame. The elements **50** and **56** coact with the element **64** to define the doorway in that wall; and they also coact with the elements **44** and **58** to help define the bottom side of the frame of the wall **20**. Those various elements coact with each other, with the corner fitting **24**, and with the panels of that wall to strengthen and rigidify that wall.

The numeral **68** denotes a vertical element which serves as the right-hand end of the wall **22**; and that element has the same cross section as the grooved structural element **44** in FIG. **11**. The ends of the vertical element **68** are mitered; and the mitered lower end of that vertical element abuts the mitered right-hand end of the bottom element **66**. As a result, the grooves, not shown, in the bottom element **66** will abut and be in register with the grooves, not shown, in the vertical element **68**. Similarly, the ribs **67** in the bottom element **66** will abut and be in register with the ribs, not shown, in the vertical element **68**.

The numeral **70** denotes a horizontal element that serves as the cap of the wall **22**; and that element has the same cross section as the grooved structural element **44** in FIG. **11**. The ends of the horizontal element **70** are mitered; and the mitered left-hand end of that element abuts the mitered upper end of the connecting portion **36** of the corner fitting **24**, while the mitered right-hand end of that element abuts the mitered upper end of the vertical element **68**. Consequently, the grooves, not shown, in the horizontal element **70** will abut and be in register with the grooves **40** and **42** in the connecting portion **36** of the corner fitting **24**, and also will abut and be in register with the grooves, not shown, in the vertical element **68**. Similarly, the ribs, not shown, in the horizontal element **70** will abut and be in register with the ribs **38** in the connecting portion **36** of the corner fitting **24**, and also will abut and be in register with the ribs, not shown, in the vertical element **68**.

The elements **66**, **68** and **70** define three sides of the frame of the wall **22**; and the connecting portion **36** of the corner fitting **24** defines the fourth side of that frame. Those elements coact with each other, with the corner fitting **24**, and with the panels of the wall **22** to strengthen and rigidify that wall. The numeral **72** denotes a panel which has a thickness that is just slightly less than the width of the groove **40** in the connecting portion **36** of the corner fitting **24**; and that thickness also is just slightly less than the width of the inner grooves, not shown, in the bottom element **66** and in the upper element **70** of the wall **22**. That panel can be a section of plywood, of wall board, of drywall, of decorating paneling, or the like; and, in one preferred embodiment of the present invention, that panel is 8 feet high, 4 feet wide, and three-eighths of an inch thick — and thus has dimensions that are standard in the construction industry. That panel can, either in its purchased state or after it has been painted, serve as part of the interior of the room or area which it helps bound and define. The left-hand edge of the panel **72** will extend into, and will be confined and guided by, the groove **40** of the connecting portion **36** of the corner fitting **24**; and the bottom edge of that panel extends into, and will be confined and guided by, the inner groove of the bottom element **66**. The upper edge of the panel **72** extends into, and will be confined and guided by, the inner groove of the upper element **70**.

The numeral **74** denotes a panel which has a thickness that is just slightly less than the width of the groove **42** in the connecting portion **36** of the corner fitting **24**; and that thickness also is just slightly less than the width of the outer grooves, not shown, in the bottom element **66** and in the upper element **70** of the wall **22**. That panel can be a section of plywood, of wallboard, of drywall, of decorating paneling, or the like; and, in the said one preferred embodiment of the present invention, that panel is 8 feet high, 4 feet wide, and three-eighths of an inch thick. If the surface of the wall **22**, of which the panel **74** is a part, helps bound and define the interior of a room or area, that panel can, either in its purchased state or after it has been painted, serve as part of that interior. However, if the surface of the wall **22**, of which the panel **74** is a part, is an exterior surface, that panel will be made so it can withstand rain, sleet, hail, snow, sunlight, heat, dirt, and the like. The left-hand edge of the panel **74** extends into, and will be confined and guided by, the groove **42** in the connecting portion **36** of the corner fitting **24**, and the bottom edge of that panel extends into, and will be confined and guided by, the outer groove of the bottom element **66**. The upper edge of the panel **74** extends into, and will be confined and guided by, the outer groove in the upper portion **70**.

The numeral **76** generally denotes a connector member which is a metal extension with an H-shaped cross section; and FIG. **10** is a perspective view of the upper end of that connector member. A web **78** of that connector member has grooves **80** and **84** extending outwardly from one face thereof, and has grooves **82** and **86** extending outwardly from the opposite face thereof. The grooves **80** and **82** are in register with each other,

and the grooves **84** and **86** are in register with each other, as shown particularly by FIGS. **2** and **10.** The height of the connector member **76** is equal to the distance between the confronting surfaces of the groove-defining portions of the lower element **66** and of the upper element **70.** As a result, that connector member can fit snugly between the upper surface of the lower element **66** and the lower surface of the upper element **70** of the wall **22.** The groove **80** in the connector member **76** will be in register with the inner grooves, not shown, of the upper and lower elements **70** and **66;** and those inner grooves are in register with the groove **40** in the connecting portion **36** of the corner fitting **24.** As a result, the groove **80** will coact with those inner grooves and with the groove **40** to define an essentially-continuous constant-width, constant-depth groove. The groove **84** in the connector member **76** will be in register with the outer grooves, not shown, of the upper and lower elements **70** and **66;** and those outer grooves are in register with the groove **42** in the connecting portion **36** of the corner fitting **24.** As a result, the groove **84** will coact with those outer grooves and with the groove **42** to define an essentially-continuous constant-width, constant-depth groove. Those essentially continuous, constant-width, constant-depth grooves are parallel to, but are transversely spaced relative to, each other. The groove **80** in the connector member **76** receives and guides and confines the right-hand edge of the panel **72,** and the groove **84** in that connector member receives and guides and confines the right-hand edge of the panel **74.** As a result, the connector member **76** coacts with the connecting portion **36** of the corner fitting **24,** with the lower element **66,** with the upper element **70,** and with the panels **72** and **74** to define a totally-enclosed space between the inner and outer surfaces of the wall **22.** The engagements between the left-hand edge of the panel **72** and the groove **40** in the connecting portion **36** of the corner fitting **24,** between the right-hand edge of that panel and the groove **80** in the connector member **76,** and between the upper and lower edges of that panel and the grooves, not shown, in the upper and lower elements **70** and **66** will enable that panel, that corner fitting, that connector member and those elements to strengthen and rigidify the wall **22.**

The grooves **80, 82, 84** and **86** in the connector member **76** can have different depths and different widths. However, the depths and widths of the grooves **80** and **82** will usually be the same, and the depths and widths of the grooves **84** and **86** will usually be the same. Importantly, the depths and widths of the grooves **80** and **82** should be the same as the depths and widths of the inner grooves of the upper and lower elements **70** and **66.** Also importantly, the depths and widths of the grooves **84** and **86** should be the same as the depths and widths of the outer grooves of those upper and lower elements.

The numerals **90, 94** and **96** denote further connector members which can be identical to the connector member **76.** Those connector members are vertically-directed, and the lower ends thereof rest upon the groove-defining portions of the lower element **66.** The upper ends of the connector members **90, 94** and **96** underlie the groove-defining portions of the upper element **70.** As shown by FIG. **1,** the connector members **76, 90, 94** and **96** are disposed between and are parallel to, the corner fitting **24** and the vertical element **68** of the wall **22.**

A short connector member **98,** which has the same cross section as the connector member **76** of FIG. **10,** is incorporated in the wall **20** in FIG. **1.** That connector member is vertically-directed; and it underlies, and extends downwardly from, the upper element **62** of that wall. A similar, short connector member **100** is vertically-directed, and it overlies and extends upwardly from the lower element **44.** The connector members **98** and **100** are in vertical alignment with each other, as indicated by FIG. **1.** Another similar, short connector member **102** is vertically-directed; and it underlies, and extends downwardly from, the upper element **62** of the wall **20.** A further, similar short connector member **104** is vertically-directed; and it overlies and extends upwardly from the lower element **44.** The connector members **102** and **104** are in vertical alignment with each other, as indicated by FIG. **1.** Two shorter, similar connector members **106** and **108** are vertically-directed; and they underlie, and extend downwardly from, the upper element **62.** The lower ends of the connector members **106** and **108** abut the groove-forming portions of the grooved structural element **64.** The connector members **98, 100, 102, 104, 106** and **108** are disposed between, and are parallel to, the corner fitting **24** and the vertical element **60** of the wall **20.**

The numeral **110** denotes a short panel which has the side edges thereof extending into, and confined and guided by, the lower portion of the groove **82** in the connector member **76** and by the lower portion of the confronting groove in the connector member **90.** The lower edge of that short panel extends into the inner groove of the lower element **66.** A similar short panel, not shown, which is disposed in register with but which is spaced outwardly of the panel **110,** has the side edges thereof extending into, and confined and guided by, the lower portions of the confronting outer grooves of the connector members **76** and **90.** A short, connector member **112,** which has the same cross section as the connector member **76** of FIG. **10,** is incorporated in the wall **22** in FIG. **1.** That connector member is horizontally-directed, and it extends between the groove-defining portions of the connector members **76** and **90.** The inner downwardly-directed groove of the connector member **112** telescopes downwardly over the upper edge of the short panel **110;** and the outer downwardly-directed groove of that connector member telescopes downwardly over the upper edge of the short panel, not shown, which is disposed in register with but which is spaced outwardly of the panel **110.** The connector member **112** coacts with the lower portions of the connector members **76** and **90** and with the lower element **66** to hold the short panel **110,** and the similar short panel, not shown, which is disposed in register with but which is spaced outwardly of the panel **110,** in parallel, spaced-apart relation.

A seal **114,** which is made from a resilient material such as rubber and which is U-shaped in cross section, extends around the top, sides and bottom of a rectangular glass pane **116.** The closed portion of that seal extends into the mid-portion of the groove **82** in the connector member **76,** into the upwardly-directed inner groove of the connector member **112,** and into the mid-portion of the inner groove, not shown, of the connector member **90.** A similar seal **121** extends around the top, sides and bottom of a rectangular glass pane **122;**

and the closed portion of that seal extends into the mid-portion of the groove **86** of the connector member **76,** into the mid-portion of the confronting groove of the connector member **90,** and into the upwardly-directed outer groove of the connector member **112.** A short, connector member **118,** which has the same cross section as the connector member **76** of FIG. **10.** is incorporated in the wall **22.** That connector member is horizontally directed; and it has the downwardly-directed inner groove thereof telescoped downwardly over the closed portion of the seal **114** adjacent the top of the glass pane **116.** The downwardly-directed outer groove of that connector member telescopes downwardly over the closed portion of the seal **121** adjacent the top of the glass pane **122.**

A short panel **119** has the left-hand side thereof extending into, and confined and guided by, the upper portion of the groove **82** in the connector member **76,** has the right-hand side thereof extending into, and confined and guided by, the upper portion of the confronting groove of the connector member **90,** has the lower edge thereof extending into, and confined and guided by, the upwardly-directed inner groove of the connector member **118,** and has the upper edge thereof extending into, and confined and guided by, the inner groove of the upper element **70.** A corresponding short panel, not shown, has the left-hand side thereof extending into, and confined and guided by, the upper portion of the groove **86** in the connector member **76,** has the right-hand side thereof extending into, and confined and guided by, the upper portion of the confronting groove in the connector member **90,** has the lower edge thereof extending into, and confined and guided by, the upwardly-directed outer groove of the connector member **118,** and has the upper edge thereof extending into, and confined and guided by, the outer groove of the upper element **70.**

The short panel **110,** the glass pane **116,** and the short panel **119** coact with the connector members **112** and **118** to serve as an essentially-continuous panel that fills the space defined by the groove **82** of the connector member **76,** the confronting groove of the connector member **90** and the inner grooves of the upper and lower elements **70** and **76.** Similarly, the short panel, not shown, which is disposed in register with but which is spaced outwardly of the panel **110,** the glass pane **122,** and the short panel, not shown, which is disposed is register with but which is spaced outwardly of the panel **119** coact with the connector members **112** and **118** to serve as an essentially-continuous panel that fills the space defined by the groove **86** of the connector member **76,** the confronting groove of the connector member **90,** and the outer grooves of the upper and lower elements **70** and **76.** Those two essentially-continuous panels will coact with the connector members **76** and **90** and with the upper and lower elements **70** and **66** to strengthen and rigidify the wall **22.**

The numeral **126** denotes a panel which has the sides thereof extending into, and confined and guided by, the confronting inner grooves of the connector members **90** and **94,** and which has the upper and lower edges thereof extending into, and confined and guided by, the inner grooves of the upper and lower elements **70** and **66.** A similar panel, not shown, which is disposed in register with but which is spaced outwardly of the panel **126,** has the sides thereof extending into, and confined and guided by, the confronting outer grooves of the connector members **90** and **94,** and has the lower and upper edges thereof extending into, and confined and guided by, the outer grooves of the lower and upper elements **66** and **70.** Those two panels will coact with the connector members **90** and **94** and with the upper and lower elements **70** and **66** to strengthen and rigidify the wall **22.**

The numeral **128** denotes a rectangular glass pane which has a resilient seal, not shown, like the resilient seal **114,** extending around the top, sides and bottom thereof. That seal, and the sides of that glass pane, extend into, and are confined and guided by, the confronting inner grooves of the connector members **94** and **96;** and that seal and the top and bottom of that glass pane, extend into, and are confined and guided by, the inner grooves of the lower and upper elements **66** and **70.** A similar glass pane, not shown, which is disposed in register with but which is spaced outwardly of the glass pane **128,** has a resilient seal, not shown, like the resilient seal **121,** extending around the top, sides and bottom thereof. That seal, and the sides of that glass pane, extend into, and are confined and giided by, the confronting outer grooves of the connector members **94** and **96;** and that seal and the top and bottom of that glass pane, extned into, and are confined and guided by, the outer grooves of the lower and upper elements **66** and **70.** Those two glass panes will coact tith the connector members **94** and **96** and with the upper and lower elements **70** and **66** to strengthen and rigidify the wall **22.**

The numeral **130** denotes a panel which has the left-hand side thereof extending into, and confined and guided by, the right-hand inner groove of the connector member **96,** has the right-hand side thereof extending into, and confined and guided by, the inner groove of the vertical element **68,** and has the upper and lower edges thereof extending into, and confined and guided by, the inner grooves of the lower and upper elements **66** and **70.** A similar panel, not shown, which is disposed in register with but which is spaced outwardly of the panel **130,** has the sides thereof extending into, and confined and guided by, the outer groove of the vertical element **68** and the confronting outer groove of the connector member **96,** and has the lower and upper edges thereof extending into, and confined and guided by, the outer grooves of the lower and upper elements **66** and **70.** The panel **130** and its outer counterpart will coact with the connector member **96,** the vertical element **68** and with the upper and lower elements **70** and **66** to strengthen and rigidify the wall **22.**

No nails, screws or other fasteners, and no cements, adhesives, mastics, tapes or the like are needed to hold the edges of the various panels and glass panes of the wall **22** within the grooves which receive those edges. Instead, those various grooves coact with each other to provide full support for those panels and glass panes. It should also be noted that each panel, each connector member, each glass pane, the corner fitting **24,** the vertical element **68,** and the lower and upper elements **66** and **70** add to the stiffness and rigidity of the wall **22.** AS a result, that wall is sturdy and strong.

The numeral **132** denotes a panel which has the lower portion of the left-hand side thereof extending into, and confined and guided by, the right-hand inner groove of the connector member **100,** has the upper portion of that left-hand side extending into, and confined and guided by, the right-hand inner groove of the

connector member **98,** and has the intermediate portion of that left-hand side extending into, and confined and guided by, the inner groove of a grooved structural element **140** which defines the right-hand side of a window-like opening in the wall **20.** The cross section of the grooved structural element **140** is preferably identical to the cross section of the grooved structural element **44** of FIG. **11.** The right-hand side of the panel **132** extends into, and is confined and guided by, the groove **34** of the corner fitting **24,** as shown particularly by FIG. **2.** The lower edge of the panel **132** entends into, and is confined and guided by, the inner groove **48** of the lower element **44;** and the upper edge of that panel extends into, and is confined and guided by, the inner groove of the upper element **62.**

A similar panel **133** has the lower portion of the left-hand side thereof extending into, and confined and guided by, the right-hand outer groove of the connector member **100,** has the intermediate portion of that left-hand side extending into, and confined and guided by, the outer groove of the element **140,** and has the upper portion of that left-hand side extending into, and confined and guided by, the right-hand outer groove of the connector member **98.** The right-hand side of the panel **122** extends into the groove **32** of the corner fitting **24,** as shown particularly by FIG. **2.** The lower edge of the panel **133** extends into, and is confined and guided by, the outer groove **48** of the lower element **44;** and the upper edge of that panel is held by the outer groove of the upper element **62.**

The numeral **134** denotes a short panel which has the sides thereof extending into, and confined and guided by, the lower portions of the confronting inner grooves of the connector members **100** and **104,** has the lower edge thereof extending into, and confined and guided by, the inner groove **48** of the lower element **44,** and has the upper edge thereof extending into, and confined and guided by, the inner groove of a grooved structural element **136** which defines the bottom of the window-like opening in the wall **20.** The cross section of the grooved structural element **136** is preferably identical to the cross section of the grooved structural element **44** of FIG. **11.** A similar short panel, not shown, has the sides thereof extending into, and confined and guided by, the outer confronting grooves of the connector members **100** and **104,** has the lower edge thereof extending into, and confined and guided by, the outer groove **48** of the lower element **44,** and has the upper edge thereof extending into, and confined and guided by, the outer groove of the element **136.**

The numeral **144** denotes a short panel which has the sides thereof extending into, and confined and guided by, the confronting inner grooves of the connector members **98** and **102,** has the upper edge thereof extending into, and confined and guided by the inner groove of the upper element **62,** and has the bottom edge thereof extending into, and confined and guided by, the inner groove of a grooved structural element **142** which defines the top of the window-like opening in the wall **20.** The cross section of the grooved structural element **142** preferably is identical to the cross section of the grooved structural element **44** of FIG. **11.** A similar short panel, not shown, has the sides thereof extending into, and confined and guided by, the confronting outer grooves of the connector members **98** and **102,** has the lower edge thereof extending into, and confined and guided by, the outer groove of the element **142,** and has the upper edge thereof extending into, and confined and guided by, the outer groove of the upper element **62.**

The numeral **146** denotes a panel which has the upper portion of the left-hand side thereof extending into, and confined and guided by, the right-hand inner groove of the connector member **106,** has the rest of that left-hand side extending into, and confined and guided by, the inner groove **54** of the vertical element **50,** has the upper portion of the right-hand side thereof extending into, and confined and guided by, the left-hand inner groove of the connector member **102,** has the lower portion of that right-hand side extending into, and confined and guided by, the left-hand inner groove of the connector member **104,** and has the intermediate portion of that right-hand side extending into, and confined and guided by, the inner groove of a grooved structural element **138** which defines the left-hand side of the windowlike opening in the wall **20.** The cross section of the grooved structural element **138** preferably is identical to the cross section of the grooved structural element **44** of FIG. **11.** The lower edge of the panel **146** extends into, and is confined and guided by, the inner groove **48** of the lower element **44;** and the upper edge of that panel extends into, and is confined and guided by the inner groove of the upper element **62.** A similar panel **151** has the upper portion of the left-hand side thereof extending into, and confined and guided by, the right-hand outer groove of the connector member **106,** has the rest of that left-hand side extending into, and confined and guided by, the outer groove **54** in the vertical element **50,** as shown particularly by FIG. **3,** has the upper portion of the right-hand side thereof extending into, and confined and guided by, the left-hand outer groove of the connector member **102,** has the lower portion of that right-hand side extending into, and confined and guided by, the lower portion of the left-hand outer groove of the connector member **104,** ans has the intermediate portion of that right-hand side extending into, and confined and guided by the outer groove of the element **138.** The lower edge of the panel **151** extends into, and is confined and guided by, the outer groove **48** of the lower element **44,** as shown particularly by FIG. **3;** and the upper edge of that panel extends into, and is confined and guided by, the outer groove of the upper element **62.**

The numeral **148** denotes a short panel which has the sides thereof extending into, and confined and guided by, the confronting inner grooves of the connector members **106** and **108.** The lower edge of that panel extends into, and is confined and guided by, the inner groove **63** of the element **64;** and the upper edge of that panel extends into, and is confined and guided by, the inner groove of the element **62.** The numeral **149** denotes a similar short panel which has the sides thereof extending into and confined and guided by the confronting outer grooves of the connector members **106** and **108.** The lower edge of the panel **149** extends into and is confined and guided by the outer groove **63** of the element **64;** and the upper edge of that panel extends into, and is confined and guided by, the outer groove of the element **62.**

The numeral **150** denotes a panel which has the upper portion of the right-hand side thereof extending into, and confined and guided by, the left-hand inner

groove of the connector member **108** and has the rest of that right-hand side extending into, and confined and guided by, the inner groove of the element **56**; and the left-hand side of that panel extends into, and is confined and guided by, the inner groove of the vertical element **60.** The lower and upper edges of the panel **150** extend into, and are confined and guided by, the inner grooves of the elements **58** and **62.** A similar panel, not shown, has the upper portion of the righthand side thereof extending into, and confined and guided by, the left-hand outer groove of the connector member **108,** has the rest of that right-hand side extending into, and confined and guided by, the outer groove of the element **56,** has the left-hand side thereof extending into and confined and guided by the outer groove of the element **60,** and has the lower and upper edges thereof extending into, and confined and guided by, the outer grooves of the elements **58** and **62.**

No nails, screws or other fasteners, and no cements, adhesives, mastics, tapes or the like are needed to hold the edges of the various panels of the wall **20** within the grooves which receive those edges. Instead, those various grooves coact with each other to provide full support for those panels. It should also be noted that each panel, each connector member, the corner fitting **24,** the vertical element **60,** the elements **50, 56, 64, 136, 138, 140** and **142,** the upper element **62,** and the lower elements **44** and **58** add to the stiffness and rigidity of the wall **20.** As a result, that wall is sturdy and strong.

The numeral **156** in FIG. **2** denotes a sturdy, L-shaped metal brace which has the vertically-directed portion thereof disposed between the exposed wall and the ribs of the element **140.** A screw **158** extends through a countersunk opening in that exposed wall and seats in an opening in the vertically-directed portion of that brace. That screw and those ribs fixedly hold the element **140** against shifting or tilting relative to that L-shaped brace. The horizontally-directed portion of the L-shaped brace **156** extends between the exposed wall and the ribs of the element **136.** A screw, not shown, will pass through a countersunk opening in that exposed wall and seat in an opening in the horizontally-directed portion of that L-shaped brace. That screw will coact with those ribs to prevent shifting or tilting of the element **136** relative to the L-shaped brace **156.**

A similar L-shaped brace, not shown, has the vertically-directed portion thereof disposed between the upper portion of the exposed wall of the element **140** and the upper portions of the ribs of that element. A screw **155** extends through a countersunk opening in that exposed wall and seats in an opening within that horizontally-directed portion; and that screw coacts with the ribs of that element to prevent shifting or tilting of the element **140** relative to that L-shaped brace. The horizontally-directed portion of that L-shaped brace will extend between the exposed wall and the ribs of the element **142;** and a screw, not shown, will extend through a countersunk opening in that exposed wall and will seat in an opening within that horizontally-directed portion.

Similar L-shaped braces will be disposed at the upper left-hand corner and at the lower left-hand corner of the window-like opening in the wall **20.** The vertically-directed portions of those L-shaped braces will be held by the exposed wall and the ribs of the element **138;** and screws, not shown, will extend through countersunk openings, not shown, in that exposed wall and seat in openings, not shown, within those vertically-directed portions. The horizontally-directed portion of the upper of those L-shaped braces will be disposed between the exposed wall and the ribs of the element **142;** and a screw, not shown, will extend through a countersunk opening in that exposed wall and seat in an opening in that horizontally-directed portion. The horizontally-directed portion of the L-shaped brace adjacent the lower left-hand corner of the window-like opening in the wall **20** will be confined by the exposed wall and the ribs of the element **136;** and a screw, not shown, will extend through a countersunk opening in that exposed wall and seat in an opening in that horizontally-directed portion. The L-shaped brace **156,** the three L-shaped braces, not shown, adjacent the other three corners of the window-like opening in the wall **20,** the screws **155** and **158,** and the other six screws, not shown, coact with the elements **136, 138, 140** and **142** to make the frame for that window-like opening sturdy and rigid. In doing so, they also help strengthen and rigidify the wall **20.**

The numeral **153** in FIG. **3** denotes a sturdy, L-shaped, metal brace which has the vertically-directed portion thereof disposed between the inner face of the exposed wall of the vertical element **50** and the left-hand faces of the ribs **52** within that element. That vertically-directed portion of that brace will have a width and thickness which will enable it to readily slip into position between that wall and those ribs, and yet prevent tilting of the axis of the element **50** relative to that L-shaped brace. A screw **152** extends inwardly through a countersunk opening in the exposed wall of the element **50** and seats in an opening in the vertically-directed portion of the L-shaped brace **153;** and that screw will coact with the ribs **52** to lock that L-shaped brace against shifting or tilting relative to the element **50.** The horizontally-directed portion of the L-shaped brace **153** extends between the inner face of the lower wall of the element **44** and the ribs **46** within that element. A screw **154** extends upwardly through a countersunk opening in that lower wall and seats in an opening in the horizontally-directed portion of the L-shaped brace **153.** That screw will coact with the ribs **46** to lock the element **44** against shifting or tilting relative to the L-shaped brace **153.**

The numeral **160** in FIG. **2** denotes a sturdy, L-shaped, metal brace which has the vertically-directed portion thereof disposed between the left-hand wall of the tubular section **26** of the corner fitting **24** and the ribs **30** of that corner fitting. A screw **162** extends through a countersunk opening in that wall and seats in an opening in that vertically-directed portion of that L-shaped metal brace. That screw will coact with that wall and those ribs to lock the corner fitting **24** against shifting or tilting relative to the L-shaped brace **160.** The horizontally-directed portion of that L-shaped brace will extend into the space between the bottom wall of the element **44** and the ribs **46** of that element; and a screw, not shown, will extend upwardly through a countersunk opening in that bottom wall and seat in an opening in that horizontally-directed portion. That screw will coact with those ribs to prevent shifting or tilting of the lower element **44** relative to that L-shaped brace.

Similar L-shaped braces, not shown, will be provided at the upper right-hand corner, the upper left-hand corner, and the lower left-hand corner of the wall **20** in FIG. **1.** The horizontally-directed portions of the L-shaped braces, not shown, adjacent the upper left-hand and upper right-hand corners of the wall **20** will be held by the ribs of the element **62** and by screws, not shown, which extend downwardly through the upper wall of that element and seat in openings in those horizontally-directed portions. The vertically-directed portion of the L-shaped brace at the upper right-hand corner of the wall **20** will be held by the upper portions of the ribs **30** of the corner fitting **24** and by a screw, not shown, which extends through a countersunk opening in the left-hand wall of the tubular section **26** of that corner fitting and seats in an opening in that vertically-directed portion. The vertically-directed portion of the L-shaped brace at the upper left-hand corner of the wall **20** will be held by the ribs of the vertical element **60** and by a screw **159** which extends through a countersunk opening in the exposed wall of that element and seats in an opening in that vertically-directed portion. The horizontally-directed portion of the L-shaped brace, not shown, at the lower left-hand corner of the wall **20** is held by the ribs, not shown, of the lower element **58** and by a screw, not shown, which extends upwardly through a countersunk opening in the bottom wall of that element and seats in an opening in that horizontally-directed portion. The vertically-directed portion of that L-shaped brace is held by the ribs, not shown, of the vertical element **60** and by a screw **161** which extends through a countersunk opening in the exposed wall of that vertical element and seats in an opening in that vertically-directed portion.

An L-shaped brace, not shown, will coact with the ribs of the lower element **58,** with the ribs of the element **56,** and with two screws, now shown, to lock those elements against shifting or tilting relative to each other. An L-shaped brace, not shown, will coact with the ribs of the element **56,** with the ribs **65** of the element **64,** and with two screws, not shown, to lock the elements **56** and **64** against shifting or tilting relative to each other. An L-shaped brace **170** has the horizontally-directed portion thereof held by the ribs **65** of the element **64** and by a screw **172** which extends upwardly through a countersunk opening in the exposed wall of that element to seat in an opening in that horizontally-directed portion. The vertically-directed portion of that L-shaped brace is held by the ribs **52** of the element **50** and by a screw **171** which extends through a countersunk opening in the exposed wall of that element and seats in an opening in that vertically-directed portion.

The L-shaped braces **153, 160** and **170** will coact with the L-shaped braces, not shown, at the upper left-hand corner, the upper right-hand corner, and the lower left-hand corner of the wall **20,** with the L-shaped braces, not shown, at the upper and lower left-hand corners of the doorway, with the screws **152, 154, 159, 161, 162, 171** and **172** and with the other screws, not shown, for those other L-shaped braces, with the corner fitting **24,** and with the grooved structural elements **44, 50, 56, 58, 60, 62** and **64** to strengthen and rigidify the wall **20.** Also, some of those L-shaped braces, screws and grooved structural elements strengthen and rigidify the doorway in that wall.

The numeral **164** in FIG. **2** denotes a sturdy, L-shaped, metal brace which can be identical to the metal braces **153, 156, 160** and **170** in the wall **20.** The vertically-directed portion of the L-shaped brace **164** is held by the ribs **38** and by a screw **166** which extends through a countersunk opening in the adjacent wall of the tubular section **26** of the corner fitting **24** and seats in an opening in that vertically-directed portion. The horizontally-directed portion of the L-shaped brace **164** is held by the ribs **67** of the lower element **66** and by a screw, not shown, which extends upwardly through a countersunk opening in the bottom wall of that element and seats in an opening, not shown, in that horizontally-directed portion. The L-shaped brace **164,** the screw **166,** and the other screw, not shown, lock the lower element **66** against shifting or tilting relative to the corner fitting **24.**

An L-shaped brace, not shown, has the vertically-directed portion thereof held by the upper portions of the ribs **38** of the corner fitting **24** and by a screw, not shown, which extends through a countersunk opening in the adjacent wall of the tubular section **26** of the corner fitting **24** and seats in an opening in that vertically-directed portion. The horizontally-directed portion of that L-shaped brace is held by the ribs of the upper element **70** and by a screw, not shown, which extends downwardly through a countersunk opening in the exposed wall of that element and seats in an opening in that horizontally-directed portion. That L-shaped brace and the screws therefor lock the upper element **70** against shifting or tilting relative to the corner fitting **24.**

An L-shaped brace, not shown, has the horizontally-directed portion thereof held by the ribs **67** of the lower element **66** and by a screw, not shown, which extends through a countersunk opening in the bottom wall of the element **66** to seat in an opening in that horizontally-directed portion. The vertically-directed portion of that L-shaped brace is held by ribs within the vertical element **68** and by a screw **167** which extends through a countersunk opening in the exposed wall of that vertical element to seat in an opening in that vertically-directed portion. That L-shaped brace and the screws therefor lock the lower element **66** against shifting or tilting relative to the vertical element **68.**

An L-shaped brace, not shown, has the horizontally-directed portion thereof held by the ribs within the upper element **70** and by a screw, not shown, which extends downwardly through a countersunk opening in the exposed wall of that upper element to seat in an opening in that horizontally-directed portion. The vertically-directed portion of that L-shaped brace is held by ribs within the vertical element **68** and by a screw **173** which extends through a countersunk opening in the exposed wall of that vertical element to seat in an opening in that vertically-directed portion. That L-shaped brace and the screws therefor lock the upper element **70** against shifting or tilting relative to the vertical element **68.** The L-shaped brace **164** will coact with the L-shaped braces, not shown, at the upper left-hand corner, the upper right-hand corner, and the lower right-hand corner of the wall **22,** with the screws **166, 167** and **173** and with the other screws, not shown, for those other L-shaped braces, with the corner fitting **24,** and with the grooved structural elements **66, 68,** and **78** to strengthen and rigidify the wall **22.**

It should be noted that only the screws **155** and **158** and six other screws are needed to interlock all of the four grooved structural elements **136, 138, 140** and **142** of the window-like opening in the wall **20.** Further, it should be noted that only the screws **152, 154, 159, 161, 162** and **171** and 10 other screws are needed to interlock all of the seven grooved structural elements **44, 50, 56, 58, 60, 62** and **64** and the corner fitting **24** of the wall **20.** In addition, it should be noted that only the screws **166, 167** and **173** and five other screws are needed to interlock all of the grooved structural elements **66, 68,** and **70** and the corner fitting **24** of the wall. All of the rest of the sturdiness and rigidity of the walls **20** and **22** is afforded by the interengagements between the L-shaped braces and the ribs and adjacent walls of the grooved structural elements and of the corner fitting and by the interengagements of the edges of the various panels and glass panes and the grooves in those grooved structural elements.

Where the outer faces of the walls **49** and **51** of the grooved structural element **44** are spaced apart 5 inches, and where the outer faces of the side walls of the grooved structural elements **50, 56, 58, 60, 62, 64, 66, 68** and **70** also are spaced apart 5 inches, the walls **20** and **22** of FIG. **1** are extremely sturdy and rigid. In fact, those walls are so sturdy and rigid that they are self-supporting and do not have to have any portions thereof bolted or otherwise secured to the floor, to a ceiling, or to anything else.

The numeral **168** denotes insulation which is disposed in the space between the outer wall of the connecting portion **36** of the corner fitting **24,** the web **78** of the connector member **76,** and the panels **72** and **74** of the wall **22.** That insulation can be of standard and usual form; and it can be loose or it can be confined by paper or other wrappings. Similar insulation will preferably be disposed between the short panel **110** and its counterpart, between the short panel **119** and its counterpart, between the panel **126** and its counterpart, between the panel **130** and its counterpart, between the panels **132** and **133,** between the short panel **134** and its counterpart, between the short panel **144** and its counterpart, between the panel **146** and the panel **151,** between the short panels **148** and **149,** and between the panel **150** and its counterpart. Further, if desired, insulation could be used to fill the tubular section **26** and the connecting portions **28** and **36** of the corner fitting **24.** Moreover, if desired, insulation could be used to fill the space defined by the walls **45, 47, 49** and **51** of the grooved structural element **44** in FIG. **11** and the corresponding spaces in the grooved structural elements **50, 56, 58, 60, 62, 64, 66, 68, 70, 136, 138, 140** and **142.**

Usually, however, some or all of the space within the tubular section **26** of the corner fitting **24** or in one or both of the connecting portions **28** and **36** of that corner fitting, will be occupied by thin wall electrical conduits for power-supplying conductors, cables or conductors for communications purposes, and insulated water pipes. Similarly, some or all of the space in some other grooved structural elements will have thin wall electrical conduits for power-supplying conductors, cables or conductors for communication purposes, and insulated water pipes in them.

In assembling the components of the walls **20** and **22** of FIG. **1,** the corner fitting **24** and the vertical elements **50, 56,** and **60** can be set horizontally with the required spacing therebetween. Thereafter, the mitered right-hand end of the grooved structural element **44** can be secured to the mitered bottom of the connecting portion **28** of the corner fitting **24** by the L-shaped brace **160,** by the screw **162,** and by a further screw, not shown. The mitered left-hand end of that grooved structural element can be secured to the mitered bottom of the element **50** by the L-shaped brace **153** and the screws **152** and **154** of FIG. **3.** The mitered ends of the grooved structural element **48** can then be secured to the mitered bottoms of the elements **56** and **60** by L-shaped braces, not shown, and by the screw **161** and other screws, not shown. The mitered ends of the grooved structural element **64** will be secured to the mitered tops of the elements **50** and **56** by the L-shaped brace **170** and screws **171** and **172** and by an L-shaped brace and two screws, not shown. The vertically-directed portion of an L-shaped brace, not shown, will be secured to the free end of the element **60** by the screw **159;** and the vertically-directed portion of another L-shaped brace, not shown, will be secured to the free end of the connecting portion **28** of the corner fitting **24.** The grooved structural elements **136, 138, 140** and **142** will have the mitered ends thereof secured together by the L-shaped brace **156** and three other L-shaped braces, and by the screws **155** and **158** and six other screws; and then the resulting window-forming frame will be set aside temporarily.

The panel **150,** and the outer panel in register therewith, will then have the side edges thereof telescoped into and held by the confronting grooves of the elements **56** and **60;** and the bottom edges of those panels will be telescoped into and held by the grooves of the grooved structural element **58.** The left-hand grooves of the H-shaped connector member **108** will be moved into telescoping engagement with the upper ends of the right-hand edges of the panel **150** and its counterpart; and the bottom of that connector member will be moved into engagement with the groove-defining portions of the grooved structural element **64.** The left-hand edges of the panels **148** and **149** will be telescoped into and held by the right-hand grooves of the H-shaped connector member **108;** and the bottoms of those panels will be telescoped into and held by the grooves of the grooved structural element **64.**

The left-hand grooves of the H-shaped connector member **106** will be moved into telescoping engagement with the right-hand edges of the panels **148** and **149;** and the bottom of that connector member will be moved into engagement with the groove-defining portions of the grooved structural element **64.** The lower and intermediate portions of the left-hand edges of the panels **146** and **151** will be telescoped into the grooves **54** of the element **50,** the upper portions of those edges will be telescoped into the right-hand grooves of the H-shaped connector member **106,** and the bottoms of those panels will be telescoped into the grooves **48** of the grooved structural element **44.** The left-hand grooves of the H-shaped connector member **104** will be moved into telescoping engagement with the lower portions of the right-hand edges of the panels **146** and **151;** and the bottom of that connector member will be moved into engagement with the groove-defining portions of the grooved structural element **44.** The left-hand edges of the panel **134** and its counterpart will be telescoped into the right-hand grooves of the H-shaped connector member **104;** and the bottoms of those pan-

els will be telescoped into the grooves **48** of the grooved structural element **44.** The left-hand grooves of the H-shaped connector member **100** will be moved into telescoping engagement with the right-hand edges of the panel **134** and its counterpart; and the bottom of that connector member will be moved into engagement with the groove-defining portions of the grooved structural element **44.** The side edges of the panels **132** and **133** will be telescoped into the grooves **34** and **32** of the connecting portion **28** of the corner fitting **24** and into the right-hand grooves of the H-shaped connector member **100.**

At this time, the grooves of the grooved structural element **138,** of the window-forming frame, will be moved into telescoping engagement with the intermediate portions of the right-hand edges of the panels **146** and **151,** and the grooves of the grooved structural element **140,** of that window-forming frame, will be moved into telescoping engagement with the intermediate portions of the left-hand edges of the panels **132** and **133.** The grooves of the grooved structural element **136,** of that window-forming frame, will be moved into telescoping engagement with the upper edges of the panel **134** and its counterpart. The left-hand grooves of the H-shaped connector member **102** will be moved into telescoping engagement with the right-hand edges of the panels **146** and **151**; and the bottom of that connector member will be moved into engagement with the groove-defining portions of the grooved structural element **142** of that window-forming frame. The right-hand grooves of the H-shaped connector member **98** will be moved into telescoping engagement with the upper portions of the left-hand edges of the panels **132** and **133**; and the bottom of that connector member will be moved into engagement with the groove-defining portions of the grooved structural element **142.** The side edges of the panel **144** and its counterpart will be telescoped into the confronting grooves of the connector members **98** and **102**; and the bottom edges of those panels will be telescoped into the grooves of the grooved structural element **142** of that window-forming frame.

Countersunk openings, not shown, will be formed in the upper wall of the grooved structural element **62**; and those openings will be in register with the openings in the horizontally-directed portions of the L-shaped braces at the free ends of the corner fitting **24** and of vertical element **60.** The grooves of that grooved structural element will then be telescoped downwardly over the upper edges of the panel **150** and its counterpart, of the panels **148** and **149,** of the panels **146** and **151,** of the panel **144** and its counterpart, and of the panels **132** and **133.** Thereafter, two self-tapping metal screws, not shown, will be passed downwardly through those countersunk openings and seated in the openings in those horizontally-directed portions of those L-shaped braces. The resulting wall **20** will be sturdy and rigid.

The vertically-directed portion of the L-shaped brace **164** will be secured to the lower end of the inner wall of the connecting portion **36** of the corner fitting **24** by the screw **166**; and the vertically directed portion of another L-shaped brace, not shown, will be secured to the upper end of that wall by a screw, not shown. The mitered right-hand end of the grooved structural element **66** will have the horizontally-directed portion of an L-shaped brace, not shown, secured to it by a screw, not shown; and the mitered left-hand end of that grooved structural element will be secured in abutting engagement with the mitered bottom of the connecting portion **36** of the corner fitting **24** by a screw, not shown. That grooved structural element will be suitably held in vertical position during and after the time the mitered left-hand end thereof is being secured to the mitered bottom of the connecting portion **36** of the corner fitting **24.** Thereafter, the wall **20** can be tilted bodily upwardly to the vertical position of FIG. **1,** and, as it is so tilted, the grooved structural element **66** will be lowered to the horizontal position of FIG. **1.** One or more props will then be used to hold that wall in vertical position.

The panels **72** and **74** will have the left-hand edges thereof telescoped into the grooves **40** and **42** of the connecting portion **36** of the corner fitting **24**; and the bottoms of those panels will be telescoped into the grooves of the grooved structural element **66.** The grooves **80** and **84** of the H-shaped connector member **76** will be telescoped over the right-nand edges of the panels **72** and **74**; and the bottom of that H-shaped connector member will be moved into engagement with the groove-defining portions of the grooved structural element **66.** The left-hand edges of the panel **110** and its counterpart will be telescoped into the grooves **82** and **86** of the H-shaped connector member **76**; and the bottom edges of those panels will be telescoped into the grooves of the grooved structural element **66.** The lower portions of the left-hand grooves of the H-shaped connector member **90** will be telescoped over the right-hand edges of the panel **110** and its counterpart; and the bottom of that H-shaped connector member will be moved into engagement with the groove-defining portions of the grooved structural element **66.** The lower grooves of the H-shaped connector member **112** will be telescoped over the upper edges of the panel **110** and its counterpart.

The seal **114** will be fitted around the top, bottom and sides of the glass pane **116**; and the seal **121** will be fitted around the top, bottom and sides of the glass pane **122.** Thereupon, the seal-encased sides of the glass pane **116** will be telescoped into the groove **82** of the H-shaped connector member **76** and into the confronting groove of the H-shaped connector member **90.** The seal-encased bottom of that glass pane will be telescoped into the upper inner groove of the H-shaped connector member **112.** The seal-encased sides of the glass pane **122** will be telescoped into the groove **86** of the H-shaped connector member **76** and into the confronting groove of the H-shaped connector member **90.** The seal-encased bottom of that glass pane will be telescoped into the upper outer groove of the H-shaped connector member **112.** The lower, inner groove of the H-shaped connector member **118** will be telescoped over the seal-encased top of the glass pane **116**; and the lower outer groove of that H-shaped connector member will be telescoped over the seal-encased top of the glass pane **122.** The side edges of the panel **119** and its counterpart will be telescoped into the grooves **40** and **42** of the H-shaped connector member **76** and into the confronting grooves of the H-shaped connector member **90.** The bottoms of those panels will be telescoped into the upper grooves of the H-shaped connector member **118.**

The left-hand edges of the panel **126** and its counterpart will be telescoped into the right-hand grooves of

the H-shaped connector member **90**; and the bottoms of those panels will be telescoped into the grooves of the grooved structural element **66.** The left-hand grooves of the H-shaped connector member **94** will be telescoped over the right-hand edges of the panel **126** and its counterpart, and the bottom of that H-shaped connector member will be moved into engagement with the groove-defining portions of the grooved structural element **66.** The top, sides and bottom of the glass pane **128** will be encased by a seal, such as the seal **114**; and the top, sides and bottom of a counterpart glass pane will be encased by a seal such as the seal **121.** The left-hand, seal-encased side of the glass pane **128** will be telescoped into the right-hand inner groove of the H-shaped connector member **94**; and the seal-encased bottom of that glass pane will be telescoped into the inner groove of the grooved structural element **66.** The left-hand, seal-encased side of the counterpart glass pane will be telescoped into the right-hand outer groove of the H-shaped connector member **94**; and the seal-encased bottom of that counterpart glass pane will be telescoped into the outer groove of the grooved structural element **66.** The left-hand inner groove of the H-shaped connector member **96** will be telescoped over the seal-encased right-hand side of the glass pane **128**; and the left-hand outer groove of that H-shaped connector member will be telescoped over the seal-encased right-hand side of the counterpart glass pane. The bottom of the H-shaped connector member **96** will be moved into engagement with the groove-defining portions of the grooved structural element **66.** The left-hand edges of the panel **130** and its counterpart will be telescoped into the right-hand grooves of the H-shaped connector member **96**; and the bottoms of those panels will be telescoped into the grooves of the grooved structural element **66.**

The mitered upper end of the vertical element **68** will have the vertically-directed portion of an L-shaped brace, not shown, secured to it by the screw **173**; and then the grooves of that element will be telescoped over the right-hand edges of the panel **130** and its counterpart. The screw **167** will then be passed inwardly through a countersunk opening in the outer wall of the mitered lower end of the element **68** and seated in an opening in the vertically-directed portion of the L-shaped brace, not shown, that was previously secured to the mitered right-hand end of the grooved structural element **66.** As a result, the screw **167** will coact with that L-shaped brace to secure the mitered lower end of the element **68** to the mitered right-hand end of the grooved structural element **66.** The grooves of the grooved structural element **70** will be telescoped downwardly over the upper edges of the panels **72** and **74,** of the panel **119** and its counterpart, of the panel **126** and its counterpart, of the seal-encased glass pane **128** and of its seal-encased counterpart, and of the panel **130** and its counterpart. Screws, not shown, will then be passed downwardly through the upper wall of the element **70** and seated in oepnings in the horizontally-directed portions of the L-shaped braces, not shown, that were previously secured to the upper ends of the vertical element **68** and of the connecting portion **36** of the corner fitting **24.** The resulting wall **22** will be sturdy and rigid.

If any insulation **168** was used in either of the walls **20** or **22,** that insulation would be introduced into the space between a panel and its counterpart while access to that space was available. Specifically, insulation would be placed in the space between the panel **134** and its counterpart before the window-defining frame, including the elements **136, 138, 140** and **142,** was telescoped into position. Similarly, insulation would be placed between the panel **110** and its counterpart before the H-shaped connector member **112** was set in position. The rest of the insulation would be set in position before the upper elements **62** and **70** were set in position.

Referring particularly to FIG. **5,** the numeral **176** generally denotes a grooved structural element which has a tubular section that is square in cross section; and that grooved structural element preferably is a metal extrusion. The numerals **178** and **180** denote grooves which are disposed at opposite sides of the outer surface of one of the walls of the grooved structural element **176**; and those grooves are parallel and extend along the entire length of that surface. The numerals **182** and **184** denote grooves which are disposed at opposite sides of the outer surface of another wall of the grooved structural element **176**; and those grooves are parallel and extend along the entire length of that surface. The numerals **186** and **188** denote grooves which are disposed at opposite sides of the outer surface of a third wall of the grooved structural element **176**; and those grooves are parallel and extend along the entire length of that surface. The grooves **186** and **188** are in registry with, but face away from, the grooves **180** and **178,** respectively. The numerals **190** and **192** denote grooves which are disposed at opposite sides of the outer surface of the fourth wall of the grooved structural element **176**; and those grooves are parallel and extend along the entire length of that surface. The grooves **190** and **192** are in registry with, but face away from, the grooves **184** and **182,** respectively.

The grooved structural element **176** can be used to interrelate the inner and outer panels of four contiguous walls. Two of those walls will be in alignment with each other; and the endmost edges of the panels of one of those walls will extend into, and be confined and guided by, the grooves **178** and **180,** while the endmost edges of the panels of the other of those walls will extend into, and be confined and guided by, the grooves **188** and **186.** The remaining two walls associated with the grooved structural element **176** will be in alignment with each other; and the endmost edges of the panels of one of those remaining walls will extend into, and be confined and guided by, the grooves **182** and **184,** while the endmost edges of the panels of the other of those remaining walls will extend into, and be confined and guided by, the grooves **192** and **190.**

The grooved structural element **176** will fix the confronting ends of the four walls relative to itself and relative to each other, and this will strengthen and rigidify all of those walls. The positioning of the endmost edges of the panels of the four walls in the grooves of the grooved structural element **176** will hold that grooved structural element against any lateral movement. If, however, additional resistance to lateral movement of that grooved structural element were desired, the lower end of that grooved structural element could be embedded within the concrete of a concrete floor, could be welded or bolted to a plate which was secured to the floor, or could be secured to the floor by L-shaped braces like the L-shaped brace **153** of FIG. **3.** Those L-shaped braces would have the vertically-directed por-

tions thereof secured to the lower portions of the walls of the grooved structural element **176** by screws, and would have the horizontally-directed portions thereof suitably secured to the floor. If desired, a pair of ribs, such as the ribs **46** of the grooved structural element **44** of FIGS. **3** and **11**, could be provided at the inner surface of that wall of the grooved structural element **176** which bears the grooves **178** and **180**; and a further pair of such ribs could be provided at the inner surface of that wall of the grooved structural element **176** which bears the grooves **188** and **186.** Those pairs of ribs would provide additional reinforcement for the L-shaped braces which were used to hold the grooved structural element **176** against movement.

Referring particularly to FIGS. **6** and **7**, the numeral **194** denotes a grooved structural element which has a tubular section that is square in cross section; and that grooved structural element preferably is a metal extrusion. A connecting portion **196** is provided adjacent one of the walls of that tubular section; and that connecting portion has ribs **204**, locking flanges **206**, and panelreceiving grooves **212.** The numeral **198** denotes a connecting portion which extends outwardly from a second of the four walls of the tubular section of the grooved element **194**; and that connecting portion has ribs **204**, locking flanges **206**, and panel-receiving grooves **212.** The numeral **200** denotes a connecting portion which extends outwardly from a third wall of the tubular section of the grooved structural element **194**; and that connecting portion is in register with, but extends away from, the connecting portion **198.** The connecting portion **200** has ribs **204**, locking flanges **206**, and panel-receiving grooves **212**; and those panel-receiving grooves are in register with the panel-receiving grooves **212** on the connecting portion **198.** The numeral **202** denotes a fourth connecting portion which could be provided at the fourth wall of the tubular section of the grooved structural element **194**, and which is shown by dotted lines in FIG. **6.** If that connecting portion were provided, it would be in register with, but would extend away from, the connecting portion **196.** That fourth connecting portion would be equipped with ribs **204**, locking flanges **206**, and panel-receiving grooves **212**; and those panel-receiving grooves would be in register with the panel-receiving grooves **212** on the connecting portion **196.**

The numeral **208** denotes plates which have locking grooves **210** at the elongated sides thereof; and those locking grooves are parallel to each other. The cross sections of the locking grooves **210** are complementary to the cross sections of the locking flanges **206** of the various connecting portions **196, 198, 200** and **202.**

When plates **208** are assembles with the locking flanges **207** of connecting portions, as shown with the connecting portions **198** and **200** in FIG. **6**, those plates close the open sides of those connecting portions. In addition, those plates stiffen and strengthen the parts of those connecting portions which support the panel-receiving grooves **212.** The provision of the plates **208** and of the locking flanges **206** of the grooved structural element **194** reduces the cost of the die used to extrude that grooved structural element.

The numeral **214** in FIG. **6** denotes a grooved structural element which can be identical to the grooved structural element **44** of FIGS. **3** and **11.** That grooved structural element has ribs **215** which are comparable to the ribs **46** of the grooved structural element **44**, and it has upwardly-opening grooves **216** which are comparable to the groove **48** of the grooved structural element **44.** The left-hand end of the grooved structural element **214** is mitered to abut the mitered lower end of the connecting portion **198** of the grooved structural element **194**; and hence the grooves **216** of that grooved structural element will abut and be contiguous to two grooves **212** of the grooved structural element **194.** An L-shaped brace **217**, which can be identical to the L-shaped brace **153** in FIG. **3**, has the vertically-directed portion thereof held by the ribs **204** of the connecting portion **198** and by a screw, not shown, which extends through a countersunk opening in the adjacent wall of the grooved structural element **194** and seats in an opening in that vertically-directed portion. The horizontally-directed portion of the L-shaped brace **217** is held by the ribs **215** of the grooved structural element **214** and by a screw, not shown, which extends upwardly through a countersunk opening in the bottom wall of that grooved structural element to seat in an opening in that horizontally-directed portion. That L-shaped brace will hold the grooved structural element **214** against shifting relative to the grooved structural element **194.**

Similar L-shaped braces, not shown, could be used to connect the mitered ends of other grooved structural elements **214** to the mitered lower ends of the connecting portions **196** and **200** — and of the connecting portion **202**, if the grooved structural element **194** is provided with the connecting portion **202.** Those L-shaped braces, and the screws therefor, would hold those grooved structural elements **214** against shifting or tilting relative to the grooved structural element **194.**

The numeral **226** in FIG. **6** denotes a panel which has the left-hand edge thereof extending into, and confined and guided by, one of the grooves **212** of the connecting portion **198** of the grooved structural element **194**; and the numeral **228** denotes a panel which has the left-hand edge thereof extending into, and confined and guided by, the other groove **212** of the connecting portion **198.** The numeral **218** denotes a wooden two-by-four which is disposed within the space bounded by the plate **208** and the groove-defining parts of the connecting portion **198.** That two-by-four can be secured in position by screws, bolts, or the like; and it will strengthen the grooved structural element **194** and the wall of which the panels **226** and **228** are parts. The numeral **220** denotes thin furring strips which are interposed between the confronting surfaces of the panels **226** and **228** and the exposed areas of the adjacent faces of the two-by-four **218**; and those furring strips fill the spaces between those panels and those exposed areas. The numeral **222** denotes a two-by-four which is disposed within the space bounded by the upper wall and the groove-defining parts of the grooved structural element **214.** That two-by-four can be secured to that upper wall by screws, bolts, or the like; and it will strengthen the grooved structural element **214** and the wall of which the panels **226** and **228** are parts. The left-hand end of the two-by-four **222** will abut the lower end of the two-by-four **218** in any desired manner. Thin furring strips **224** are interposed between the confronting surfaces of the panels **226** and **228** and the exposed areas of the adjacent surfaces of the two-by-four **222**; and those furring strips fill the spaces between those panels and those exposed areas.

The two-by-fours **218** and **222** will be used in situations where additional strength and solidity are required for the wall which has the grooved structural element **194** as the left-hand end thereof, which has the grooved structural element **214** as the bottom thereof, and which has the panels **226** and **228** as two of the panels thereof. In addition, further two-by-fours and further furring strips could be disposed between the confronting surfaces of other panels of that wall. Ordinarily, however, the two-by-fours **218** and **222,** and any further two-by-fours, will not be needed; because walls which are made from the grooved structural element **194,** from grooved structural elements such as the grooved structural element **214,** and from panels such as the panels **226** and **228** will be quite sturdy and rigid.

Referring particularly to FIG. **8,** the numeral **230** denotes a grooved structural element which has a tubular section with a connecting portion **232** at one of the faces thereof and with a connecting portion **233** at a second of the faces thereof. Ribs **234** are provided in the connecting portion **232,** and grooves **236** are provided at the outer face of that connecting portion. Ribs **235** are provided in the connecting portion **233,** and grooves **237** are provided at the outer face of that connecting portion. The grooved structural element **230** preferably is a metal extrusion; and it is shown as being identical to the corner fitting **24** of FIG. **2.**

The numeral **238** denotes a vertically-directed grooved structural element which preferably is made as a metal extrusion; and that grooved structural element can be identical to the grooved structural element **44** of FIGS. **3** and **11.** The mitered upper end of the grooved structural element **238** abuts the mitered end of the connecting portion **232** of the grooved structural element **230;** and hence the grooves **239** of the former grooved structural element will abut and be in register with the grooves **236** of that connecting portion. Similarly, the ribs **241** of the grooved structural element **238** will abut and be in register with the ribs **234** of the connecting portion **232.**

An L-shaped brace **240** will have the horizontally-directed portion thereof held by the ribs **234** of the connecting portion **232,** and by a screw **242** which extends downwardly through a countersunk opening in the upper wall of that connecting portion and seats in an opening within that horizontally-directed portion. The vertically-directed portion of the L-shaped brace **240** will be held by the ribs **241** of the grooved structural element **238,** and by a screw **243** which extends through the inner wall of that grooved structural element and seats in an opening in that vertically-directed portion. The L-shaped brace **240** will be identical to the L-shaped brace **153** in FIG. **3;** and it will coact with the ribs **234** and **241** and with the screws **242** and **243** to hold the grooved structural element **238** against shifting or tilting relative to the grooved structural element **230.**

The numeral **244** in FIG. **8** denotes a grooved structural element which preferably is made as a metal extrusion; and that grooved structural element has the same cross section as the grooved structural element **230.** The grooved structural element **244** has a connecting portion **246;** and ribs **248** are provided at the interior of that connecting portion, and grooves **250** extend outwardly from that connecting portion. The grooved structural element **244** also has a connecting portion **247;** and ribs **252** are provided at the interior of that connecting portion, and grooves **254** extend outwardly from that connecting portion. The mitered lower end of the vertically-directed grooved structural element **238** abuts the mitered end of the connecting portion **246** of the grooved structural element **244;** and hence the grooves **250** of that connecting portion abut, and are contiguous to, the grooves **239** of that grooved structural element. Similarly, the ribs **248** of that connecting portion abut, and are contiguous to, the ribs **241** of that grooved structural element.

The numeral **256** denotes an L-shaped brace which can be identical to the L-shaped brace **153** in FIG. **3;** and it has the vertically-directed portion thereof held by the ribs **241** of the vertically-directed grooved structural element **238,** and by a screw, not shown, which extends through a countersunk opening in the inner wall of that grooved structural element and seats in an opening in that vertically-directed portion. The horizontally-directed portion of the L-shaped brace **256** is held by the ribs **248** of the connecting portion **246** of the grooved structural element **244,** and by a screw **258** which extends upwardly through a countersunk opening in the lower wall of that connecting portion and seats in an opening in that horizontally-directed portion. That L-shaped brace will coact with the ribs **241** and **248,** with the screw **258,** and with the screw, not shown, that extends through the outer wall of the grooved structural element **238** to hold that grooved structural element against shifting or tilting relative to the grooved structural element **244.**

The numeral **264** denotes a grooved structural element which preferably is made as a metal extrusion; and that grooved structural element can be identical to the grooved structural element **44** in FIG. **3.** However, the wide outer wall of the grooved structural element **264** is disposed in a vertical plane, whereas the wide outer wall of the grooved structural element **44** of FIG. **3** is disposed in a horizontal plane. The grooved structural element **264** has ribs **263** which can be identical to the ribs **46** of the grooved structural element **44;** and it has grooves **265** which can be identical to the grooves **48** of the grooved structural element **44.** The left-hand end of the grooved structural element **264** is mitered to abut the mitered end of the connecting portion **247** of the grooved structural element **244;** and hence the grooves **265** of the former grooved structural element abut, and are contiguous to, the grooves **254** of that connecting portion. Similarly, the ribs **263** of the grooved structural element **264** abut, and are contiguous to, the ribs **252** of that connecting portion.

The numeral **260** denotes an L-shaped brace which can be identical to the L-shaped brace **153** in FIG. **3;** and the left-hand portion of that L-shaped brace is held by the ribs **252** of the connecting portion **247,** and by a screw **262** which extends through a countersunk opening in the inner wall of that connecting portion and seats in an opening in that left-hand portion. The right-hand portion of the L-shaped brace **260** is held by the ribs **263** of the grooved structural element **264** and by a screw, not shown, which extends through the wide outer wall of that grooved structural element and seats in an opening in that right-hand portion. That L-shaped brace will coact with the ribs **252** and **263,** with the screw **262,** and with the screw, not shown, that extends through the outer wall of the grooved structural element **264** to hold that grooved structural element

against shifting or tilting relative to the grooved structural element **244.**

The numeral **266** at the top of FIG. **8** denotes a grooved structural element which preferably is made as a metal extrusion; and that grooved structural element can be identical to the grooved structural element **264** at the bottom of FIG. **8.** The grooved structural element **266** has ribs **267** which can be identical to the ribs **263,** and it has grooves **269** which can be identical to the grooves **265.** The wide outer wall of the grooved structural element **266** is disposed in a vertical plane. The mitered left-hand end of the grooved structural element **266** abuts the mitered end of the connecting portion **233** of the grooved structural element **230;** and hence the grooves **269** of the former grooved structural element abut, and are contiguous to, the grooves **237** of that connecting portion. Similarly, the ribs **267** of the grooved structural element **266** abut, and are contiguous to, the ribs **235** of that connecting portion.

The numeral **268** denotes an L-shaped brace which can be identical to the L-shaped brace **153** in FIG. **3;** and the left-hand portion of that L-shaped brace is held by the ribs **235** of the connecting portion **233,** and by a screw **270** which extends through a countersunk opening in the inner wall of that connecting portion and seats in an opening in that left-hand portion. The right-hand portion of the L-shaped brace **268** is held by the ribs **267** of the grooved structural element **266** and by a screw **271** which extends through the wide outer wall of that grooved structural element and seats in an opening in that right-hand portion. That L-shaped brace will coact with the ribs **235** and **267** and with the screws **270** and **271** to hold that grooved structural element against shifting or tilting relative to the grooved structural element **230.**

The numeral **272** denotes a panel which has the upper edge thereof extending into, and confined and guided by, the outer groove **236** of the connecting portion **232** of the grooved structural element **230,** which has the lower edge thereof extending into, and confined and guided by, the outer groove **250** of the connecting portion **246** of the grooved structural element **244,** and which has one side edge thereof extending into, and confined and guided by, the outer groove **239** of the grooved structural element **238.** The numeral **274** denotes a panel which has the upper edge thereof extending into, and confined and guided by, the inner groove **236** of the connecting portion **232** of the grooved structural element **230,** which has the lower edge thereof extending into, and confined and guided by, the inner groove **250** of the connecting portion **246** of the grooved structural element **244,** and which has one side edge thereof extending into, and confined and guided by, the inner groove **239** of the grooved structural element **238.** Those panels coact with other panels, not shown, to constitute the inner and outer surfaces of a wall which has the grooved structural element **230** as the cap thereof and which has the grooved structural element **244** as the base thereof. Those various panels will coact with those grooved structural elements, with the grooved structural element **238,** and with a similar vertically-directed grooved structural element to make that wall sturdy and rigid.

The numeral **276** denotes a two-by-four which abuts the right-hand web of the connecting portion **233** of the grooved structural element **230,** and that two-by-four is disposed between the groove-defining portions of that connecting portion. That two-by-four can be secured to that web by screws, bolts, or the like; and furring strips **278** are secured to the exposed areas of the narrow surfaces of that two-by-four. The numeral **284** denotes a panel which has the left-hand edge thereof extending into, and confined and guided by, the outer groove **237** of the connecting portion **233** of the grooved structural element **230,** and which has another edge thereof extending into, and confined and guided by, the outer groove **269** of the grooved structural element **266.** The numeral **286** denotes a panel which has the left-hand edge thereof extending into, and confined and guided by, the inner groove **237** of the connecting portion **233** of the grooved structural element **230,** and which has another edge thereof extending into, and confined and guided by, the inner groove **269** of the grooved structural element **266.** The furring strips **278** fill the spaces between the confronting surfaces of the panels **284** and **286** and the exposed areas of the adjacent surfaces of the two-by-four **276.** The numeral **280** denotes a two-by-four which abuts the inner wall of the grooved structural element **266** and which is disposed between the groove-defining portions of that grooved structural element; and that two-by-four can be secured to that inner wall by screws, bolts, or the like. The left-hand end of the two-by-four **280** will abut the end of the two-by-four **276.** Furring strips **282** fill the spaces between the confronting surfaces of the panels **284** and **286** and the exposed areas of the adjacent surfaces of the two-by-four **280.**

The furring strips **278** and **282** make it possible to solidly secure the inner surface of the panel **284** to the two-by-fours **276** and **280** by nails, staples, or the like without causing any portions of that panel to bend downwardly out of the plane defined by the outer groove **237** of the connecting portion **233** of the grooved structural element **230** and by the upper groove **269** of the grooved structural element **266.** Similarly, the furring strips **278** and **282** make it possible to solidly secure the inner surface of the panel **286** to the two-by-fours **276** and **280** by nails, staples, or the like without causing any portions of that panel to bend upwardly out of the plane defined by the inner groove **237** of the connecting portion **233** of the grooved structural element **230** and by the inner groove **269** of the grooved structural element **266.** The panel **286** will serve as part of the ceiling for a room; and the panel **284** could serve as part of the roof for that room.

The numeral **288** denotes a two-by-four which abuts the right-hand web of the connecting portion **247** of the grooved structural element **244;** and that two-by-four is disposed between the groove-defining portions of that connecting portion. That two-by-four can be secured to that web by screws, bolts, or the like; and furring strips **290** are secured to the exposed areas of the narrow surfaces of that two-by-four. The numeral **292** denotes a two-by-four which abuts the inner wall of the grooved structural element **264** and which is disposed between the groove-defining portions of that grooved structural element; and that two-by-four can be secured to that inner wall by screws, bolts, or the like. The left-hand end of the two-by-four **292** will abut the end of the two-by-four **288.** Furring strips **294** are secured to the exposed areas of the narrow surfaces of the two-by-four **292.** The numeral **296** denotes a panel which has the left-hand edge thereof extending into, and confined and guided by, the inner groove **254** of

the connecting portion **247** of the grooved structural element **244,** and which has another edge thereof extending into, and confined and guided by, the inner groove **265** of the grooved structural element **264.** That panel will serve as part of the floor of the room which has the panel **286** as part of the ceiling thereof. The numeral **298** denotes a panel which has the lefthand edge thereof extending into, and confined and guided by, the outer groove **254** of the connecting portion **247** of the grooved structural element **244,** and which has another edge thereof extending into, and confined and guided by, the outer groove **265** of the grooved structural element **264.** The furring strips **290** fill the spaces between the confronting surfaces of the panels **296** and **298** and the exposed areas of the adjacent surfaces of the two-by-four **288**; and the furring strips **294** fill the spaces between the confronting surfaces of those panels and the exposed areas of the adjacent surfaces of the two-by-four **292.**

The furring strips **290** and **294** make it possible to solidly secure the inner surface of the panel **296** to the two-by-fours **288** and **292** by nails, staples, or the like without causing any portions of that panel to bend downwardly out of the plane defined by the inner groove **254** of the connecting portion **247** of the grooved structural element **244** and by the inner groove **265** of the grooved structural element **264.** Similarly, the furring strips **290** and **294** make it possible to solidly secure the inner surface of the panel **298** to the two-by-fours **288** and **292** by nails, staples, or the like without causing any portions of that panel to bend upwardly out of the plane defined by the outer groove **254** of the connecting portion **247** of the grooved structural element **244** and by the outer groove **265** of the grooved structural element **264.**

Additional two-by-fours, not shown, could be disposed between the confronting surfaces of the panels **284** and **286**; and furring strips, such as the furring strips **278** and **282,** would be interposed between the exposed areas of the narrow surfaces of those two-by-fours and the inner surfaces of the panels **284** and **286.** Similarly, additional two-by-fours, not shown, could be disposed between the confronting surfaces of the panels **296** and **298**; and furring strips, such as the furring strips **290** and **294,** would be interposed between the exposed areas of the narrow surfaces of those two-by-fours and the inner surfaces of the panels **296** and **298.** Those various additional two-by-fours would additionally stiffen and rigidify the ceiling and the floor of the room indicated by FIG. **8.**

It will be noted that the L-shaped brace **260** in FIG. **8** can be assembled with the grooved structural element **244** while that grooved structural element is in its final position. Similarly, it will be noted that the L-shaped brace **268** can be assembled with the grooved structural element **230** while that grooved structural element is in its final position. As a result, those L-shaped braces need not be assembled with those grooved structural elements before those grooved structural elements and the rest of the wall, of which they are parts, have been fully assembled and erected. Moreover, because the L-shaped brace **260** has the angularly-displaced portions thereof lying in vertical planes, rather than horizontal planes, the grooved structural element **264** need not be secured to the grooved structural element **244** before the latter grooved structural element and the rest of the wall, of which it is a part, have been fully assembled and erected. As a result, the assembly of the structure in FIG. **8** is somewhat simpler than the assembly of the structure in FIG. **1.**

The procedure used in assembling the structure of FIG. **8** can generally follow the procedure used in assembling the structure of FIG. **1.** However, because the grooved structural element **264** can be assembled with the grooved structural element **244** after the wall in FIG. **8** has been fully assembled and erected, the floor of the room will preferably be assembled as a sub-assembly and then bodily secured to that wall. The assembling of that floor as a sub-assembly is particularly desirable where the panel **298,** and similar panels not shown, are to be nailed to the two-by-fours **288** and **292** and to further two-by-fours, not shown. The assembling of the floor with the wall is easily effected by passing screws inwardly through countersunk openings in the outer walls of the grooved structural element **264,** and of its counterpart at the other end of the grooved structural element **244,** and seating those screws in openings in the laterally-directed portions of the L-shaped brace **260** and of its counterpart. If desired, the ceiling of the room in FIG. **8** could be assembled as a sub-assembly and then bodily secured to the grooved structural element **230** by means of the L-shaped brace **268** and its counterpart.

Once the walls, the floor and the ceiling of the room in FIG. **8** have been assembled together, thin cushioning pads, not shown, could be cemented in position atop the panel **296** and atop the other panels, not shown, which constitute the upper surface of the floor. Those cushioning pads would have thicknesses comparable to the thickness of the wall which defines the upper limit of the upper groove **254** of the grooved structural element **244.** As a result, those cushioning pads would coact with the exposed, horizontally-disposed portions of the grooved structural elements **244** and **264** and with the exposed horizontally-disposed portions of similar grooved structural elements to provide an essentially smooth surface for the floor. Vinyl, linoleum, asphalt or other floor coverings, either in the form of wide sheets or of individual tiles, could then be cemented in position atop the cushioning pads. If desired, of course, the floor of the room could be left as shown by FIG. **8,** or it could have a smooth surface poured or cast thereon.

Referring particularly to FIG. **9,** the numeral **300** denotes a grooved structural element which can be used to close, and to support, one end of a wall or partition; and it preferably is formed as a metal extrusion. That grooved structural element has a tubular section and a connecting portion **303**; and that connecting portion has ribs **302** at the interior thereof and grooves **304** at the exterior thereof. Those ribs can be identical to the ribs **30** in FIG. **2,** and those grooves can be identical to the grooves **32** and **34** in FIG. **2.** The numeral **306** denotes a grooved structural element which can be identical to the grooved structural element **44** of FIGS. **3** and **11.** That grooved structural element has ribs **305** which can be identical to the ribs **46** in FIG. **3,** and it has grooves **307** which can be identical to the grooves **48** in FIG. **3.**

The bottom of the connecting portion **303** of the grooved structural element **300** will be mitered, and the adjacent end of the grooved structural element **306** will be mitered; and those mitered ends will abut each other. The numeral **308** denotes an L-shaped brace

which can be identical to the L-shaped brace **153** in FIG. **3**; and a screw **310** extends through a countersunk opening in the inner web of the connecting portion **303** of the grooved structural element **300** and seats in an opening in the vertically-extending portion of that L-shaped brace. A similar screw, not shown, will extend upwardly through a countersunk opening in the bottom wall of the grooved structural element **306** to seat in an opening in the horizontally-extending portion of the L-shaped brace **308.** As a result, that L-shaped brace will hold the grooved structural element **306** against shifting relative to the grooved structural element **300.**

The numeral **312** denotes a panel which has one side edge thereof extending into, and confined and guided by, the left-hand groove **304** of the grooved structural element **300,** and which has the bottom edge thereof extending into, and confined and guided by, the left-hand groove **307** of the grooved structural element **306.** The numeral **314** denotes a panel which has one side edge thereof extending into, and confined and guided by, the right-hand groove **304** of the grooved structural element **300,** and which has the bottom edge thereof extending into, and confined and guided by, the right-hand groove **307** of the grooved structural element **306.** Those panels constitute portions of the opposite faces of the wall or partition of which the grooved structural elements are parts. A cap, which can be identical to the grooved structural element **306,** will have the mitered end thereof secured to the mitered upper end of the connecting portion **303** of the grooved structural element **300** by an L-shaped brace which is comparable to the L-shaped brace **308.** A second grooved structural element **300** could be used to close, and to support, the other end of the wall shown by FIG. **9**; or, if desired, one of the other grooved structural elements of the present invention could be used to close, and to support, that other end.

If desired, insulation could be disposed between the panels **312** and **314,** could be disposed within the connecting portion **303,** and could be disposed within the tubular section of the grooved structural element **300.** Further, if desired, thin-wall metal conduits, cables and conductors, and insulated water pipes could be disposed within the tubular section of that grooved structural element.

Where the outer faces of the sides of the connecting portion **303** are spaced apart a distance of 5 inches, and where the other end of the wall or partition of FIG. **9** is solidly secured to a support, that wall or partition can be free-standing and will not need any lateral support or reinforecements — even where that wall or partition is 10 to 15 feet long. Not only do the L-shaped braces help strengthen and rigidify that wall or partition, but the interengagement of the edges of the panels **312** and **314** with the grooves of the grooved structural element **300,** of the grooved structural element **306,** and of the cap, not shown, help strengthen and rigidify that wall or partition.

Referring particularly to FIG. **12,** the numeral **320** denotes a panel section which is corrugated; and it preferably is formed as a metal extrusion. An elongated groove **322** is formed in the lower edge of that panel section, and an elongated tongue **324** is formed at the upper edge of that panel section. The elongated groove **322** is aligned with, and complementary to, the elongated groove **324.** The numeral **326** denotes a further panel section which can be identical to the panel section **320.** The groove **328** at the lower edge of the panel section **326** is identical to the groove **322** at the lower edge of the panel section **320**; and the former groove telescopes over the tongue **324** at the upper edge of the panel section **320.** When two or more panel sections **320** and **326** are set in edge-to-edge relation, and the groove of one panel section is telescoped over the tongue of the adjacent panel section, those panel sections can have a width comparable to the width of the panel **130** in FIG. **1.** The panel sections **320** and **326** can have any desired lengths; and hence can be used to form walls or partitions of any desired heights.

The groove-defining edge of the panel section **320** is dimensioned to fit snugly within a groove **332** of a grooved structural element **330.** That grooved structural element could be similar to any of the grooved structural elements of FIGS. **1–11.** Because the tongue **324** is narrower than the groove-defining edge of either of the panel sections **320** and **326,** a seal should be telescoped over that tongue if that tongue should be extended into, and confined and guided by, the groove of a grooved structural element.

If the panel sections **320** and **326** were to be used as part of an outer wall of a structure, a flowable sealant could be placed within the grooves into which the ends of the corrugations of those panel sections were to extend. That flowable sealant could coact with those grooves and with the recessed portions of the outer surfaces of the panel sections **320** and **326** to form liquid-type seals which would make the outer wall of the structure liquid-tight.

Referring particularly to FIGS. **13–17,** the numeral **336** denotes the base for one of the walls shown in FIG. **13**; and that base preferably is an H-shaped connector member which is similar to the H-shaped connecter member **76** of FIG. **10.** The base **336** has upwardly-opening grooves **338** and **340** adjacent the opposite sides thereof, and it has downwardly-opening grooves which are in register with those grooves. The H-shaped connector member **336** differs from the H-shaped connector element **76** of FIG. **10,** in that the groove **338** is wider than the groove **340.** In the said one preferred embodiment, the groove **338** is essentially six hundred and twenty-five thousandths of an inch wide, whereas the groove **340** is essentially four hundred and six thousandths of an inch wide. If desired, of course, the grooves **338** and **340** could have the same widths, or could have any desired combinations of different widths.

The numeral **342** denotes the base of the other wall shown in FIG. **13**; and that base has upwardly-opening grooves **344** and **346.** Further, as shown particularly by FIG. **15,** that base has downwardly-opening grooves in register with those upwardly-opening grooves. Preferably, the configuration of the base **342** is identical to the configuration of the base **336.** The adjacent ends of the bases **336** and **342** are mitered to enable the axes of those bases to lie at right angles to each other.

The numeral **347** denotes an L-shaped reinforcing plate which underlies the webs of the bases **336** and **342,** as shown particularly by FIGS. **15-17.** That L-shaped reinforcing plate is dimensioned to fit between, and to have the side edges thereof immediately adjacent, the groove-defining portions which extend downwardly from those webs. Screws **349** extend downwardly through countersunk openings in those webs and seat in openings adjacent the ends of that L-shaped

reinforcing plate. Those screws help that L-shaped reinforcing plate to keep the base **342** from shifting relative to the base **336.**

The numeral **348** generally denotes a corner fitting which has grooves **350** and **352** that have the axes thereof displaced 90°, and which has further grooves **354** and **356** that have the axes thereof displaced 90°. The axis of the groove **352** is parallel to the axis of the groove **356**; and the axis of the groove **350** is parallel to the axis of the grooves **354.** Ribs at one side of the web of the corner fitting **348** define confronting grooves **360** and **362,** while corresponding ribs at the opposite side of that web define confronting grooves **358** and **364.**

The numeral **366** denotes an L-shaped brace which has the upwardly-extending portion thereof telescoped into the grooves **358** and **364** of the corner fitting **348,** and which has the horizontally-extending portion thereof fixedly secured to the web of the base **336** and to the L-shaped reinforcing plate **347** by screws **370.** The numeral **368** denotes an L-shaped brace which can be identical to the L-shaped brace **366**; and the vertically-directed portion of the former L-shaped brace extends upwardly into the confronting grooves **360** and **362,** while the horizontally-directed portion of that brace is secured to the web of the base **342** and to the L-shaped reinforcing plate **347** by screws **370.** The L-shaped braces **366** and **368** coact with the grooves **358** and **364** and the grooves **360** and **362,** with the screws **370,** with the webs of the bases **336** and **342,** and with the L-shaped reinforcing plate **347** to hold the corner fitting **348** at right angles to the plane defined by those webs.

The numeral **388** denotes a resilient seal which is essentially U-shaped in cross section; and that seal is disposed within the groove **338** of the base **336** and within the groove **350** of the corner fitting **348.** A panel **372** has the bottom edge thereof and one side edge thereof encased by the seal **388** and extending into, and confined and guided by, the grooves **338** and **350.** That seal will coact with that panel and those grooves to provide an elongated liquid-tight joint between that panel and the base **336** and the corner fitting **348.** The numeral **390** denotes a resilient seal which is essentially U-shaped in cross section; and that seal is disposed within the groove **346** of the base **342** and within the groove **352** of the corner fitting **348.** The bottom edge and one side edge of a panel **378** are encased by the seal **390,** and they extend into, and are confined and guided by, the grooves **346** and **352.**

A panel **384** has the bottom edge thereof extending into, and confined and guided by, the groove **340** of the base **336,** and it has one side edge extending into, and confined and guided by, the groove **354** of the corner fitting **348.** The numeral **386** denotes a panel which has the bottom edge thereof extending into, and confined and guided by, the groove **344** of the base **342,** and which has one side edge thereof extending into, and confined and guided by, the groove **356** of the corner fitting **348.** Because the panels **384** and **386** are intended to constitute portions of interior walls, seals are not used to encase the edges of those panels.

The left-hand edge of the panel **372** is encased by the seal **388,** and it extends into, and is confined and guided by, the right-hand outer groove of an H-shaped connector member **374.** That H-shaped connector member is preferably similar to the H-shaped connector member **76** of FIG. **10**; but the outer groove of that H-shaped connector member has a width essentially identical to the width of the groove **338** in the base **336.** The bottom of the H-shaped connector member **374** will rest upon the portions of the base **336** which define the grooves **338** and **340.** The opposite side edge of the panel **384** will extend into the right-hand inner groove of the H-shaped connector member **374.** Because the groove **350** is spaced a greater distance from the H-shaped connector member **374** than is the groove **354,** the panel **372** must be slightly wider than the panel **384.**

A panel **376** will have a seal, comparable to the seal **388,** extending around all of the edges thereof; and the seal-encased bottom edge of that panel will extend into, and be confined and guided by, the groove **338** of the base **336.** The seal-encased right-hand edge of the panel **376** will extend into, and be confined and guided by, the left-hand outer groove of the H-shaped connector member **374.** A panel, not shown, will be in register with the panel **376,** will have the lower edge thereof extending into, and confined and guided by, the groove **340** of the base **336,** and will have one side edge thereof extending into, and confined and guided by, the left-hand inner groove of the H-shaped connector member **374.**

The right-hand edge of the panel **378** is encased by the seal **390,** and it extends into, and is confined and guided by, the left-hand outer groove of an H-shaped connector member **380.** THat H-shaped connector member is preferably identical to the H-shaped connector member **374**; and the bottom of that H-shaped connector member will rest upon the portions of the base **342** which define the grooves **344** and **346.** The opposite side edge of the panel **386** will extend into the left-hand inner groove of the H-shaped connector member **380.** Because the groove **352** is spaced a greater distance from the H-shaped connector member **380** than is the groove **356,** the panel **378** must be slightly wider than the panel **386.**

The numeral **382** denotes a panel which has a seal, comparable to the seal **390,** extending around all of the edges thereof; and the seal-encased bottom edge of that panel extends into, and is confined and guided by, the groove **346** of the base **342.** The seal-encased left-hand edge of the panel **382** will extend into, and be confined and guided by, the right-hand outer groove of the H-shaped connector member **380.** A panel, not shown, will be in register with the panel **382,** will have the lower edge thereof extending into, and confined and guided by, the groove **344** of the base **342,** and will have one side edge thereof extending into, and confined and guided by, the right-hand inner groove of the H-shaped connector member **380.**

If desired, insulation can be disposed between the various outer and inner panels of the two walls shown in FIG. **13.** Thereafter, caps **392** and **394** can be secured to the upper end of the corner fitting **348.** The cap **392** can be identical to the base **336**; and the downwardly-opening outer groove of that cap will telescope downwardly over the seal-encased upper edges of the panels **372** and **376.** Consequently, the panels **372** and **376** can coact with the seals therefor and with the corner fitting **348,** the base **336,** the cap **392,** the H-shaped connector member **374** and other H-shaped connector members, not shown, and with other seal-encased panels, not shown, to define a wall which is sealed against

the entry of any rain, snow, sleet, and the like. The downwardly-opening inner groove of the cap **392** will telescope over the upper edge of the panel **384** and over the upper edge of the panel which is the counterpart of the panel **376.** The portions of that cap which define the downwardly-opening grooves in that cap will abut the upper edges of the corner fitting **348** and the upper edge of the H-shaped connector member **374.**

The cap **394** can be identical to the base **342**; and the downwardly-opening outer groove of that cap will telescope downwardly over the seal-encased upper edges of the panels **378** and **382.** As a result, the panels **378** and **382** can coact with the seals therefor and with the corner fitting **348,** the base **342,** the cap **394,** the H-shaped connector member **380** and other H-shaped connector members, not shown, and with other seal-encased panels, not shown, to define a wall which is sealed against any entry of rain, snow, sleet, and the like.

An L-shaped reinforcing plate, not shown, which can be identical to the L-shaped reinforcing plate **347,** will be secured to the upper surfaces of the webs of the caps **392** and **394.** Also, L-shaped braces, not shown, which can be identical to the L-shaped braces **366** and **368** will be secured to the web of the corner fitting **348** before the caps **392** and **394** are set in position. After those caps have been set in position, screws, not shown, will be passed downwardly through countersunk openings in the webs of those caps and through openings in the L-shaped reinforcing plate, not shown, to seat in openings in the horizontally-directed portions of the L-shaped braces secured to the upper end of the web of the corner fitting **348.**

The walls shown in FIG. **13** can have shorter overall heights, for the same height panels, than can the walls in FIG. **1**; because the heights of the bases **336** and **342** are shorter than the heights of the grooved structural elements **44** and **66** in FIG. **1,** and because the heights of the caps **392** and **394** are shorter than the heights of the grooved structural elements **62** and **70.** However, the walls of FIG. **13** do not have the horizontally-extending and vertically-extending metal-encased areas which are present in the walls of FIG. **1,** and which can accommodate thin walled conduits, cables and conductors, and insulated water pipes.

FIG. **18** shows an A-frame building that is made in accordance with the principles and teachings of the present invention; and that building is shown as being underlain by a concrete slab **400.** Bases **402** and **404** are provided at one end of that building; and those bases can be similar to the grooved structural element **44** of FIGS. **3** and **11,** can be similar to the H-shaped connector member **76** of FIG. **10,** or can be similar to the bases **336** and **342** of FIGS. **13** and **15–17.** A similar base, not shown, is provided at the opposite end of the building in FIG. **18.** Those various bases will be fixedly secured to the concrete slab **400** by bolts, studs or other fasteners.

The numerals **406** and **408** denote vertically-directed grooved structural elements which can be similar to the grooved structural element **44** of FIGS. **3** and **11**; and the lower ends of those grooved structural elements are mitered to abut the mitered inner ends of the bases **402** and **404.** The numeral **410** denotes a horizontally-directed grooved structural element which can be similar to the grooved structural element **44** of FIGS. **3** and **11**; and the opposite ends of that grooved structural element are mitered to abut the mitered upper ends of the grooved structural elements **406** and **408.** An L-shaped brace, comparable to the L-shaped brace **153** in FIG. **3,** will be used at the lower end of the grooved structural element **406** to fixedly secure that lower end to the base **402,** a second L-shaped brace will be used at the upper end of the grooved structural element **406** to fixedly secure that upper end to the grooved structural element **410,** a third L-shaped brace will be used at the lower end of the grooved structural element **408** to fixedly secure that lower end to the base **404,** and a fourth L-shaped brace will be used at the upper end of the grooved structural element **408** to fixedly secure that upper end to the grooved structural element **410.** The grooved structural elements **406, 408** and **410** will define a doorway which will accommodate a door **412** of standard and usual design.

The numeral **422** denotes a panel which has the upper edge thereof cut at an angle, as indicated by FIG. **18**; and the lower edge of that panel extends into, and is confined and guided by, the outer groove of the base **402,** and the right-hand edge of that panel extends into, and is confined and guided by, the outer groove of the grooved structural element **406.** A similar panel, not shown, has the lower edge thereof extending into, and confined and guided by, the inner groove of the base **402,** and has the right-hand edge thereof extending into, and confined and guided by, the inner groove of the grooved structural element **406.** An H-shaped connector member **414** has the left-hand outer groove thereof telescoped over the upper portion of the right-hand edge of the panel **422**; and that H-shaped connector member has the left-hand inner groove thereof telescoped over the upper portion of the right-hand edge of the panel, not shown, which is the counterpart of the panel **422.**

A glass pane **418,** which has a seal like the seal **114** of FIG. **2** extending around all of the edges thereof, has the seal-encased lower edge thereof extending into, and confined and guided by, the outer groove of the grooved structural element **410,** and has the seal-encased left-hand edge thereof extending into, and confined and guided by, the right-hand outer groove of the H-shaped connector member **414.** A similar glass pane, not shown, has the seal-encased lower edge thereof extending into, and confined and guided by, the inner groove of the grooved structural element **410,** and has the seal-encased left-hand edge thereof extending into, and confined and guided by, the right-hand inner groove of the H-shaped connector member **414.** An H-shaped connector member **416** has the left-hand outer groove thereof telescoped over the seal-encased right-hand edge of the glass panel **418,** and has the left-hand inner groove thereof telescoped over the seal-encased right-hand edge of the glass pane which is the counterpart of the glass pane **418.** An H-shaped connector member **420** has the downwardly-opening outer groove thereof telescoped over the seal-encased upper edge of the glass pane **418,** and has the downwardly-opening inner groove thereof telescoped over the seal-encased upper edge of the glass pane which is the counterpart of the glass pane **418.** The lower ends of the H-shaped connector members **414** and **416** bear against the groove-defining portions of the grooved structural element **410.** The ends of the H-shaped connector member **420** bear against those portions of the H-shaped connector members **414** and **416** which define

the confronting grooves of those H-shaped connector members.

A panel **434,** which has the upper edge thereof defined by two upwardly-converging lines, has the lower edge thereof extending into, and confined and guided by, the upwardly-opening outer groove of the H-shaped connector member **420,** has the lower portion of the left-hand side thereof extending into, and confined and guided by, the right-hand outer groove of the H-shaped connector member **414,** and has the lower portion of the right-hand side thereof extending into, and confined and guided by, the left-hand outer groove of the H-shaped connector member **416.** A similar panel, not shown, has the lower edge thereof extending into, and confined and guided by, the upwardly-opening rear groove of the H-shaped connector member **420,** has the lower portion of the left-hand edge thereof extending into, and confined and guided by, the right-hand inner groove of the H-shaped connector member **414,** and has the lower portion of the right-hand edge thereof extending into, and confined and guided by, the left-hand inner groove of the H-shaped connector member **416.**

The numeral **428** denotes a panel which has the lower edge thereof extending into, and confined and guided by the outer groove of the base **404,** has the lower portion of the left-hand edge thereof extending into, and confined and guided by, the outer groove of the grooved structural element **408,** and has the upper portion of that left-hand edge extending into, and confined and guided by, the right-hand outer groove of the H-shaped connector member **416.** A similar panel **456,** which is shown in FIG. **19,** has the lower edge thereof extending into, and confined and guided by, the inner groove of the base **404,** has the lower portion of the left-hand edge thereof extending into, and confined and guided by, the inner groove of the grooved structural element **408,** and has the rest of that left-hand edge extending into, and confined and guided by, the right-hand inner groove of the H-shaped connector member **416.**

The numeral **424** denotes an H-shaped connector member which has the lower edge thereof resting upon the groove-defining portions of the base **402,** and which has the right-hand outer groove thereof telescoped over the left-hand edge of the panel **422.** The right-hand inner groove of that H-shaped connector member is telescoped over the left-hand edge of the panel, not shown, which is disposed inwardly of the panel **422.** The H-shaped connector member **424** is telescoped over the right-hand edge of a triangular panel **426;** and that panel has the lower edge thereof extending into, and confined and guided by, the outer groove of the base **402.** A similar triangular panel, not shown, has the lower edge thereof extending into, and confined and guided by, the inner groove of the base **402,** and has the right-hand edge thereof extending into, and confined and guided by, the left-hand inner groove of the H-shaped connector member **424.**

The numeral **430** denotes an H-shaped connector member which has the lower edge thereof resting upon the groove-defining portions of the base **404,** which has the left-hand outer groove thereof telescoped over the right-hand edge of the panel **428,** and which has the left-hand inner groove thereof telescoped over the right-hand edge of the panel **456.** The right-hand outer groove of the H-shaped connector member **430** is telescoped over the left-hand edge of a triangular **432** which has the lower edge thereof extending into, and confined and guided by, the outer groove of the base **404.** A similar triangular panel, not shown, has the lower edge thereof extending into, and confined and guided by, the inner groove of the base **404,** and has the left-hand edge thereof extending into, and confined and guided by, the right-hand inner groove of the H-shaped connector member **430.**

The panels **422, 426, 428, 432** and **434** constitute portions of the exterior surface at one end of the A-frame building of FIG. **18;** and hence those panels should be capable of withstanding prolonged exposure to wind, rain, snow and the like. Also, the edges of those panels should be encased by seals like the seals **388** and **390** of FIG. **16.** Where that is done, those panels will be able to coact with the glass pane **418** and the door **412,** and with the grooved structural elements **402, 404, 406, 408, 410, 414, 416, 420, 424** and **430** to effectively exclude rain, snow and the like.

The numeral **440** denotes a grooved structural element which has a tubular portion, which has grooves **442** and **444** extending outwardly from one face of that tubular portion, has grooves **446** and **448** extending outwardly from the opposite face of that tubular portion, and which has grooves **450** and **452** extending outwardly from a third face of that tubular portion. That grooved structural element inclines upwardly from lower right to upper left; and the groove **450** thereof telescopes over the seal-encased, inclined upper edges of the panels **432, 428** and **434.** The groove **452** of the grooved structural element **440** telescopes over the inclined upper edges of the panel which is the counterpart of the panel **432,** of the panel **456** as shown by FIG. **19,** and of the panel which is the counterpart of the panel **434.** The seal which encases the edges of the panel **428** is denoted by the numeral **454,** and it is shown in FIG. **19.**

The numeral **458** denotes a roof panel which has a seal **459** extending around all of the edges thereof; and the seal-encased, left-hand edge of that roof panel is telescoped into, and confined and guided by, the groove **444** of the grooved structural element **440,** as shown by FIG. **19.** The numeral **460** denotes a narrower roof panel which has a seal **461** extending around all of the edges thereof; and the seal-encased, right-hand edge of the roof panel is telescoped into, and confined and guided by, the groove **446** of the grooved structural element **440.** The numeral **462** denotes a panel which is part of the ceiling of the A-frame building, and the left-hand edge of that panel is telescoped into, and confined and guided by, the groove **442** of the grooved structural element **440.** The numeral **464** denotes a panel which is in register with but disposed inwardly of the roofing panel **460,** and the right-hand edge of that panel is telescoped into, and confined and guided by, the groove **448** of the grooved structural element **440.**

The numeral **466** denotes a grooved structural element which serves as an end element of the roof of the A-frame building; and the cross section of that grooved structural element is similar to the cross section of the grooved structural element **44** in FIG. **11.** The grooved structural element **466** has grooves **468** and **470;** and the groove **468** is in register with the groove **448** of the grooved structural element **440,** while the groove **470** is in register with the groove **446** of that grooved struc-

tural element. The seal-encased, left-hand edge of the roofing panel **460** is telescoped into, and confined and guided by, the groove **470**; and the left-hand edge of the panel **464** extends into the groove **468,** as shown by FIG. **19.**

The numeral **474** denotes a base which rests upon the concrete slab **400,** and which underlies the lower edge of the right-hand side of the roof of the A-frame building. That base has grooves **476** and **478**; and, as shown particularly by FIG. **23,** those grooves have their axes inclined to the vertical. The inclinations of those axes are the same as the inclination of the grooved structural element **440**; and the bottom of that grooved structural element is cut so it rests upon the groove-forming portions of the base **474.** The numeral **480** denotes a fastener which extends downwardly through the web of the base **474,** and which is tightly seated within the concrete slab **400.** Similar fasteners will be provided along the length of the base **474** to fixedly secure that base against shifting relative to the concrete slab **400.** The right-hand end of the base **404** will be cut to snugly abut the left-hand edge of the base **474.**

The numeral **484** denotes a number of identical grooved structural elements which are aligned end-to-end and which serve as the cap of the A-frame building of FIG. **18**; and the cross section of one of those grooved structural elements is shown by FIG. **21.** That grooved structural element has a groove **486** and a groove **488**; and the axes of those grooves diverge downwardly and outwardly. The axis of the groove **488** is aligned with the axis of the groove **478** of the base **474.** The grooved structural element **484** has a vertically-directed web; and it has grooves **490** and **492** at the lower end of that web which diverge outwardly and downwardly. The axis of the groove **492** is coplanar with the axis of the groove **476** of the base **474,** and it is parallel to the axis of the groove **488.** The axis of the groove **490** is parallel to the axis of the groove **486,** as shown by FIG. **21.**

The numeral **493** denotes an H-shaped connector member which can be identical to the H-shaped connector member **342** in FIGS. **15** and **16.** Similar H-shaped connector members **494** and **534** also are provided for the right-hand portion of the roof of the A-frame building of FIG. **18.** In addition, an H-shaped connector member **500** and tow additional H-frame connector members, not shown, are provided for the left-hand portion of the roof of that A-frame building; and those H-shaped connector members are paired with the H-shaped connector members **494, 493** and **534.** As indicated by FIGS. **21** and **22,** the upper ends of each pair of H-shaped connector members are cut at angles and are abutted together to define parts of the ridge of the A-frame building. The left-hand outer groove of the H-shaped connector member **493** is telescoped over the right-hand edge of the roof panel **458**; and the left-hand inner groove of that H-shaped connector member is telescoped over the right-hand edge of the ceiling panel **462.**

The numeral **496** denotes a roof panel which has a seal **533,** of U-shaped cross section, extending around the edges thereof; and the seal-encased upper edge of that panel extends into the groove **488** of the adjacent grooved structural element **484.** The right-hand edge of the roof panel **496** extends into the groove **495** of the H-shaped connector **494**; and the left-hand edge of that roof panel extends into the right-hand outer groove of the H-shaped connector member **493.** A ceiling panel **526** is generally in register with the panel **496**; and the upper edge of that panel extends into the groove **492** of the adjacent grooved structural element **484,** as shown by FIG. **21.** The right-hand edge of the ceiling panel **526** extends into the groove **497** of the H-shaped connector member **494,** and the left-hand edge of that ceiling panel extends into the right-hand inner groove of the H-shaped connector member **493.**

The numeral **502** denotes a frusto-triangular plate which abuts the webs of the H-shaped connector members **494** and **500.** Bolt and nut combinations **504** extend through that frusto-triangular plate and through the webs of those H-shaped connector members to help that plate fix those H-shaped connector members against shifting or tilting relative to each other. L-shaped braces **506** are set in abutting engagement with the opposite faces of the webs of contiguous grooved structural elements **484,** as shown particularly by FIG. **22**; and nut and bolt combinations **508** extend through the longitudinally-extending portions of those L-shaped braces and through those webs to fixedly secure those L-shaped braces to those webs. Further nut and bolt combinations **508** extend through the laterally-extending portions of the L-shaped braces **506,** through the webs of the H-shaped connector members **494** and **500,** and through the frusto-triangular plate **502** to fixedly secure the contiguous grooved structural elements **484** to those H-shaped connector members. The L-shaped braces **506** thus coact with the webs of the contiguous grooved structural elements **484** and with the webs of the H-shaped connector members **494** and **500** to fixedly interrelate those H-shaped connector members and those contiguous grooved structural elements.

The numeral **532** denotes a seal which extends around the edges of a roof panel **514** which constitutes part of the left-hand side of the roof of the A-frame building of FIG. **18.** The right-hand edge of that panel extends into the groove **501** of the H-shaped connector member **500**; and the upper edge of that panel extends into the groove **486** of the adjacent grooved structural element **484.** The left-hand edge of the panel **514** will be disposed within the right-hand outer groove of an H-shaped connector member, not shown, which is coplanar with the H-shaped connector member **493.** A panel **524,** which serves as part of the ceiling of the A-frame building, will have the right-hand edge thereof disposed within the groove **503** of the H-shaped connector member **500,** and will have the upper edge thereof disposed within the groove **490** of the adjacent grooved structural element **484.** The left-hand edge of the ceiling panel **524** will be disposed within the right-hand inner groove of the H-shaped connector member which is coplanar with the H-shaped connector member **493.**

The numeral **510** denotes a roof panel which has a seal **520** extending around the edges thereof; and the seal-encased left-hand edge of that roof panel is disposed within the groove **498** of the H-shaped connector member **494.** The upper edge of the roof panel **510** will extend into the groove **488** of the adjacent grooved structural element **484,** and the right-hand edge of the roof panel **510** will extend into the left-hand outer groove of the H-shaped connector member **534.** The numeral **512** denotes a roof panel which has a seal **516** extending around the edges thereof; and the seal-

encased upper edge of that roof panel is disposed within the groove **486** of the adjacent grooved structural element **484.** The right-hand edge of that roof panel is disposed within the left-hand outer groove of the H-shaped connector member, not shown, which is coplanar with the H-shaped connector member **534**; and the left-hand edge of that panel is disposed within the groove **505** of the H-shaped connector member **500,** as shown by FIG. **22.**

A ceiling panel **535** is disposed inwardly of, and generally in register with, the roof panel **510**; and the upper edge of that ceiling panel is disposed within the groove **492** of the adjacent grooved structural element **484.** The side edges of that ceiling panel are disposed within the confronting inner grooves of the H-shaped connector members **494** and **534.** A ceiling panel **537** is disposed inwardly of, and generally in register with, the roof panel **512**; and the upper edge of that ceiling panel is disposed within the groove **490** of the adjacent grooved structural element **484.** The side edges of that ceiling panel are disposed within the right-hand inner groove of the H-shaped connector member **500** and the confronting groove of the H-shaped connector member, not shown, which is coplanar with the H-shaped connector member **534.**

The numeral **536** denotes a further roof panel; and a seal, not shown, extends around the edges of that roof panel. The seal-encased, left-hand edge of that roof panel extends into the right-hand outer groove of the H-shaped connector member **534,** and the seal-encased upper edge of that roof panel extends into the groove **488** of the adjacent grooved structural element **484,** and the seal-encased right-hand edge of that roof panel extends into a groove **574** in a grooved structural element **566** which serves as an end element of the right-hand side of the roof. That grooved structural element has a tubular portion with additional grooves **572, 570** and **568** projecting outwardly therefrom, as shown by FIG. **20.** The lower edge of the grooved structural element **566** will be cut to provide a snug fit with the right-hand end of the base **474.**

A ceiling panel, not shown, is disposed inwardly of, and generally in register with, the roof panel **536**; and the upper edge of that ceiling panel is disposed within the groove **492** of the adjacent grooved structural element **484.** The side edges of that ceiling panel are disposed within the confronting inner grooves of the H-shaped connector member **534** and of the grooved structural element **566.**

The numerals **538, 540, 542, 544** and **546** denote horizontally-directed, H-shaped connector members which extend, respectively, between the grooved structural elements **466** and **440,** the grooved structural element **440** and the H-shaped connector member **493,** the H-shaped connector members **493** and **494,** the H-shaped connector members **494** and **534,** and the H-shaped connector member **534** and the grooved structural element **566.** The upper grooves of the H-shaped connector member **538** receive and support the lower edges of panels **460** and **464,** the upper grooves of the H-shaped connector member **540** receive and support the lower edges of panels **458** and **462,** the upper grooves of the H-shaped connector member **542** receive and support the lower edges of panels **496** and **526,** the upper grooves of the H-shaped connector member **544** receive and support the lower edges of panels **510** and **535,** and the upper grooves of the H-shaped connector member **546** receive and support the lower edges of the panel **536** and its counterpart.

The numeral **547** denotes a roof panel which has a seal, not shown, extending around the four edges thereof; and that roof panel has the seal-encased, right-hand edge thereof telescoped into the lower portion of the groove **446** of the grooved structural element **440,** has the seal-encased, left-hand edge thereof telescoped into the lower portion of the groove **470** of the grooved structural element **466,** has the seal-encased upper edge thereof telescoped into the lower outer groove of the H-shaped connector member **538,** and has the seal-encased, lower edge thereof telescoped into the groove **478** of the base **474.** A generally-similar panel, not shown, is disposed inwardly of the roof panel **547**; and the side edges of that panel are telescoped into the lower portions of the grooves **448** and **468,** respectively, of the grooved structural elements **440** and **466,** the upper edge of that panel is telescoped into the inner lower groove of the H-shaped connector member **538,** and the lower edge of that panel is telescoped into the groove **476** of the base **474.**

The numeral **548** denotes a roof panel which has a seal, not shown, extending around the four edges thereof; and that roof panel has the seal-encased, right-hand edges thereof telescoped into the lower portion of the outer left-hand groove of the H-shaped connector member **493,** has the seal-encased, left-hand edge thereof telescoped into the lower portion of the groove **444** of the grooved structural element **440,** has the seal-encased upper edge thereof telescoped into the lower outer groove of the H-shaped connector member **540,** and has the seal-encased lower edge thereof telescoped into the groove **478** of the base **474.** A ceiling panel, not shown, is disposed inwardly of the roof panel **548**; and the side edges of that panel are telescoped into the lower portions of the groove **442** of the grooved structural element **440** and the inner left-hand groove of the H-shaped connector member **493,** the upper edge of that panel is telescoped into the inner lower groove of the H-shaped connector member **540,** and the lower edge of that panel is telescoped into the groove **476** of the base **474.**

The numeral **550** denotes a further roof panel which has a seal **556** extending around the four edges thereof; and that roof panel has the seal-encased right-hand edge thereof telescoped into the lower portion of the left-hand outer groove of the H-shaped connector member **494,** has the seal-encased left-hand edge thereof telescoped into the lower portion of the right-hand outer groove of the H-shaped connector member **493,** has the seal-encased upper edge thereof telescoped into the lower outer groove of the H-shaped connector member **542,** and has the seal-encased lower edge thereof telescoped into the groove **478** of the base **474,** as shown by FIG. **23.** A ceiling panel **558** is disposed inwardly of the roof panel **550**; and the side edges of that panel are telescoped into the lower portions of the inner confronting grooves of the H-shaped connector members **493** and **494,** the upper edge of that panel is telescoped into the inner lower groove of the H-shaped connector member **542,** and the lower edge of that panel is telescoped into the groove **476** of the base **474,** as shown by FIG. **23.**

The numeral **552** denotes a further roof panel which has a seal extending around the four edges thereof; and that roof panel has the seal-encased side edges thereof

telescoped into the lower portions of the confronting outer grooves of the H-shaped connector members **494** and **534**, as shown in part by FIG. **20**, has the seal-encased upper edge thereof telescoped into the outer lower groove of the H-shaped connector member **544**, and has the seal-encased lower edge thereof telescoped into the groove **478** of the base **474**. A ceiling panel **584** is disposed inwardly of the roof panel **552**; and the side edges of that panel are telescoped into the lower portions of the inner confronting grooves of the H-shaped connector members **494** and **534**, the upper edge of that panel is telescoped into the inner lower groove of the H-shaped connector member **544**, and the lower edge of that panel is telescoped into the groove **476** of the base **474**.

The numeral **554** denotes a roof panel which has a seal **586** extending around the four edges thereof; and that roof panel has the seal-encased, right-hand edge thereof telescoped into the lower portion of the groove **574** of the grooved structural element **566**, as shown by FIG. **20**, has the seal-encased, left-hand edge thereof telescoped into the lower portion of the outer right-hand groove of the H-shaped connector member **534**, as shown by FIG. **20**, has the seal-encased upper edge thereof telescoped into the lower outer groove of the H-shaped connector member **546**, and has the seal-encased lower edge thereof telescoped into the groove **478** of the base **474**. A ceiling panel **582** is disposed inwardly of the roof panel **554**; and the side edges of that panel are telescoped into the lower portions of the groove **572** of the grooved structural element and the confronting groove of the H-shaped connector member **534**, as shown by FIG. **20**, the upper edge of that panel is telescoped into the inner lower groove of the H-shaped connector member **546**, and the lower edge of that panel is telescoped into the groove **476** of the base **474**.

The seal-encased roof panels **458, 460, 496, 510, 536, 547, 548, 550, 552**, and **554** coact with the grooved structural elements **440, 446** and **566**, the base **474**, the various lengths of the grooved structural element **484**, the the H-shaped connector members **493, 494, 534, 538, 540, 542, 544** and **546** to constitute the right-hand half of a water-tight roof for the A-frame building of FIG. **18**. The seal-encased roof panels **512** and **514** and additional seal-encased roof panels, not shown, which are counterparts of the roof panels **458, 460, 536, 547, 548, 550, 552** and **554** coact with a grooved structural element **559**, which is a mirror image of the grooved structural element **466**, grooved structural elements, not shown, which are mirror images of the grooved structural elements **440** and **566**, a base, not shown, which is a mirror image of the base **474**, the various lengths of the grooved structural element **484**, the H-shaped connector member **500**, and H-shaped connector members, not shown, which are mirror images of the H-shaped connector members **493, 534, 538, 540, 542, 544** and **546** to constitute the left-hand half of that water-tight roof.

The panel **464** in FIG. **19**, panels **557** and **564** in FIG. **18**, a panel, not shown, which is a mirror image of the panel **564**, and H-shaped connectors **538** and **565** coact with the grooved structural elements **466** and **559** to define the inner surface of an overhang at the front of the A-frame building of FIG. **18**. The ceiling panels **462, 526, 535, 558, 582** and **584** and the ceiling panels, not shown, in register with the roof panels **536** and **548**, coact with the grooved structural elements **440** and **566**, the base **474**, the various lengths of the grooved structural element **484**, and the H-shaped connector members **493, 494, 534, 540, 542, 544** and **546** to constitute the right-hand half of the ceiling of the A-frame building of FIG. **18**. The ceiling panels **524** and **537** and the other ceiling panels, not shown, which are coplanar with them coact with the grooved structural elements, not shown, which are mirror images of the grooved structural elements **440** and **566**, a base, not shown, which is a mirror image of the base **474**, the various lengths of the grooved structural element **484**, the H-shaped connector member **500**, and H-shaped connector members, not shown, which are mirror images of the H-shaped connector members **493, 534, 540, 542, 544** and **546** to constitute the left-hand half of that ceiling.

The numeral **560** in FIG. **23** denotes an L-shaped brace which is secured to the web of the H-shaped connector member **494** and also to the web of the base **474** by bolt and nut combinations **562**. The numeral **590** in FIG. **20** denotes an L-shaped brace which is secured to the web of the H-shaped connector member **534** and also to the web of the base **474** by nut and bolt combinations **592**. Similar L-shaped braces and similar nut and bolt combinations, not shown, will secure the lower ends of the grooved structural elements **440, 466** and **566**, and the lower end of the H-shaped connector member **493** to the base **474**. Also, similar L-shaped braces and similar nut and bolt combinations, not shown, will secure the lower end of the grooved structural element **559**, the lower ends of the grooved structural elements corresponding to the grooved structural elements **440** and **566**, the lower end of the H-shaped connector member **500**, and the lower ends of the H-shaped connector members corresponding to the H-shaped connector members **493** and **534** to the base which is the counterpart of the base **474**. As a result, the roof and ceiling of the A-frame building of FIG. **18** will be sturdy and rigid, and will strengthen and rigidify that A-frame building.

The numeral **576** denotes a triangular panel which has a seal **578** extending around the three edges thereof; and that panel has the inclined upper edge thereof telescoped into the groove **568** of the grooved structural element **566**, as shown by FIG. **20**. The bottom edge of that panel will be telescoped into the outer groove of the base **594** which corresponds to the base **404**, and the left-hand edge of that panel will be telescoped into the right-hand outer groove of an H-shaped connector member which corresponds to the H-shaped connector member **430**. Other panels, not shown, which can be glass panes or solid panels will coact with the panel **576** to help constitute the outer surface of the wall at the other end of the A-frame building of FIG. **18**. The numeral **580** in FIG. **20** denotes a panel which is triangular in configuration, and which has the inclined upper edge thereof telescoped into the groove **570** of the grooved structural element **566**. The bottom edge of that panel will be telescoped into the inner groove of the base **594**, and the left-hand edge of that panel will telescope into the right-hand inner groove of the H-shaped connector member which corresponds to the H-shaped connector member **430**. Further panels, not shown, which can be glass panes or solid panels, will coact with the panel **580** to help constitute the

inner surface of the wall at the other end of the A-frame building of FIG. **18.**

The components of the A-frame building of FIG. **18** could be assembled together in different ways; but they will preferably be assembled by securing the base **474** and its counterpart to the concrete slab **400,** and by securing the bases **402, 404** and **594** to that concrete slab. Thereafter, the grooved structural element **440** and its counterpart will be secured together and will be set off to one side; and the grooved structural elements **466** and **559** will be secured together and will be set off to one side. The grooved structural elements **406, 408** and **410** will be interconnected and then will be connected to the bases **402** and **404.** The panel **422** and its corresponding inner panel will then be set in position, and the H-shaped connector member **414** will be set in position. The seal-encased glass pane **418** and its counterpart will be set in position, the H-shaped connector member **420** will be set in position, the H-shaped connector member **416** will be set in position, the panel **428** and inner panel **456** will be set in position, and the panel **434** and its counterpart will be set in position. The H-shaped connector member **424** will be set in position, and the triangular panel **426** and its counterpart will be set in position. The H-shaped connector member **430** will be set in position, and the triangular panel **432** and its counterpart will be set in position. As, or after, the panels **422, 426, 428, 432** and **434** and their counterparts are set in position, insulation will preferably be disposed between the confronting faces of those panels. Thereafter, the assembled grooved structural element **440** and its counterpart will be raised to vertical position, and then will be jacked up sufficiently to enable the grooves therein to be set in position above, and in register with, the upper edges of the panels **422, 426, 428, 432** and **434** and their counterparts. Thereupon, the grooved structural element **440** and its counterpart will be lowered, and the grooves therein will telescope over those upper edges. At such time, the lower ends of the grooved structural element **440** and its counterpart will be fixedly secured to the base **474** and to the counterpart of that base.

The roof panel **548** and its ceiling panel will be set in position with insulation therebetween, and the H-shaped connector member **540** will be set in position. The corresponding roof panel and ceiling panel will then be set in position, and the H-shaped connector member corresponding to the H-shaped connector member **540** will be set in position. The roof panel **458** and the ceiling panel **462** will be set in position with insulation therebetween; and the corresponding roof panel and ceiling panel will then be set in position. At such time, the length of the grooved structural element **484** which accommodates the upper edges of the roof panel **458** and of its counterpart and which also accommodates the upper edges of the ceiling panel **462** and its counterpart will be telescoped into position. One end of that length of that grooved structural element will be fixedly secured to the upper ends of the grooved structural element **440** and its counterpart.

The upper ends of the H-shaped connector member **493** and its counterpart will be suitable connected together, and then the left-hand grooves of those H-shaped connector members will be telescoped over the right-hand edges of the roof panels **458** and **548** and their counterparts and of the corresponding ceiling panels and their counterparts. The upper ends of those H-shaped connector members will be suitably connected to the previously-installed length of grooved structural element **484**; and the lower ends of those H-shaped connector members will be suitably connected to the base **474** and its counterpart.

In similar fashion, the roof panels **496, 510, 536, 550, 552** and **554** and their counterparts, the corresponding ceiling panels and their counterparts, the H-shaped connector members **494, 500, 534, 542, 544** and **546** and the counterparts of the H-shaped connector members **534, 542, 544** and **546,** and the remaining three lengths of the grooved structural element **484** will be installed.

At this time, the grooved structural element **566** will be set in position; and its lower end will be suitably secured to the base **474,** and its upper end will be suitably secured to the right-handmost length of grooved structural element **484.** The triangular panels **576** and **580** will be set in position, the H-shaped connector member which corresponds to the H-shaped connector member **430** will be set in position, and the panels which correspond to the panel **428** and inner panel **456** will be set in position. A full length H-shaped connector member, rather than the short H-shaped connector member **416,** will be set in position; and a full length panel, rather than the short panel **434,** will be set in position, and so will the adjacent inner panel. A full length H-shaped connector member, rather than the short H-shaped connector member **414,** will be set in position; and panels which correspond to the panel **422** and its inner panel will be set in position. An H-shaped connector member which corresponds to the H-shaped connector member **424** will be set in position; and panels which correspond to the panel **426** and its inner panel will be set in position. Thereafter, the counterpart of the grooved structural member **566** will be set in position; and the upper edges of the inner and outer taller panels of the left-hand side of the other end wall of the A-frame building of FIG. **18** will be tilted outwardly to enable the upper ends of the horizontally-directed and vertically-directed grooves of that grooved structural element to be telescoped over the adjacent edges of the roof and ceiling and wall panels. Thereupon, the upper end of that grooved structural element will be suitably secured to the upper end of the grooved structural element **566** and to the right-handmost length of the grooved structural element **484**; and the lower end of that grooved structural element will be suitably secured to the base which is the counterpart of the base **474.**

One or more of the panels of the other end wall of the A-frame building of FIG. **18** could consist of or include glass panels. Similarly, one or more of the panels of the roof and ceiling of that A-frame building could consist of or include glass panels.

To complete the exterior of the A-frame building, the roof panel **547** and its corresponding inner panel will be set in position; and the H-shaped connector member **538** will be set in position. The panel **564** and the counterpart of panel **546** and the H-shaped connector member **565** will be set in position. Thereafter, the roof panel **460** and the panel **464** will be set in position; and the panel **557** and the counterpart of the panel **460** will be set in position. At this time, the adjacent length of the grooved structural element **484** will be telescoped into position atop the upper edges of the panels **460, 464, 557** and the counterpart of the panel **460**; and that length of that grooved structural element will be suit-

ably secured to the upper ends of the grooved structural element **440** and its counterpart. The previously-connected grooved structural elements **466** and **559** will be raised to vertical position; and then the grooves in those grooved structural elements will be telescoped over the outer edges of the panels **460, 464, 547, 557, 564** and of the counterparts of the panels **460, 547** and **564.** The upper ends of the grooved structural elements **466** and **559** will be suitably secured to the left-handmost grooved structural element **484**; and the lower ends of those grooved structural elements will be suitably secured to the base **474** and its counterpart.

The A-frame building of FIG. **18** will be extremely sturdy and rugged. Each panel, each H-shaped connector member, each of the bases, each length of the grooved structural element **484,** the grooved structural elements **440, 466, 559** and **566,** and the counterparts of the grooved structural elements **440** and **566** interact to make that A-frame building sturdy and rugged. Yet, only a minimum number of screws, bolt and nut combinations, or other fasteners are needed to interconnect the various component parts of that A-frame building.

Referring particularly to FIG. **24,** the numeral **596** generally denotes a grooved structural element which serves as a corner fitting and which resembles, but which differs individually from, the corner fitting **348** of FIGS. **13-17.** Instead of having the grooves for the outer panels of adjacent walls disposed close to the outer corner, as is the case with the corner fitting **348,** the corner fitting **596** has grooves **598** and **600** that are spaced several inches from that outside corner. The corner fitting **596** also has grooves **602** and **604** which are intended to accommodate the inner panels of two adjacent walls. Ribs **606** and **608** are provided at the opposite sides of the web of the corner fitting **596**; and the ribs **606** are intended to engage the vertically-extending portions of L-shaped braces, not shown, while the ribs **608** are intended to engage the upwardly-extending portions of further L-shaped braces, not shown. The horizontally-extending portions of those L-shaped braces will be secured to suitable bases and to suitable caps, not shown, of those adjacent walls.

Ribs **597** are formed on the corner fitting **596,** and those ribs are intermediate the grooves **598** and **602.** Ribs **605** also are formed on the corner fitting **596,** and those ribs are intermediate the grooves **600** and **604.** Locking flanges **599** and **601** are provided on the corner fitting **596,** and those locking flanges are spaced inwardly of the ribs **597.** The ribs **597** and the locking flanges **599** and **601** snugly accommodate the vertically-extending portions of additional L-shaped braces, not shown. The numerals **607** and **609** denote locking flanges which are provided on the corner fitting **596;** and those locking flanges are disposed inwardly of the ribs **605.** The ribs **605** and the locking flanges **607** and **609** snugly accommodate the vertically-extending portions of still further L-shaped braces, not shown. Where L-shaped braces are associated with the ribs **606** and **608,** it will not ordinarily be necessary to associate L-shaped braces with the ribs **597** and the locking flanges **599** and **601** or with the ribs **605** and the locking flanges **607** and **609.** However, where L-shaped braces are not associated with the ribs **606** and **608,** L-shaped braces will usually be associated with the ribs **597** and the locking flanges **599** and **601** and with the ribs **605** and the locking flanges **607** and **609.**

The numeral **603** denotes a plate which has locking grooves at the opposite edges thereof; and one of those locking grooves is complementary to the locking flange **599,** while the other of those locking grooves is complementary to the locking flange **601.** The plate **603** can be assembled with the corner fitting **596** by telescoping the locking grooves of that plate into engagement with the locking flanges **599** and **601.** Similarly, the numeral **611** denotes a plate which has locking grooves at the opposite edges thereof; and one of those locking grooves is complementary to the locking flange **607,** while the other of those locking grooves is complementary to the locking flange **609.** The plate **611** can be assembled with the corner fitting **596** by telescoping the locking grooves of that plate into engagement with the locking flanges **607** and **609.** The plate **603** fixes the spacing between the confronting faces of the locking flanges **599** and **601,** and thus enable the corner fitting **596** to fully resist any forces which would tend to move the groove **598** closer to, or further away from, the groove **602.** Similarly, the plate **611** fixes the spacing between the confronting faces of the locking flanges **607** and **609,** and thus enable the corner fitting **596** to fully resist any forces which would tend to move the groove **600** closer to, or further away from the groove **604.**

It will be noted that the groove **602** and **604** of the corner fitting **596** have abutments **613** which are in alignment with the inner ends of the grooves **598** and **600.** The spacing of the grooves **598** and **600** from the outer corner of the corner fitting **596** will coact with the abutments **613** in the grooves **602** and **604** to enable the corner fitting **596** to be used with inner an outer panels which have the same widths. As a result, the sawing operations and the resulting waste which are entailed in the cutting of the inner panels **384** and **386** of FIG. **16** are obviated.

If desired, the lower end of the corner fitting **596** of FIG. **24** could be held against lateral movement by being set within the concrete of a concrete floor or by being secured to a plate which was fastened to that concrete. In addition, if desired, metal plates **617** could have the lower ends thereof embedded within the concrete of a concrete floor, and could have the upper ends telescoped into the lower end of the corner fitting **596.** Those upper ends would fit neatly into the spaces between two abutments **615** and the inner ends of the grooves **598** and **600.**

FIG. **25** shows a spacer **610** which has a web **612** with flanges **614** and **616** at the opposite ends of that web. The flange **614** can abut the inner panel of a wall while the flange **616** abuts the outer panel of that wall; and hence that spacer can provide support for the portions of those panels which are intermediate the edges thereof. Ribs **618** are provided at one face of the spacer **610** to accommodate the vertically-directed portions of L-shaped braces, not shown, which can have the horizontally-directed portions thereof secured to a suitable base and cap, not shown. Similarly, ribs **620** are provided at the opposite face of the spacer **610** to accommodate the vertically-directed portions of L-shaped braces, not shown, which can have the horizontally-directed portions thereof secured to a suitable base and cap, not shown. The inner panel of the wall can be secured to the flange **614** of the spacer **610** by cement, by self-tapping screws, or by other ways known to the art. Similarly, the outer panel of that wall can be

secured to the flange **616** by cement, self-tapping screws, or by other ways known to the art. The exposed faces of the flanges **614** and **616** are shown as being roughened to enable cements, adhesives, mastics, or the like to adhere tightly to them.

The flanges **614** and **616** of the spacer **610** will have the bottom edges thereof resting upon the portions of a base which define the upper edges of grooves in that base. The upper edges of those flanges will underlie the portions of a cap which define the lower edges of the grooves in that cap. If desired, the spacer **610** could be set in horizontal position within a wall; and, in that position, it would serve as a fire stop for that wall.

Referring particularly to FIG. **26,** the numeral **622** generally denotes an H-shaped connector member which is similar to, but which differs individually from, the H-shaped connector member **76** of FIG. **10.** The H-shaped connector member **622** has grooves **624, 626, 628** and **630** which are comparable to the grooves **84, 86, 80** and **82** of the H-shaped connector member **76.** However, the H-shaped connector member **622** has ribs **632** at one side of the web thereof which confront each other and which are disposed between the grooves **624** and **628.** Also, that H-shaped connector member has ribs **634** at the opposite side of that web which confront each other and which are disposed between the grooves **626** and **630.** The space between the ribs **632** and that web can accommodate the vertically-extending portions of L-shaped braces which can have the horizontally-extending portions thereof secured to the webs of bases and caps; and one such L-shaped brace is denoted by the numeral **629** in FIG. **26.** The horizontally-directed portion of that L-shaped brace is held by a screw and by the ribs of a base **631.** The space between the ribs **634** and the web of the H-shaped connector member **622** can accommodate the vertically-extending portions of L-shaped braces which can have the horizontally-directed portions thereof secured to the webs of bases or caps; and one such L-shaped brace is denoted by the numeral **633** in FIG. **26.** The horizontally-directed portion of that L-shaped brace is held by a screw and by the ribs of the base **631.**

The spacer **610** of FIG. **25** is shown in FIG. **26** as it appears when it is secured to a base, such as the base **631.** An L-shaped brace **635** has the vertically-directed portion thereof disposed in the space between the web **612** and the ribs **618;** and the horizontally-directed portion of that brace is secured to the base **631** by a screw and by the ribs of that base. An L-shaped brace **637** has the vertically-directed portion thereof disposed in the space between the web **612** and the ribs **620;** and the horizontally-directed portion of that brace is secured to the base **631** by a screw and by the ribs of that base. A panel **639** has the lower edge thereof disposed within the inner groove of the base **631,** and cement, an adhesive, screws, or the like can secure that panel to the flange **614** of the spacer **610.** A panel **641** has the lower edge thereof disposed within the outer groove of the base **631,** and cement, an adhesive, screws, or the like can secure that panel to the flange **616** of that spacer. The grooves **626** and **630** of the H-shaped connector member **622** and the confronting grooves of an adjacent H-shaped connector member will support the side edges of the panels **639** and **641;** and the spacer **610** will help support the intermediate portions of those panels.

FIG. **27** shows, on a larger scale and in perspective, the L-shaped brace **629** of FIG. **26.** The vertically-directed portion of that L-shaped brace has a countersunk opening therein and has oppositely-disposed notches therein. That countersunk opening will accommodate a screw, not shown, which seats in an opening, not shown, in the web of the H-shaped connector member **622.** Those notches accommodate the ribs of the base **631.** The horizontally-directed portion of the L-shaped brace **629** has a countersunk opening therein; and that countersunk opening will accommodate the screw which seats in an opening, not shown, in the web of the base **631.**

The L-shaped brace **629,** and similar L-shaped braces, will have the horizontally-directed portions thereof threaded into the space between one end of the web of the base **631** and the ribs of that base. Thereafter, those L-shaped braces will be slid along the length of that base until they are in the desired positions. At such time, the appropriate H-shaped connector members, the appropriate spacers, or appropriate grooved structural elements will have the ribs thereof telescoped downwardly over the vertically-directed portions of those L-shaped braces. The interactions of the various ribs, webs and screws will securely and solidly lock those L-shaped braces, H-shaped connector members, spacers, and grooved structural elements in position.

Referring particularly to FIG. **28,** the numeral **636** generally denotes a grooved structural element which could be used in lieu of each of the grooved structural elements **136, 138, 140** and **142** around the window-like opening in FIG. **1.** That grooved structural element has grooves **638** and **640,** and it has ribs **642** which confront each other and which are disposed between the grooves **638** and **640.** The ribs **642** can coact with the web of the grooved structural element **636** to accommodate portions of L-shaped braces that will be used to lock that grooved structural element to other grooved structural elements which are set at right angles to that grooved structural element. If desired, the grooved structural element **636** could be used in lieu of any of the grooved structural elements **336, 342, 392** and **394** of FIGS. **13-17** in lieu of any of the grooved structural elements **466, 559** and **566** and the counterpart of **566** in FIG. **18,** and in lieu of the base **631** in FIG. **26.**

Referring to FIG. **29,** the numeral **646** generally denotes a grooved structural element which has a web **648** with grooves **650, 652** and **654** adjacent one end of that web, and with grooves **656, 658** and **660** adjacent the opposte end of that web. A rib **662** is provided adjacent the grooves **652** and **654,** ribs **664** are disposed at the right-hand face of the web **648** and are disposed between the grooves **654** and **656,** a rib **666** is provided adjacent the grooves **656** and **658,** and ribs **668** are disposed at the left-hand face of the web **648** and are disposed between the grooves **650** and **660.** The web **648** and the ribs **668** can accommodate the vertically-directed portions of L-shaped braces which can have the horizontally-directed portions thereof secured to a base and cap, not shown. Similarly, the web **648** and the ribs **664** can accommodate the vertically-directed portions of L-shaped braces, not shown, which can have the horizontally-directed portions thereof secured to a base and cap, not shown.

FIG. 29 also shows a grooved structural element 670 which is a mirror image of the grooved structural element 646. The grooved structural element 670 as a web 672 with grooves 674, 676 and 678 adjacent one end thereof and with grooves 680, 682 and 684 adjacent the opposite end thereof. A rib 686 is provided adjacent the grooves 674 and 676, and that rib is set in register with the rib 662 on the grooved structural element 646. Ribs 688 are provided at the right-hand face of the web 672 and are disposed between the grooves 678 and 680; and a rib 690 is set in register with the rib 666 on the grooved structural element 646. Ribs 692 are provided at the left-hand face of the web 672, and those ribs are intermediate the grooves 674 and 684. The space between the web 672 and the ribs 688 can accommodate the vertically-directed portions of L-shaped braces, not shown, which can have the horizontally-directed portions thereof secured to a base and cap, not shown. Similarly, the space between the web 672 and the ribs 692 can accommodate the vertically-directed portions of L-shaped braces, not shown, which can have the horizontally-directed portions thereof secured to a base and cap, not shown. The rib 686 can coact with the rib 662 and with the adjacent walls of the grooves 674 and 654 to accommodate the vertically-directed portions of L-shaped braces, not shown, which can have the horizontally-directed portions thereof secured to a base and cap, not shown. Similarly, the rib 690 can coact with the rib 666 and with the adjacent walls of the grooves 684 and 656 to accommodate the vertically-directed portions of L-shaped braces, not shown, which can have the horizontally-directed portions thereof secured to a base and cap, not shown.

A panel 694 has the right-hand edge thereof disposed within the groove 650 of the grooved structural element 646, and a panel 698 has the left-hand edge thereof disposed within the groove 678 of the grooved structural element 670; and those panels constitute parts of the inner surface of a wall. A panel 704 has the right-hand edge thereof disposed within the groove 660 of the grooved structural element 646, and a panel 708 has the left-hand edge thereof disposed within the groove 680 in the grooved structural element 670; and those constitute parts of the outer surface of that wall. The numeral 696 denotes a spacer which has the left-hand edge thereof disposed within the groove 654 of the grooved structural element 646 and which has the right-hand edge thereof disposed within the groove 674 of the structural element 670. A similar spacer 706 has the left-hand edge thereof disposed within the groove 656 of the grooved structural element 646 and has the right-hand edge thereof disposed within the groove 684 of the grooved structural element 670. The spacers 696 and 706 will lie in the planes, respectively, of the inner and outer surfaces of the wall, but they can be made of unornamented or rough material because they will be concealed.

The numeral 700 denotes a panel which has one edge thereof disposed within the groove 652 of the grooved structural element 646, and the numeral 702 denotes a panel which has one edge thereof disposed within the groove 676 of the grooved structural element 670. Those panels constitute parts of the inner and outer surfaces of a wall which extends at right angles to the wall which is defined, in part, by the panels 694, 698, 704 and 708. The numeral 710 denotes a panel which has one edge thereof disposed within the groove 658 of the grooved structural element 646, and the numeral 712 denotes a panel which has one edge thereof disposed within the groove 682 of the grooved structural element 670. The panel 710 is in alignment with the panel 700, and the panel 712 is in alignment with the panel 702; and the panels 710 and 712 constitute parts of the inner and outer surfaces of a second wall which extends at right angles to the wall which is defined, in part, by the panels 694, 698, 704 and 708. As a result, the two compact and inexpensive grooved structural elements 646 and 670 make it possible to connect two walls at right angles to a through wall or to interconnect the abutting ends of four separate walls. Those two grooved structural elements thus perform at least one of the functions of the grooved structural element 194 of FIG. 6, even if that grooved structural element is equipped with the dotted-line connecting portion 202.

Referring particularly to FIG. 30, the numeral 720 denotes a grooved structural element which has a web 722 with grooves 724, 726 and 728 adjacent one end thereof and with grooves 730 and 732 adjacent the opposite end thereof. A rib 734 is provided adjacent the grooves 726 and 728, ribs 736 are disposed adjacent the right-hand face of the web 722 and are intermediate the grooves 728 and 730, and ribs 738 are disposed at the left-hand face of that web and are intermediate the grooves 724 and 732. The numeral 740 in FIG. 30 denotes a grooved structural element which is a mirror image of the grooved structural element 720 — having a web 742 with grooves 744, 746 and 748 adjacent one end thereof and with grooves 750 and 752 adjacent the opposite end thereof. A rib 754 is provided adjacent the grooves 746 and 744, and that rib is set in register with the rib 734 on the grooved structural element 720. Ribs 756 are disposed at the right-hand face of the web 742 and are intermediate the grooves 748 and 750, and ribs 758 are disposed at the left-hand face of that web and are disposed between the grooves 744 and 752.

A panel 760 has the right-hand edge disposed within the groove 724 of the grooved structural element 720, and a panel 764 has the left-habd edge thereof disposed within the groove 748 of the grooved structural element 740. Those panels define part of the inner face of a wall; and part of the outer face of that wall is defined by a panel 770 which has the right-hand edge thereof disposed within the groove 732, by a panel 772 which has the opposite edges thereof disposed within the grooves 730 and 752, and by a panel 774 which has the left-hand edge thereof disposed within the groove 750. The numeral 762 denotes a spacer which has the opposite edges thereof disposed within the grooves 728 and 744. Although that spacer lies in the plane defined by the panels 760 and 764, that spacer will be hidden, and thus can be an unornamented or rough piece of wood. The numeral 766 denotes a panel which has one edge thereof disposed within the groove 726 of the grooved structural element 720, and the numeral 768 denotes a panel which has one edge thereof disposed within the groove 746 of the grooved structural element 740. The panels 766 and 768 are parts of the inner and outer surfaces of a wall which is set at right angles to the wall, which is defined, in part, by the panels 760, 764, 770, 772 and 774. As a result, the two compact and inexpensive grooved structural elements 720 and 740 are able

to perform one of the functions of the structural element **194** of FIG. **6.**

FIG. **31** shows a grooved structural element **776** which has a web **778** with grooves **780** and **782** at one end thereof and with grooves **784** and **786** at the other end thereof. Ribs **788** are disposed adjacent the left-hand face of the web **778,** and those ribs are intermediate the grooves **780** and **786.** Those ribs can coact with the web **778** to accommodate the vertically-directed portions of L-shaped braces, not shown, which can have the horizontally-directed portions thereof secured to cap and to a base **789.** The numeral **790** denotes a panel which has one side edge thereof disposed within the groove **782,** and the lower edge of that panel will be set in the left-hand groove of the base **789.** The numeral **792** denotes a panel which has one side edge thereof disposed within the groove **784,** and the lower edge of that panel will be set in that left-hand groove of that base. The panels **790** and **792** constitute parts of one face of a wall; and the numeral **794** denotes a panel which constitutes part of the other face of that wall. The lower edge of the panel **794** extends into the right-hand groove of the base **789;** and the side edges of that panel will extend into the confronting grooves of the grooved structrual elements, not shown.

The numeral **796** denotes a panel which has the right-hand edge thereof disposed within the groove **780,** and the numeral **798** denotes a panel which has the right-hand edge thereof disposed within the groove **786.** The panels **796** and **798** define parts of the inner and outer surfaces of a wall which is disposed at right angles to the wall which is constituted, in part, by the panels **790, 792** and **794.** As a result, the simple and inexpensive grooved structural element **766** of FIG. **31** is able to perform part of the fuction of the grooved structural element **194** in FIG. **6.**

The numeral **800** in FIG. **32** denotes a grooved structural element which can be identical to the grooved structural element **44** in FIG. **11;** and the numeral **802** denotes a further grooved structural element which can be identical to the grooved structural element **44.** An elongated L-shaped metal extrusion **804** has a flange **806** extending at right angles to one of the arms thereof, and has a flange **808** extending at right angles to the other arm thereof. One arm of the extrusion **804** abuts the outer web of the grooved structural element **800,** while the other arm of that extrusion abuts the outer web of the grooved structural element **802.** In doing so, that L-shaped extrusion disposes the grooved structural elements **800** and **802** at right angles to each other.

The numeral **810** denotes an L-shaped metal extrusion with an abutment **816** extending inwardly thereof adjacent the free end of one of the arms thereof, and with an abutment **818** extending inwardly thereof adjacent the free end of the other arm thereof. As shown particularly by FIG. **32,** the free end of the right-hand arm of the L-shaped extrusion **810** abuts the outer face of the flange **806** on the right-hand arm of the extrusion **804,** and the abutment **816** abuts that right-hand arm. The free end of the left-hand arm of the L-shaped extrusion **810** abuts the flange **808** on the left-hand arm of the extrusion **804,** and the abutment **818** abuts that left-hand arm. Fasteners **820,** and similar fasteners in vertical relation with them, fixedly secure the right-hand arm of the extrusion **804** to the outer web of the grooved structural element **800;** and fasteners **822,** and similar fasteners in vertical relation with them, fixedly secure the left-hand arm of that extrusion to the outer web of the grooved structural element **802.** A fastener **824,** and similar fasteners in vertical relation with it, secure the free end of the left-hand arm of the extrusion **810,** the flange **808** on the extrusion **804,** and the adjacent wall of the grooved structural element **802** together. A fastener **826,** and similar fasteners in vertical relation with it, secure the free end of the right-hand arm of the extrusion **810,** the flange **806** on the extrusion **804,** and the adjacent wall of the grooved structural element **800** together.

The extrusions **804** and **810** interconnect the grooved structural elements **800** and **802** to provide an overall structure which is very similar to, and which effectively performs the functions of, the grooved structural element **24** in FIG. **2.** For example, the grooved structural element **800** performs the function of the connecting portion **28** of the grooved structural element **24,** the grooved structural element **802** performs the function of the connecting portion **36** of the grooved structural element **24,** and the extrusions **804** and **810** help define the sides of a tubular portion which is like the tubular portion **26** of the grooved structural element **24.** As a result, FIG. **32** shows how two of the grooved structural elements of the present invention can be combined together with connecting members to constitute the equivalent of a more complex grooved structural element. Hence, it should be apparent that some of the grooved structural elements of the present invention could be fabricated as well as extruded; and that various of those grooved structural elements could be combined together or with other members to provide various cross-sectional configurations.

The fabricated grooved structural element shown in FIG. **32** has one important advantage over the grooved structural element **24** in FIG. **2.** Specifically, that fabricated grooved structural element makes it possible to assemble two adjacent walls, while all of the components of those walls are in their horizontal positions, and then bodily tilt those walls up to vertical position and interconnect the adjacent ends of those walls.

Further, the fabricated grooved structural element of FIG. **32** permits two adjacent walls to be separated from each other — to eliminate an undesired partition or wall, to enable those walls to be moved to a new location and then be re-connected, or to permit easy alteration or replacement of either of those walls.

FIGS. **1, 2, 6, 13** and **15–17** show how walls can be disposed at right angles to each other and interconnected by corner fittings. If desired, a number of walls could be assembled and set in end-to-end fashion so they were coplanar, and then the grooved structural elements at the confronting ends of the adjacent walls could be screwed or bolted together to form one very long, continuous wall. Similarly, if desired, a number of walls could be assembled and set one above the other in coplanar fashion, and then the grooved structural elements at the bottoms of the upper walls could be screwed or bolted to the tops of the lower walls to form one very high continuous wall. Moreover, if desired, a number of walls could be assembled in end-to-end fashion and further walls could be set one above the other, and then the grooved structural elements at the confronting portions of the adjacent walls could be screwed or bolted to form one very long, very high wall. As a result, it should be apparent that by use of the

present invention, it should be possible to provide almost any desired size or configuration of wall or other composite structure.

If it ever became necessary to obtain access to the space between the panel **126** of the wall **22** in FIG. **1** and its counterpart, a hole could be drilled in that panel. and then a keyhole saw or a saber-type jigsaw could be used to cut two vertically-directed slots in that panel. Those slots would preferably be about one foot apart, perfectly straight, and extend from the groove-defining portion of the grooved structural element **66** to the groove-defining portion of the grooved structural element **70.** Thereafter, a chisel or other sharp-pointed tool would be inserted in the lower ends and upper ends of those slots to extend those slots to the upper and lower edges of that panel, and thereby subdivide that panel into a 1-foot wide section, a left-hand section, and a right-hand section.

Thereupon, the midpoint of the 1-foot wide section could be bowed outwardly until the top thereof could be moved out of the inner groove of the grooved structural element **70,** or the bottom thereof could be moved out of the inner groove of the grooved structural element **66.** Subsequently, the left-hand section and the right-hand section of the panel **126** could be successively shifted toward the space created by the removal of the one-foot wide section of that panel; and then the mid-points of those sections could be bowed outwardly to free the upper and lower edges of those sections from the inner grooves of the grooved structural elements **70** and **66.** In that way, the panel **126** can be removed from the wall **22** without disturbing any other portion of that wall.

Before the three sections of the panel **126** are replaced in the wall **22** in FIG. **1,** two of the spacers **610** of FIG. **25** will have the lower ends thereof rested on the upper edges of the confronting, groove-defining flanges of the grooved structural element **66,** and will have the upper ends thereof disposed immediately adjacent the lower edge of the confronting, groove-defining flanges of the grooved structural element **70.** Those spacers can be suitably secured to the grooved structural elements **66** and **70** by screws and by L-shaped connectors, such as the L-shaped connector **560** in FIG. **23** or the L-shaped connector **590** in FIG. **20.** If desired, of course, two-by-fours could be used instead of the spacers **610** of FIG. **25.**

One of the spacers **610** or one of the two-by-fours will be disposed in register with the joint between the left-hand section and the 1-foot wide section of the panel **126,** and the other spacer **610** or the other two-by-four will be disposed in register with the joint between the right-hand section of that panel and that 1-foot wide section. Thereafter, the left-hand section and the right-hand section of that panel will be successively set adjacent the wall **22,** the bottom edges of those sections will be set within the inner groove of the grooved structural element **66,** the midpoints of those sections will be bowed outwardly until the upper edges of those sections are below the level of the inner groove of the grooved structural element **70,** and then those upper edges will be guided into that groove. Those sections of the panel **126** will then be shifted away from each other until the left-hand edge of the left-hand section of that panel again telescopes into the right-hand inner groove of the connector member **90** and the right-hand edge of the right-hand section of that panel again telescopes into the left-hand inner groove of the connector member **94.** At this time, the lower edge of the 1-foot wide section of the panel **126** will be disposed within the inner groove of the grooved structural element **66,** the midpoint of that section will be bowed outwardly, and the upper edge of that section will be guided into the inner groove of the grooved structural element **70.** Thereupon, holes will be drilled through the portions of the three sections of the panel **126** which overlie the flanges **616** of the spacer **610,** and those holes will be extended through those flanges so self-tapping metal screws can be passed through the openings in those sections and seated in the openings in those flanges. Once this has been done, the edges of all three sections of the panel **126** will be solidly held in the same plane. The joints between the one-foot wide sectiona and the left-hand and right-hand sections of the panel **126** can then be suitably masked by tape and paint.

The hereinbefore-described method of replacing the three sections of the panel **126** can also be used whenever it is desirable to install a panel within a space which has already been enclosed by grooved structural elements. As a result, even if a workman prematurely completed a frame, and thereby enclosed all four sides of a space before he installed within that space the panels intended therefor, that workman could subsequently install those panels within that space without having to open one side of that frame. It thus should be apparent that the present invention permits the removal and subsequent replacement of panels from completed frames, and also permits the insertion of panels into completed frames.

The grooved structural elements of FIGS. **5, 6** and **29–31** are shown as they would appear when used as vertically-directed, grooved structural elements, but those grooved structural elements could be incorporated into walls wherein they would be horizontally directed. Where so incorporated, those grooved structural elements could be used to support shelves, table tops, sub-ceilings, raised floors, stair steps or the like. For example, the grooved structural element **176** in FIG. **5** could have the grooves **186** and **188** thereof telescoped downwardly over the upper edges of the panel **134** in the wall **20** of FIG. **1** and its counterpart, and could have the lower edges of panels such as the panel **144** and its counterpart telescoped downwardly into the grooves **180** and **178** thereof. At such time, the grooves **182** and **184** could be used to support the ends of built-in shelves, a table top, or the like. Similarly, the grooves **190** and **192** could be used to support the ends of built-in shelves, a table top, a sub-ceiling, a raised floor, stair steps, or the like. The grooved structural element **776** of FIG. **31** would be particularly useful as a support for built-in shelves, or a built-in table top, because the ends thereof could easily be mitered to mate with the mitered ends of connecting members such as the connecting member **76** of FIG. **10.** As a result, it should be apparent that the various grooved structural elements of the present invention could be used where they are to be horizontally-directed as well as vertically-directed. Further, as indicated by FIGS. **18–23,** the grooved structural elements of the present invention could be used in inclined positions as well as in vertical and horizontal positions.

Each panel which has the edges thereof telescoped into the elongated, transversely-spaced grooves of the

grooved structural elements provided by the present invention will usually be handled as a unit, and will usually have a thickness just slightly smaller than the widths of those grooves or will have the edges thereof encased by seals which have widths close to the widths of those grooves. However, in some instances it may be desirable to utilize a panel which is a composite panel. For example, where a panel such as the panel **126** has been cut into three sections to permit its removal and replacement, as described hereinbefore, or has been cut into three sections to permit its initial introduction into a previously-closed frame, it may be desirable to have the exposed surface of that panel overlain by an ornamental panel. That ornamental panel would be almost as wide as the panel **126,** but it would be sufficiently shorter than the panel **126** to permit the upper and lower edges thereof to abut the groove-defining inner flanges of the grooved structural elements **70** and **66.**

In installing such a composite panel, the three sections of panel **126** would be installed in the manner described hereinbefore; and the edges of the 1-foot wide section and the adjacent edges of the left-hand and right-hand sections of that panel would be suitably secured to spacers **610** or to two-by-fours which had the tops and bottom thereof secured to the grooved structural elements **70** and **66.** Thereafter, a suitable mastic would be applied to the exposed face of the panel **126;** and then the ornamental panel would have the left-hand edge thereof telescoped into the space which is within the right-hand inner groove of the connector member **90** and at the exposed surface of the left-hand section of the panel **126.** This can easily be done, because the upper and lower edges of the ornamental panel will not have to be telescoped into the inner grooves of the grooved structural elements **66** and **70** — the length of that ornamental panel being essentially equal to the distance between the confronting edges of the groove-defining flanges of those grooved structural elements. Once the left-hand side of the ornamental panel has been adequately secured to the left-hand portion of the panel **126,** the right-hand edge of that ornamental panel will be telescoped into the space which is within the left-hand inner groove of the connector member **94** and at the exposed surface of the right-hand section of the panel **126.** Thereafter, the rest of that ornamental panel will be pressed into adhering engagement with the mastic which overlies the rest of the exposed face of the panel **126.** With a relatively slow-drying mastic, it will be possible to adequately smooth out the ornamental panel, and thereby provide an attractice surface for the appropriate portion of the wall. Where the edges of such a composite panel were to be fitted into grooves which were five-eighths of an inch wide, the panel **126** could have a thickness of three-eighths of an inch and the ornamental panel could have a thickness of about one-quarter of an inch. The use of such a composite panel would eliminate the need of taping and painting the joints between the 1-foot wide section and the left-hand and right-hand sections of the panel **126.** Further, it would permit the use of less-expensive and less-decorative wood in the panel **126.**

The walls provided by the present invention can be vertically directed to serve as exterior walls, walls between rooms, walls between rooms and corridors, or as free standing walls or partitions. Further, the walls provided by the present invention can be horizontally directed to serve as shelves, floors, ceilings or roofs. Moreover, the walls provided by the present invention can be inclined to serve as inclined roofs, ceilings, or partitions. As a result, it should be understood that as used herein and in the appended claims, the word "walls" is intended to comprehend walls, partitions, shelves, floors, ceilings, roofs and the like.

The various grooved structural elements provided by the present invention make it possible to provide overall structures which can be assembled quickly and with a minimum of fasteners, and yet which are very sturdy and rugged. Each component of those grooved structural elements contributes its proportionate share of the sturdiness and ruggedness needed by the overall structure; and hence that overall structure is desirably sturdy and rugged.

Whereas the drawing and accompanying description have shown and described several different embodiments of the present invention, it should be apparent to those skilled in the art that various changes may be made in the form of the invention without affecting the scope thereof.

What I claim is:

1. A wall that has an aperture therein and that includes an elongated base member, an elongated top member disposed above and in vertical registry with said base member, a vertically-directed member extending between said base member and said top member, a second vertically-directed member extending between said base member and said top member, said second vertically-directed member being laterally displaced from the first said vertically-directed member, a spacing member extending between said base member and said top member, said spacing member being laterally displaced from said first said vertically-directed member and from said second vertically-directed member, said members being frame-defining members which coact to define a frame for said wall, a plurality of aperture-defining members which coact to define said aperture for said wall, said base member having a horizontally-directed web, said top member having a horizontally-directed web parallel to said web of said base member, said first said vertically-directed member having a vertically-directed web which is normal to said web of said base member and which also is normal to said web of said top member, said second vertically-directed member having a vertically-directed web which is parallel to said web of said first said vertically-directed member and which is normal to said web of said base member and which also is normal to said web of said top member, said spacing member having a web, each of said aperture-defining members having a web, a plural-arm locking member having one arm thereof abutting one portion of said web of said base member and having another arm thereof abutting one portion of said web of said first said vertically-directed member, a second plural-arm locking member having one arm thereof abutting a second portion of said web of said base member and having another arm thereof abutting one portion of said web of said second vertically-directed member, a third plural-arm locking member having one arm thereof abutting one portion of said web of said top member and having another arm thereof abutting a second portion of said web of said first said vertically-directed member, a fourth plural-arm locking member having one arm thereof abutting

a second portion of said web of said top member and having another arm thereof abutting a second portion of said web of said second vertically-directed member, a fifth plural-arm locking member having one arm thereof abutting one portion of said web of said spacing member and having another arm thereof abutting a third portion of said web of said base member, a sixth plural-arm locking member having one arm thereof abutting a second portion of said web of said spacing member and having another arm thereof abutting a third portion of said web of said top member, further plural-arm locking members having arms thereof abutting said webs of said aperture-defining members, each of said aperture-defining members and some of said frame-defining members having elongated, parallel, transversely-spaced grooves, said elongated, parallel, transversely-spaced grooves of said aperture-defining members facing outwardly and away from said aperture, said elongated, parallel, transversely-spaced grooves of said some frame-defining members facing inwardly of said frame, said elongated, parallel, transversely-spaced grooves of said aperture-defining members confronting and being in register with said transversely-spaced grooves in a plurality of said some frame-defining members, each of said transversely-spaced grooves in said aperture-defining members having substantial portions of the confronting surfaces of the walls thereof parallel to each other, said transversely-spaced grooves in contiguous members of said some frame-defining members being aligned and in communication with each other, said transversely-spaced grooves in contiguous members of said aperture-defining members being aligned and in communication with each other, fasteners which are positively and mechanically secured to said first said, second, third, fourth, fifth and sixth locking members, further fasteners which are positively and mechanically secured to said further locking members, a plurality of panels which coact to define a plane and which have edges thereof extending into and held by one of said transversely-spaced grooves in said some frame-defining members, a second plurality of panels which coact to define a second plane and which have edges thereof extending into and held by the second of said transversely-spaced grooves in said some frame-defining members, at least one of said panels of the first said plurality of panels having an edge thereof extending into and held by one of said transversely-spaced grooves in at least one of said aperture-defining members, at least one of said panels of said second plurality of panels having an edge thereof extending into and held by the second of said transversely-spaced grooves in said one of said aperture-defining members, the panels of said first said plurality of panels coacting to define a first surface for said wall, the panels of said second plurality of panels coacting to define a second surface for said wall, said aperture-defining members and said frame-defining members coacting with said first said and said second plurality of panels to bound and define an insulating space which is located within said wall and which is intermediate said aperture and the outer periphery of said frame, said top member having elongated ribs thereon which are spaced apart but which are in register with each other and which extend toward each other, said ribs being parallel to but spaced short distances away from said web of said top member to define transversely-spaced slots that receive and confine both side edges of said one arm of said third locking member and of said one arm of said fourth locking member and of said other arm of said sixth locking member, whereby said third locking member engages and is secured to and confined by said top member and whereby said fourth locking member engages and is secured to and confined by said top member and whereby said sixth locking member engages and is secured to and confined by said top member, said first said vertically-directed member having elongated ribs thereon which are spaced apart but which are in register with each other and which extend toward each other, said ribs being parallel to but spaced short distances away from said web of said first said vertically-directed member to define transversely-spaced slots that receive and confine both side edges of said other arm of said third locking member and of said other arm of said first said locking member, whereby said third locking member engages and is secured to and confined by said first said vertically-directed member and whereby said first said locking member engages and is secured to and confined by said first said vertically-directed member, said third locking member coating with one of the first said fasteners and with said ribs on said top member to provide three transversely-spaced points of securement between said top member and said third locking member to rigidly lock said third locking member to said top member and thereby fix the location of said first said vertically-directed member relative to said top member, said second vertically-directed member having elongated ribs thereon which are spaced apart but which are in register with each other and which extend toward each other, said ribs being parallel to but spaced short distances away from said web of said second vertically-directed member to define transversely-spaced slots that receive and confine both side edges of said other arm of said fourth locking member and of said other arm of said second locking member, whereby said fourth locking member engages and is secured to and confined by said second vertically-directed member and whereby said second locking member engages and is secured to and confined by said second vertically-directed member, said fourth locking member coacting with one of said first said fasteners and with said ribs on said top member to provide three transversely-spaced points of securement between said top member and said fourth locking member to rigidly lock said fourth locking member to said top member and thereby fix the location of said second vertically-directed member relative to said top member, said base member having elongated ribs thereon which are spaced apart but which are in register with each other and which extend toward each other, said ribs being parallel to but spaced short distances away from said web of said base member to define transversely-spaced slots that receive and confine both side edges of said one arm of the first said locking member and of said one arm of said second locking member and of said other arm of said fifth locking member, whereby said second locking member engages and is secured to and confined by said base member and whereby said first said locking member engages and is secured to and confined by said base member and whereby said fifth locking member engages and is secured to and confined by said base member, said first said locking member coacting with one of said first said fasteners and with said ribs on said base member to provide three

transversely-spaced points of securement between said base member and said first said locking member to rigidly lock said first said locking member to said base member and thereby fix the location of said first said vertically-directed member relative to said base member, said second locking member coacting with one of said first said fasteners and with said ribs on said base member to provide three transversely-spaced points of securement between said base member and said second locking member to rigidly lock said second locking member to said base member and thereby fix the location of said second vertically-directed member relative to said base member, said spacing member having elongated ribs thereon which are spaced apart but which are in register with each other and which extend toward each other, said ribs being parallel to but spaced short distances away from said web of said spacing member to define transversely-spaced slots that receive and confine both side edges of said one arm of said fifth locking member and of said one arm of said sixth locking member, whereby said fifth locking member engages and is secured to and confined by said spacing member and whereby said sixth locking member engages and is secured to and confined by said spacing member, said fifth locking member coacting with one of said first said fasteners and with said ribs on said base member to provide three transversely-spaced points of securement between said base member and said fifth locking member to rigidly lock said fifth locking member to said base member and thereby fix the location of said spacing member relative to said base member, said sixth locking member coacting with one of said first said fasteners and with said ribs on said top member to provide three transversely-spaced points of securement between said top member and said sixth locking member to rigidly lock said sixth locking member to said top member and thereby fix the location of said spacing member relative to said top member, each of said aperture-defining members having elongated ribs thereon which are spaced apart but which are in register with each other and which extend toward each other, said ribs being parallel to but spaced short distances away from said webs of said aperture-defining members to define transversely-spaced slots that receive and confine both side edges of said arms of said further locking members, whereby said further locking members engage and are secured to and confined by said aperture-defining members, each of said further fasteners coacting with one of said further locking members and with said ribs on one of said aperture-defining members to provide three transversely-spaced points of securement between said web of said one of said aperture-defining members and the adjacent arm of said one of said further locking members, said aperture-defining members having the same cross-sectional configuration, said webs of said aperture-defining members having exposed surfaces that are essentially planar surfaces and that provide each of said aperture-defining members with an exposed surface which is essentially free of flanges, ribs or other protuberances, at least one of said frame-defining members having the same cross-sectional configuration as said aperture-defining members, whereby said one of said frame-defining members can provide an exposed surface for one portion of said frame which is essentially free of flanges, ribs or other protuberances, and at least some of said first said fasteners extending inwardly of said wall to engage and securely hold arms of some of said locking members and the web of one of said frame-defining members.

2. A wall that includes an elongated base member, an elongated top member disposed above and in vertical registry with said base member, a vertically-directed member extending between said base member and said top member, a second vertically-directed member extending between said base member and said top member, said second vertically-directed member being laterally displaced from the first said vertically-directed member, said members being frame-defining members which coact to define a frame for said wall, said base member having a horizontally-directed web, said top member having a horizontally-directed web parallel to said web of said base member, said first said vertically-directed member having a vertically-directed web which is normal to said web of said base member and which also is normal to said web of said top member, said second vertically-directed member having a vertically-directed web which is parallel to said web of said first said vertically-directed member and which is normal to said web of said base member and which also is normal to said web of said top member, a plural-arm locking member having one arm thereof abutting one portion of said web of said base member and having another arm thereof abutting one portion of said web of said first said vertically-directed member, a second plural-arm locking member having one arm thereof abutting a second portion of said web of said base member and having another arm thereof abutting one portion of said web of said second vertically-directed member, a third plural-arm locking member having one arm thereof abutting one portion of said web of said top member and having another arm thereof abutting a second portion of said web of said first said vertically-directed member, a fourth plural-arm locking member having one arm thereof abutting a second portion of said web of said top member and having another arm thereof abutting a second portion of said web of said second vertically-directed member, some of said frame-defining members having elongated, parallel, transversely-spaced grooves, said elongated, parallel, transversely-spaced grooves of said some frame-defining members facing inwardly of said frame, said transversely-spaced grooves in contiguous members of said some frame-defining members being aligned and in communication with each other, fasteners which are positively and mechanically secured to said first said, second, third and fourth locking members, a plurality of panels which coact to define a plane and which have edges thereof extending into and held by one of said transversely-spaced grooves in said some frame-defining members, a second plurality of panels which coact to define a second plane and which have edges thereof extending into and held by the second of said transversely-spaced grooves in said some frame-defining members, the panels of said first said plurality of panels coacting to define a first surface for said wall, the panels of said second plurality of panels coacting to define a second surface for said wall, said frame-defining members coacting with said first said and said second plurality of panels to bound and define an insulating space which is located within said wall, said first said vertically-directed member being disposed intermediate the ends of said wall, said first said vertically-directed member having elongated, vertically-directed, parallel, transversely-spaced flanges at the opposite

edges of said vertically-directed web thereof, one of said elongated, vertically-directed, parallel, transversely-spaced flanges of said first said vertically-directed member extending outwardly beyond both faces of said vertically-directed web of said first said vertically-directed member, the other of said elongated, vertically-directed, parallel, transversely-spaced flanges of said first said vertically-directed member also extending outwardly beyond both faces of said vertically-directed web of said first said vertically-directed member, said one of said elongated, vertically-directed, parallel, transversely-spaced flanges of said first said vertically-directed member receiving and helping hold one portion of one panel of said first plurality of panels, the other of said elongated, vertically-directed, parallel, transversely-spaced flanges of said first said vertically-directed member receiving and helping hold one portion of one panel of said second plurality of panels, the other of said elongated, vertically-directed, parallel, transversely-spaced flanges of said first said vertically-directed member receiving and helping hold one portion of one panel of said second plurality of panels, said top member having elongated ribs thereon which are spaced apart but which are in register with each other and which extend toward each other, said ribs being parallel to but spaced short distances away from said web of said top member to define transversely-spaced slots that receive and confine both side edges of said one arm of said third locking member and of said one arm of said fourth locking member, whereby said third locking member engages and is secured to and confined by said top member and whereby said fourth locking member engages and is secured to and confined by said top member, said first said vertically-directed member having elongated ribs thereon which are spaced apart but which are in register with each other and which extend toward each other and which are normal to said elongated, vertically-directed, parallel, transversely-spaced flanges of said first said vertically-directed member, said ribs being parallel to but spaced short distances away from said web of said first said vertically-directed member to define transversely-spaced slots that receive and confine both side edges of said other arm of said third locking member and of said other arm of said first said locking member, whereby said third locking member engages and is secured to and confined by said first said vertically-directed member and whereby said first said locking member engages and is secured to and confined by said first said vertically-directed member, said third locking member coacting with one of said fasteners and with said ribs on said top member to provide three transversely-spaced points of securement between said top member and said third locking member to rigidly lock said third locking member to said top member and thereby fix the location of said first said vertically-directed member relative to said top member, said second vertically-directed member having elongated ribs thereon which are spaced apart but which are in register with each other and which extend toward each other, said ribs being parallel to but spaced short distances away from said web of said second vertically-directed member to define transversely-spaced slots that receive and confine both side edges of said other arm of said fourth locking member and of said other arm of said second locking member, whereby said fourth locking member engages and is secured to and confined by said second vertically-directed member and whereby said second locking member engages and is secured to and confined by said second vertically-directed member, said fourth locking member coacting with one of said fasteners and with said ribs on said top member to provide three transversely-spaced points of securement between said top member and said fourth locking member to rigidly lock said fourth locking member to said top member and thereby fix the location of said second vertically-directed member relative to said top member, said base member having elongated ribs thereon which are spaced apart but which are in register with each other and which extend toward each other, said ribs being parallel to but spaced short distances away from said web of said base member to define transversely-spaced slots that receive and confine both side edges of said one arm of the first said locking member and of said one arm of said second locking member, whereby said second locking member engages and is secured to and confined by said base member and whereby said first said locking member engages and is secured to and confined by said base member, said first said locking member coacting with one of said fasteners and with said ribs on said base member to provide three transversely-spaced points of securement between said base member and said first said locking member to rigidly lock said first said locking member to said base member and thereby fix the location of said first said vertically-directed member relative to said base member, said second locking member coacting with one of said fasteners and with said ribs on said base member to provide three transversely-spaced points of securement between said base member and said second locking member to rigidly lock said second locking member to said base member and thereby fix the location of said second vertically-directed member relative to said base member, said other arm of said third locking member having notches therein which are in register with and which accommodate said ribs on said top member, whereby said third locking member and hence said first said vertically-directed member can be set at a desired position along the length of said top member, and said other arm of said first said locking member having notches therein which are in register with and which accommodate said ribs on said base member, whereby said first said locking member and hence said first said vertically-directed member can be set at a desired position along the length of said base member.

3. A wall that includes an elongated base member, an elongated top member disposed above and in vertical registry with said base member, a vertically-directed member extending between said base member and said top member, a second vertically-directed member extending between said base member and said top member, said second vertically-directed member being laterally displaced from the first said vertically-directed member, a plurality of spacing members extending between said base member and said top member, said spacing members being laterally displaced from said first said vertically-directed member and from said second vertically-directed member, said members being frame-defining members which coact to define a frame for said wall, said base member having a horizontally-directed web, said top member having a horizontally-directed web parallel to said web of said base member, said first said vertically-directed member having a

vertically-directed web which is normal to said web of said base member and which also is normal to said web of said top member, said second vertically-directed member having a vertically-directed web which is parallel to said web of said first said vertically-directed member and which is normal to said web of said base member and which also is normal to said web of said top member, each of said spacing members having a web, a plural-arm locking member having one arm thereof abutting one portion of said web of said base member and having another arm thereof abutting one portion of said web of said first said vertically-directed member, a second plural-arm locking member having one arm thereof abutting a second portion of said web of said base member and having another arm thereof abutting one portion of said web of said second vertically-directed member, a third plural-arm locking member having one arm thereof abutting one portion of said web of said top member and having another arm thereof abutting a second portion of said web of said first said vertically-directed member, a fourth plural-arm locking member having one arm thereof abutting a second portion of said web of said top member and having another arm thereof abutting a second portion of said web of said second vertically-directed member, further plural-arm locking members, each of said further plural-arm locking members having one arm thereof abutting one portion of the web of one of said spacing members and having another arm thereof abutting a portion of said web of said base member, still further plural-arm locking members, each of said still further plural-arm locking members having one arm thereof abutting one portion of the web of one of said spacing members and having another arm thereof abutting a portion of said web of said top member, some of said frame-defining members having elongated, parallel, transversely-spaced grooves, said elongated, parallel, transversely-spaced grooves of said some frame-defining members facing inwardly of said frame, said transversely-spaced grooves in contiguous members of said some frame-defining members being aligned and in communication with each other, fasteners which are positively and mechanically secured to said first said, second, third, fourth, further, and still further locking members, a plurality of panels which coact to define a plane and which have edges thereof extending into and held by one of said transversely-spaced grooves in said some frame-defining members, a second plurality of panels which coact to define a second plane and which have edges thereof extending into and held by the second of said transversely-spaced grooves in said some frame-defining members, the panels of said first said plurality of panels coacting to define a first surface for said wall, the panels of said second plurality of panels coacting to define a second surface for said wall, said frame-defining members coacting with said first said and said second plurality of panels to bound and define an insulating space which is located within said wall, said top member having elongated ribs thereon which are spaced apart but which are in register with each other and which extend toward each other, said ribs being parallel to but spaced short distances away from said web of said top member to define transversely-spaced slots that receive and confine both side edges of said one arm of said third locking member and of said one arm of said fourth locking member and of said other arms of said still further locking members, whereby said third locking member engages and is secured to and confined by said top member and whereby said fourth locking member engages and is secured to and confined by said top member and whereby said still further locking members engage and are secured to and confined by said top member, said first said vertically-directed member having elongated ribs thereon which are spaced apart but which are in register with each other and which extend toward each other, said ribs being parallel to but spaced short distances away from said web of said first said vertically-directed member to define transverse-spaced slots that receive and confine both side edges of said other arm of said third locking member and of said other arm of said first said locking member, whereby said third locking member engages and is secured to and confined by said first said vertically-directed member and whereby said first said locking member engages and is secured to and confined by said first said vertically-directed member, said third locking member coacting with one of said fasteners and with said ribs on said top member to provide three transversely-spaced points of securement between said top member and said third locking member to rigidly lock said third locking member to said top member and thereby fix the location of said first said vertically-directed member relative to said top member, said second vertically-directed member having elongated ribs thereon which are spaced apart but which are in register with each other and which extend toward each other, said ribs being parallel to but spaced short distances away from said web of said second vertically-directed member to define transversely-spaced slots that receive and confine both side edges of said other arm of said fourth locking and of said other arm of said second locking member, whereby said fourth locking member engages and is secured to and confined by said second vertically-directed member and whereby said second locking member engages and is secured to and confined by said second vertically-directed member, said fourth locking member coacting with one of said fasteners and with said ribs on said top member to provide three transversely-spaced points of securement between said top member and said fourth locking member to rigidly lock said fourth locking member to said top member and thereby fix the location of said second vertically-directed member relative to said top member, said base member having elongated ribs thereon which are spaced apart but which are in register with each other and which extend toward each other, said ribs being parallel to but spaced short distances away from said web of said base member to define transversely-spaced slots that receive and confine both side edges of said one arm of the first said locking member and of said one arm of said second locking member and of said other arms of said further locking members, whereby said second locking member engages and is secured to and confined by said base member and whereby said first said locking member engages and is secured to and confined by said base member and whereby said further locking members engage and are secured to and confined by said base member, said first said locking member coacting with one of said fasteners and with said ribs on said base member to provide three transversely-spaced points of securement between said base member and said first said locking member to rigidly lock said first said locking member to said base member and thereby fix the location of said

first said vertically-directed member relative to said base member, said second locking member coacting with one of said fasteners and with said ribs on said base member to provide three transversely-spaced points of securement between said base member and said second locking member to rigidly lock said second locking member to said base member and thereby fix the location of said second vertically-directed member relative to said base member, each of said spacing members having elongated ribs thereon which are spaced apart but which are in register with each other and which extend toward each other, said ribs being parallel to but spaced short distances away from said webs of said spacing members to define transversely-spaced slots that receive and confine both side edges of said one arm of said further locking members and of said still further locking members, whereby said further locking members engage and are secured to and confined by said spacing members and whereby said still further locking members engage and are secured to and confined by said spacing members, said further locking members coacting with more of said fasteners and with said ribs on said base member to provide groups of three transversely-spaced points of securement between said further locking members and said base member to rigidly lock said further spacing members to said base member and thereby fix the locations of said spacing members relative to said base member, said still further locking members coacting with additional ones of said fasteners and with said ribs on said top member to provide groups of three transversely-spaced points of securement between said top member and said still further locking members to rigidly lock said still further locking members to said top member and thereby fix the locations of said spacing members relative to said top member, said base member and said top member having elongated, parallel, transversely-spaced flanges, said spacing members having elongated, parallel, transversely-spaced flanges which are in register with and which abut said elongated, parallel, transversely-shaped flanges on said base member and on said top member, said elongated, parallel, transversely-spaced flanges on said sapcing members being planar and receiving full support from said elongated, parallel, transversely-spaced flanges on said base member, said elongated, parallel, transversely-spaced flanges on said spacing members and on said base member and on said top member coacting to hold the confronting faces of said panels of said first said and of said second plurality of panels spaced apart a predetermined minimum distance, and said elongated, parallel, transversely-spaced grooves on said some of said frame-defining members helping keep said confronting faces of said panels of said first said and of said second plurality of panels immediately adjacent said elongated, parallel, transversely-spaced flanges on said spacing members and on said base member and on said top member.

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