Dec. 20, 1966 H. C. NICOLINI 3,292,325

CONNECTING STRUCTURE BETWEEN WALL AND ROOF

Filed Feb. 19, 1962 3 Sheets-Sheet 1

Fig. 1

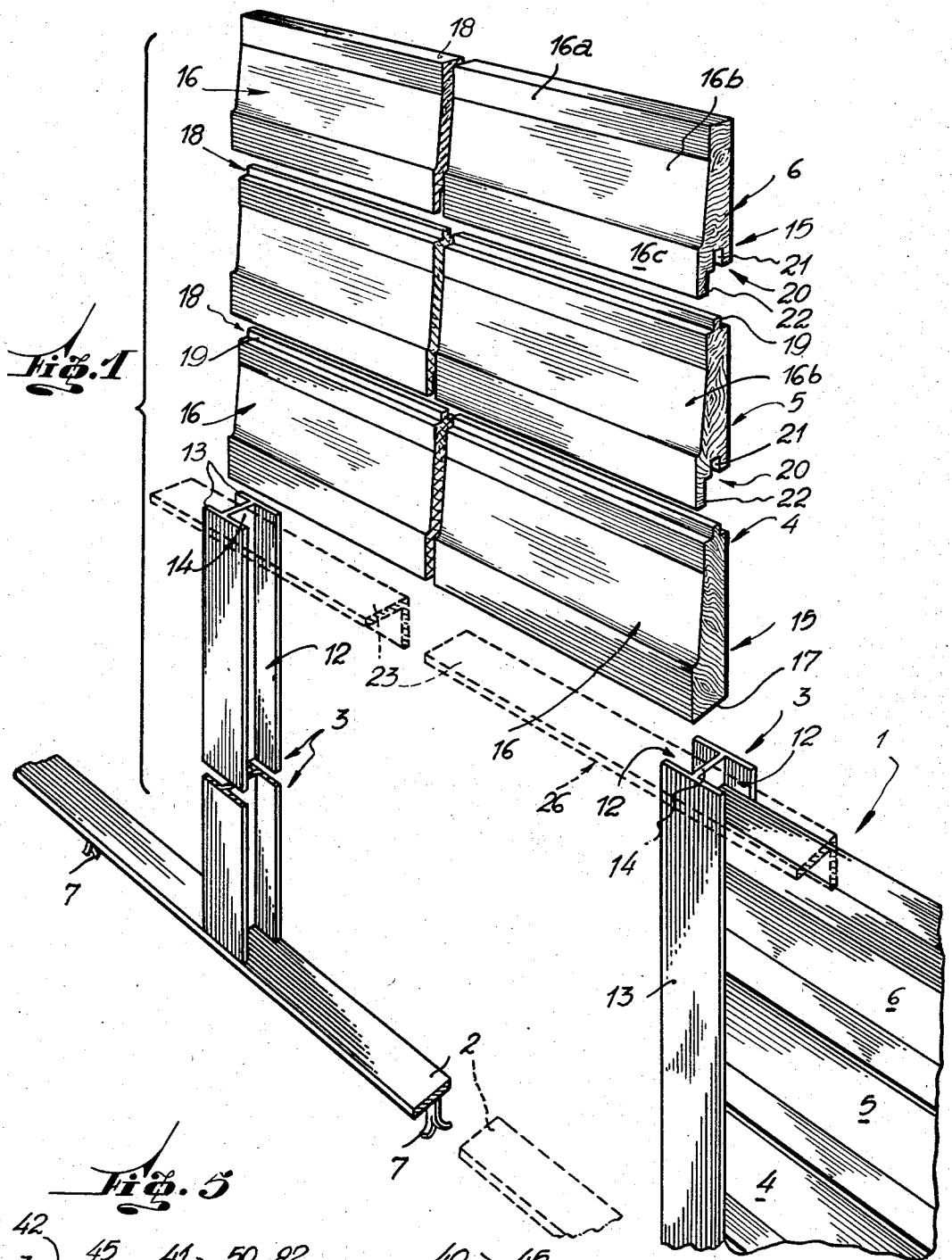
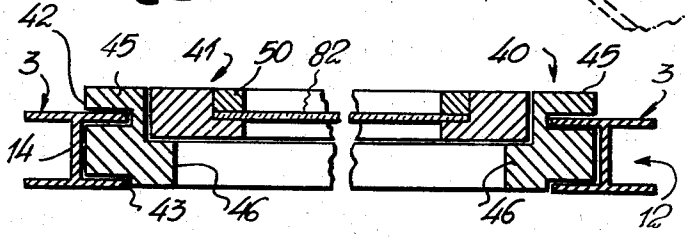



Fig. 5




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CONNECTING STRUCTURE BETWEEN WALL AND ROOF

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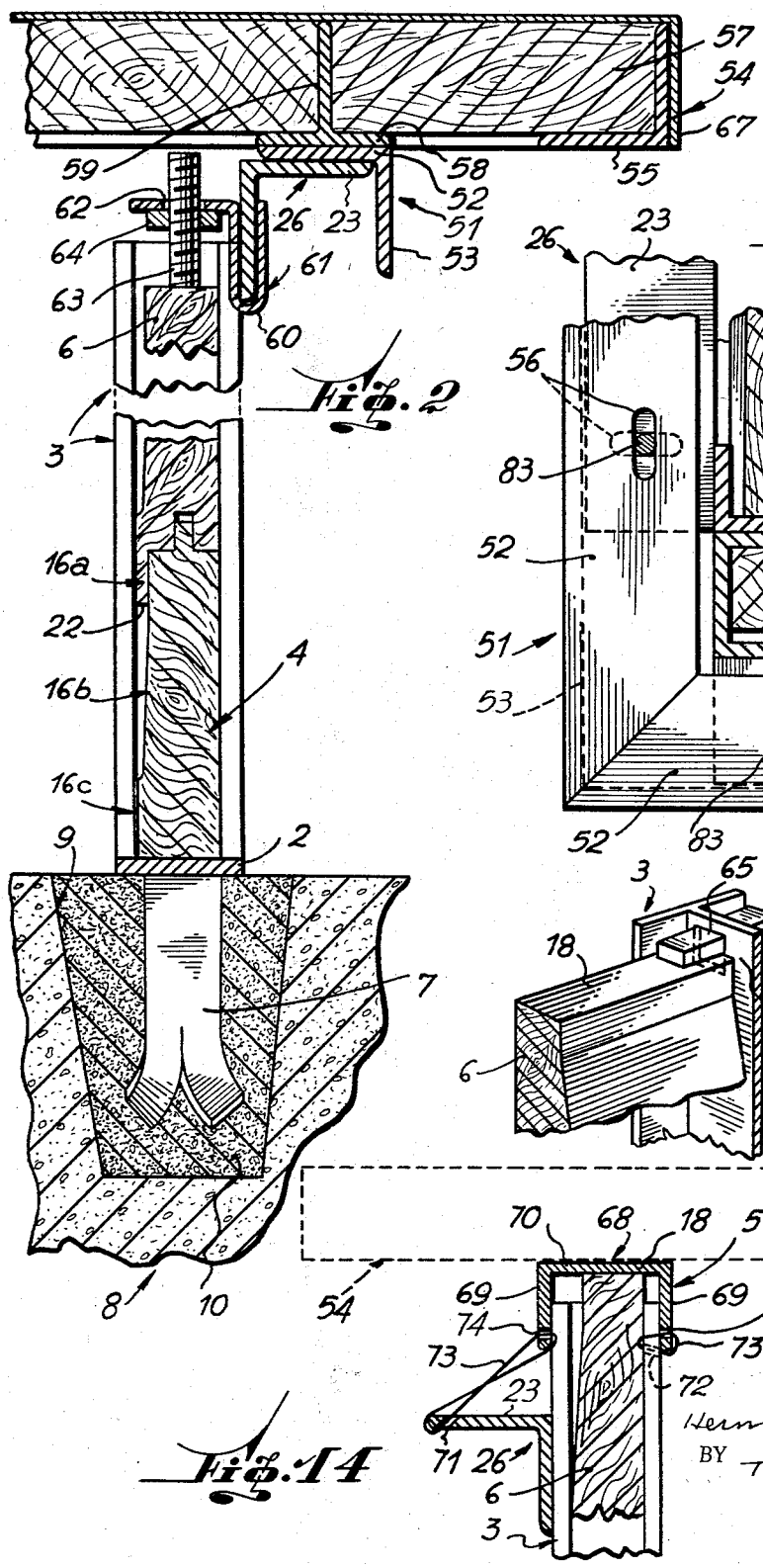



Fig. 2




Fig. 3




Fig. 13

Fig. 14

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CONNECTING STRUCTURE BETWEEN WALL AND ROOF

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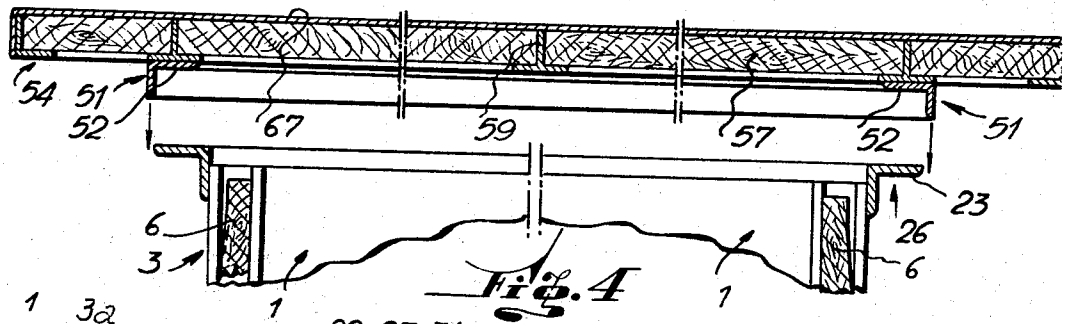



Fig. 4

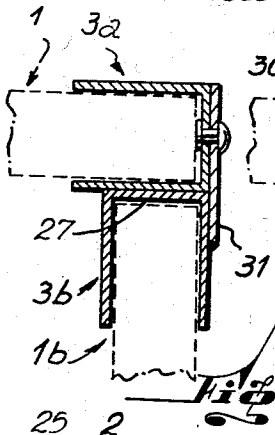



Fig. 8

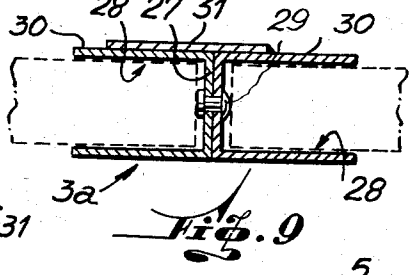



Fig. 9

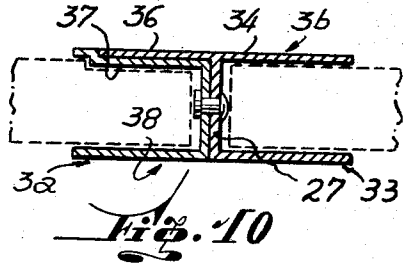



Fig. 10

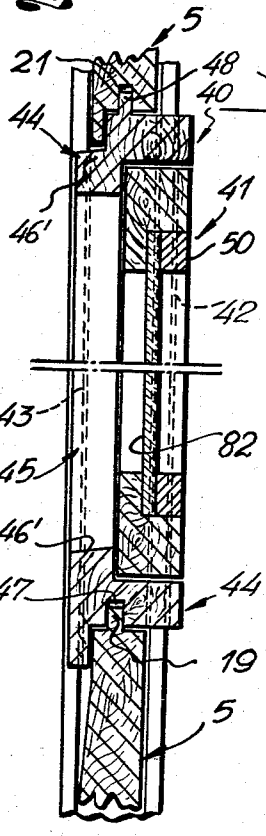



Fig. 6

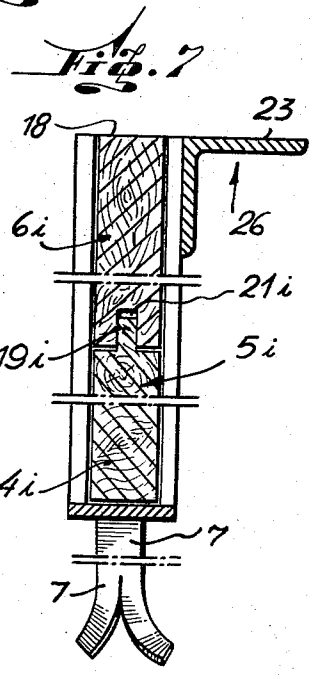



Fig. 7

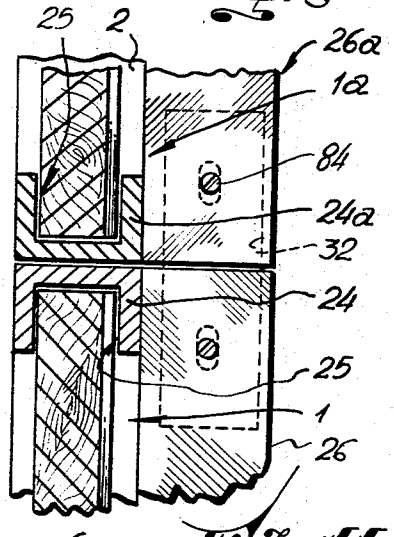



Fig. 11

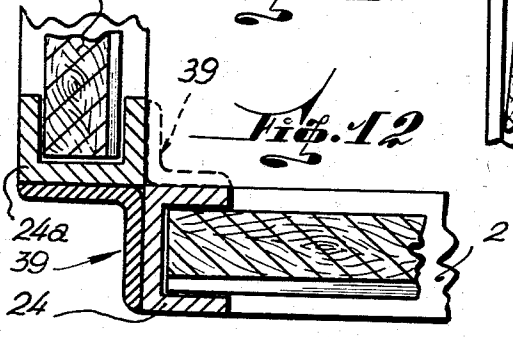



Fig. 12

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Patented Dec. 20, 1966



3,292,325

# CONNECTING STRUCTURE BETWEEN WALL AND ROOF

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Filed Feb. 19, 1962, Ser. No. 173,877
6 Claims. (Cl. 52—227)

The present invention relates to improvements in building systems, and more particularly it relates to prefabricated buildings and to prefabricated units employed therein.

One of the main objects of the present invention consists in providing building systems and structures wherein a reduced number of types of prefabricated units is used, such units being able to be preassembled in sections which may be readily transported to the site at which the building is to be erected. A further object of the invention resides in providing building systems and structures of the nature mentioned wherein the prefabricated units and sections preassembled therefrom may be readily handled in assembling the final structure so that no special tools are required in this work.

A further object of the invention consists in providing building systems and structures of the nature explained in which any of the prefabricated units may be readily removed from the final assembly. A further object consists in providing building systems and structures of the nature explained which may be readily dismantled into the original prefabricated units which may be re-used in order to assemble the same or a similar building at another site.

Another object of the invention consists in providing prefabricated units for use in the systems and structures mentioned which may be manufactured and assembled economically and with great speed.

An additional object of the invention consists in providing a building system and structure particularly suitable for the use of prefabricated units made of wood, pressed board or similar light material. The invention thus enable houses, bungalows, sheds and similar buildings to be erected with great economy and speed, and to be dismantled into component parts which may be re-used.

Further objects of the invention will become apparent from the following detailed description of preferred embodiments of the invention which have been illustrated by way of examples in the accompanying drawings in which:

FIG. 1 is a perspective partially exploded view of the central portion of a wall structure of a building embodying the present invention.

FIG. 2 is a section in elevation of the wall structure shown in FIG. 1, with the panels inserted, and it also shows in sectional elevation a portion of the roof structure supported by said wall.

FIG. 3 is a plan view of a roof structure embodying the present invention.

FIG. 4 is a schematical section in elevation of a roof section before final assembly of a building embodying the present invention.

FIG. 5 is a cross sectional view of a window structure embodying the present invention.

FIG. 6 is a sectional elevation of the window structure of FIG. 5.

FIG. 7 is a section in elevation of an inner wall of a building embodying the present invention.

FIGS. 8, 9 and 10 are cross sectional views of several embodiments of some of the prefabricated structural units according to the present invention.

FIG. 11 is a cross section of a portion of a straight wall comprising two adjacent sections embodying the present invention.



FIG. 12 is a similar illustration of a corner portion of such wall.

FIG. 13 is a perspective view partially in section of the upper portion of a column embodying the present invention, and

FIG. 14 is a section in elevation of a further embodiment of the top portion of a column.

Throughout the several figures of the drawings equal references have been employed in order to designate the same or corresponding parts.

Referring to FIG. 1, it will be seen that the same shows a wall structure generally indicated at **1**, comprising a supporting sill **2**, pillars or columns **3**, wall sheetings or panels **4**, **5**, **6**, and an upper beam **26** (which latter has been represented in broken lines for the sake of clearness).

The base sill **2** preferably is of steel and at suitable distances it is provided with shoes or anchoring members **7** welded or otherwise firmly secured thereto. As shown in FIG. 2, the entire building rests on a foundation **8** having holes **9** into which the anchoring members **7** are introduced whereafter the holes are filled with cement or the like **10** so as to secure the anchoring members **7** firmly to the foundation **8**.

Fixed to the base sill **2** by welding or any other suitable means are the steel pillars or columns **3** which are uniformly spaced one from another. The pillars or columns **3** are in cross section of double T, or H, shape and thus each of them defines between its two flanges **13** two channels **12** having a common bottom wall **14** from which the channels extend in opposite directions. The panels **4**, **5**, **6** are of such thickness that their lateral end portions fit into the channels **12** and thus the panels **4**, **5**, **6** can be inserted between any two adjacent columns **3** by sliding them downwardly into the desired position. The distance between the webs **14** of any two adjacent columns **3** is slightly greater than the length of each panel **4**, **5**, **6** which preferably may be about 70 or 80 cm. This size has been found to be suitable since the corresponding spacing of the columns will provide appropriate resistance to loads whilst the panels can be readily handled and they still will have sufficient strength, so as to resist rough treatment.

FIG. 1 shows three different types of panels, namely, the bottom panels **4**, intermediate panels **5** and top panels, **6**. All of these may be made of wood or any other suitable material such as metal sheets, plastic slabs or the like. However, wood or pressed board is generally preferred.

As shown in FIG. 1, the panels have a plane inside face **15** while the outside surface **16** comprises a plane upper portion **16*a***, parallel to face **15**, an outwardly and downwardly inclined central portion **16*b*** and a substantially plane lower portion **16*c***, parallel to face **15**. However, if desired, the panels may have parallel or generally downwardly diverging inside and outside faces. They may also be similar to panels ***4i***, ***5i***, ***6i*** shown in FIG. 7.

The bottom panels **4** have a horizontal bottom surface **17** adapted to rest on the top surface of the sill **2**. If desired, a spacer strip, layer or the like may be interposed between sill **2** and the panels **4**. The upper surface **18** of the panels **4** and of the intermediate panels **5** is provided with a preferably centrally arranged upwardly projecting rib **19**. The upper surface **18** of the upper panels **6** is plane.

The bottom surfaces **20** of panels **5** and **6** are provided with a groove **21** extending over the full length of the panel, such groove being of such width and depth that in the final assembly the ribs **19** of the respective lower next bottom panels **4** and intermediate panels **5** are received therein. From the lower face **20** of the panels **5** and **6** an extension **22** projects downwardly. Due to the outwardly flaring shape of the central portions **16*b*** of the panels **4**, **5**, **6** the bottom surface is of a greater width

than the top surface so that in the final assembly the extensions **22** overlie the plane faces of the upper portions **16***a* of the respective lower next panel. The outer surface of the wall structure **1** as a whole thus provides protection against rain, dust and the like, since the joints between any two rows of panels are located beneath the extensions **22**.

The wall structure **1** comprises of course only one horizontal row of panels **4** and **6**, respectively, between which a plurality of horizontal rows of panels **5** is inserted in order to obtain a wall of suitable height. It is generally preferred to employ panels having a relatively small height such as for instance 15 cm. With such relatively reduced dimensions of the panels the weight of each individual panel decreases and it is thus easier to assemble the structure and, apart from this, the small dimensions ensure resistance against bending or distortioning forces during storage, transportation and assembly. Also, the relatively small height of the panels **4, 5, 6** allows variations in the dimensions of openings in the wall for windows and doors, which will be described below.

The top portions of the pillars or columns are connected together by the horizontal beam **26** which, as shown in FIGS. 1 and 2, may be an angle iron having an outwardly projecting horizontal flange **23** which may be flush with the top face **18**, of the top panels **6** (FIG. 7), or it may be at a slightly higher level. The vertical flange of horizontal beam **26** may be secured to the columns **3** by welding or rivets or any other suitable means. The beam extends over the full length of the wall **1**.

The lateral ends of base sill **2** and horizontal beam **26** are connected together by end pillars **24** which preferably are U-shaped sections. In the final assembly the lateral end portions of the last vertical row of panels **4, 5, 6**, of a wall **1** are received within the channel **25** of the end pillars **24**, and the latter are secured to sill **2** and beam **26** by welding, riveting or any other suitable means.

While in FIG. 1 the intermediate pillars or columns **3** are shown as integral H-irons it is also possible to employ two U-irons **3***a* joined together at the bottom walls **27** of the respective channels **28**, by rivets **29**, as shown in FIG. 9, or by welding or any other suitable means.

It will be understood that each individual U-iron **3***a* is substantially similar to the end pillars **24**. In order to provide improved stiffness and reinforcement the outer flanges **30** of each pair of U-irons **3***a* may be linked together by a cover strip **31** welded or otherwise securely fixed thereto. This strip may extend over the full height of the pillar or one or more shorter strips may be used at suitable levels.

A similar arrangement may be used in connection with the end pillars **24** if it is desired to extend the length of a wall structure **1**, as shown in FIG. 11. In this case, the extension **1***a* is substantially alike the wall structure **1** and the adjacent end pillars **24**, **24***a* may be joined together by welding or the like.

Alternatively, as shown the pillars **24** and **24***a* may not be connected together and in this event they are maintained in their proper position by means of the sill **2** and beam member **26**. The space between the pillars **24**, **24***a* may be filled with any suitable filler or sealing material in order to properly prevent the passage of liquids, dust or the like.

The horizontal beams **26**, **26***a* are linked together by means of a plate **32** welded, screwed **84** of otherwise fixed onto the lower face of the horizontal flange of the beams **26**, **26***a*. At the height of the intermediate panels **5**, a cover plate similar to the short strips mentioned in the description of cover plate **31** of FIG. 9 may be used in order to join the outer flanges of the U-shaped end pillars **24** together.

The arrangement of pillars **24**, **24***a* may also be used in order to replace thereby any of the intermediate columns **3** in the wall structure **1**.



As shown in FIG. 8, U-shaped pillars **24** are also employed in order to connect a wall **1***b* at right angle to the wall structure **1**. In this case the bottom wall **27** of U-shaped column **3***b* is welded, rivetted or otherwise firmly secured to the lateral flange of U-shaped column **3***a* and the assembly is stiffened and strengthened by a cover plate **31** riveted, welded or otherwise secured to the bottom wall of the channel of U-shaped column **3***a* and the outer flange of U-shaped column **3***b*.

In FIG. 10 another embodiment of columns which may be employed in the place of columns **3** or alternatively in the place of columns **24**, is illustrated. In either event, use is made of a column **33** which is of general U-shape in cross section, the outer flange **34** extending beyond the base wall or web **27** of the channel to form a tongue **36** to which a flange **37** of the U-shaped column **38** is secured. The end portion of the flange **37** is bent outwardly around the end of the wing **36**. The bent portion of the flange **37** is welded or otherwise secured to the end portion of the wing **36**. The arrangement of FIG. 10 possesses sufficient strength and stiffness without the necessity of using an auxiliary element such as plates **31** or **32**.

Similar arrangements may be employed in order to connect to the wall structure **1** inner walls extending at right angles thereto, and these are represented, by way of example, in FIG. 7, which shows in elevation panels **4***i*, **5***i*, **6***i* which have parallel inner and outer faces while the upper faces of panels **4***i* and **5***i* and the lower faces of panels **5***i* and **6***i* may be provided with longitudinally extending ribs **19***i* and corresponding grooves **21***i*, respectively.

A further arrangement for joining, at right angles, to the wall structure **1** a wall structure **1***a*, is shown in FIG. 12. In this case, a column **39** in the form of an angle iron is used in order to connect the end pillars **24** and **24***a* one to another by welding the flanges of column **39** to the respective base walls or webs of the U-shaped columns **24**, **24***a*. Alternatively, as shown in broken lines, the column **39** may be welded at its flanges to the respective inner flanges of U-shaped pillars **24**, **24***a*. Instead of welds, rivets or any other securing means may be used.

Where it is desired to insert a window in the wall structure **1**, a number of panels **5** is replaced by the structure shown in FIGS. 5 and 6. It will be readily understood that between any two pillars **3** the rectangular frame **40** is inserted. This frame comprises two horizontal members **44** and two vertical or lateral members **45**. The vertical members **45** show an outer groove **42** and recess **43** adapted to receive the flanges of the H-iron column **3** adjacent thereto. The grooves and recesses continue over the lateral end faces of the horizontal members **44** as shown by dotted lines in FIG. 6. Towards the inside of the frame, the vertical members **45** are provided with projections **46**.

The horizontal members **44** are adapted to be assembled with the upper and under faces of the adjacent intermediary panels **5** or, as the case, may be, according to the desired height or level of the window, with the upper surface of panel **4** and the under surface of the panel **6**, respectively and for this purpose the lower face of the lower horizontal member has a groove **47** adapted to receive the rib **19** while the upper horizontal member carries on its upper face a rib **48** adapted to be received within the groove **21**. A projection **46'** corresponds to projection **46** of the vertical members **45**.

The frame **40** is thus adapted to receive and surround the window frames **41** fixed thereto by hinges or the like (not shown). The window glasses **82** are fixed to the window frames by means of the counter frames **50**.

In a similar way (not shown) a bottom panel **4** and a number of panels **5** or all the panels **5** between any two adjacent pillars **2** may be replaced by a frame for a door opening in order to provide a door in the wall structure **1**. It will be obvious that in a door opening the

lower horizontal member **44** of frame **40** may be adequately modified in order to serve as a door step.

The roof structure embodying the present invention is illustrated principally in FIGS. 2, 3 and 4. As already explained, the columns **3** including the end pillars **24** are connected together by means of the horizontal beam **26** having a horizontal flange **23**. This horizontal beam thus surrounds the entire building comprising at least four wall structures **1** defining, for instance, a rectangle or square. Secured to the flange **23** of the beam member **26** is a closure frame **51** which comprises L-shaped members the horizontal flange **52** of which is bolted, welded or otherwise secured to the flange **23** while the vertical flange **53** projects downwardly. If rivets or screws **83** (FIG. 3) are employed as securing means, both flanges may be provided with slots **56** inserting at right angles through which the securing means may pass.

The roof proper comprises a roof frame **54** formed from angle iron, L-sections or similar members having a lower horizontal inwardly extending flange **55**. At least two of these members or preferably all of them extend outwardly beyond the frame proper until they engage the closure or connecting frame **51** to which they are secured as by welding, bolting, riveting or any other suitable means. If desired, interconnecting bracings may be interposed between frames **51** and **54**. The lower flange of the roof frame **54** supports roof sheets, plates or the like, **57**, and if desired, inverted T-irons **59** may be arranged at suitable distances to span the space within frame **54**, the lower flanges **58** of the T-irons further supporting the sheetings **57**. The horizontal flanges **58** may also be secured, if desired, to the horizontal flange **52** of the closure frame **51** so that the entire roof structure is securely fixed to through the beams **26** to the supporting pillars **3** and **24**.

On top of the roof sheeting or plates **57** a suitable layer of protecting material may be arranged. This layer **67** may be formed from thin metal sheets, corrugated sheets, or simply by asphalt coating.

It will be evident that the closure or connecting frame **51** may be considered as part of the roof structure because it is secured to the roof frame **54**. When the several sections are assembled the entire roof structure including the connecting frame **51** secured thereto may be assembled at the plant and then transported as a pre-assembled unit to the site of the building where it may be placed on the wall structure and properly secured to the horizontal flange of beam **26** as already described.

To the vertical portion of beam **26** plates **60** are secured at such spaces that at least one plate is present for each section of the walls **1** comprised between any two columns **3** or between columns **3** and **24**. The plate **60** has a hook-like extension **61** which is bent over the vertical portion of beam **26** and welded or otherwise securely secured thereto. The plate **60** has an opening **62** therein through which a threaded rod or stem **63** passes. The opening **62** is vertically aligned with panels **6**. A nut **64** is arranged on rod **63** below the plate **60** so that, when the nut is turned round in the proper direction, while it engages the plate **60**, it causes the stem **63**, which in the opening **62** is held against rotary movement, to move downwardly and exert a compression force on the panels **4**, **5**, **6**. The necessary pressure on the panels to hold them together in proper engagement, is thus transmitted from the roof support and the roof.

If it is desired to exert pressure on the panels **4**, **5**, **6**, from the pillars **3**, **24** rather than from the roof support or roof, an arrangement such as that illustrated in FIG. 13 may be employed. In this case, the bottom wall **14** of channels **12** of pillars **3** (or the base of the U-shaped pillars **24**) have an opening **65** which extends downwardly from a position above the top face of panels **6** to a position below said top surface. A wedge **66** may then be introduced into the upper portion of the opening **65** to place the panels **4**, **5**, **6** under pressure. It will be readily understood that in FIG. 13 only one of the flanges of the H-irons has been represented for the sake of clearness.

A further alternative embodiment of means actually preferred for exerting the necessary pressure on the panels **4**, **5**, **6** has been illustrated in FIG. 14. According to this embodiment of the invention the roof structure including the connecting frame **51** are supported not by the beam **26** but by the panels **6** so that the weight of the roof structure serves in order to urge the panels towards the base sill **2**. The closure frame **51** in this case is shown as consisting of members in the form of an inverted U, **68**, the vertical flanges **69** of which embrace the lateral flanges of the H-shaped column **3** while the central portion **70** of the U-shaped frame member **68** rests on the top surface **18** of the panel **6**. The horizontal flange **23** of the beam **26** and the inner lateral flange of the H-shaped column **3** are provided with openings **71**, **72**, respectively, through which wires **73** pass. These wires also pass through the openings **74** provided in each of the flanges **69** of the frame member **68** so as to form a loop, which may be tightened in order to secure the roof structure including the closure frame **51** to the beam **26** and the pillars **3**, respectively.

In erecting a building according to the system of the present invention all the individual units may be assembled at the site of the building but preferably preassemblies such as for instance sections **1**, **1***a* or roof sections are prepared at a plant and shipped to the site where they can be readily assembled.

It will be appreciated that a number of modifications or variations may be introduced in the structures and units shown without departing from the scope of the invention. Thus, for instance, instead of any of the rib and slot arrangements extending over the full length of the respective members as described, equivalent tooth and hole arrangements may be employed. Also, instead of flat roof sheetings inclined roofs, gable roofs or the like may be mounted on the roof frame. All such variations are desired to be included within the scope of the annexed claims.

What I claim is:

**1.** A building or the like comprising a plurality of wall structures each comprising a base sill, uniformly spaced vertical pillars secured to said base sill, each pillar comprising at least one vertically extending groove, a plurality of horizontally extending wall panels arranged between two adjacent pillars, each panel having lateral end portions received in said grooves, and a horizontal beam above the uppermost row of panels for connecting the top portions of said pillars together, said beam having an outwardly projecting horizontal flange, the lateral end portion of each wall structure being joined to the adjacent end portion of a similar adjacent wall structure; a roof structure comprising a frame surrounding the same and sheetings secured to said frame; a connecting structure securing said roof structure to the horizontal beams comprised in each of said wall structures, said connecting structure including a closure frame comprising inverted L-shaped members, each L-shaped member having a horizontal leg and a downwardly depending vertical leg, said horizontal leg being fixed to said roof structure, said vertical legs surrounding the horizontal flanges of said horizontal beams; and means for exerting pressure on said panels to urge the same towards said base sill.

**2.** A building or the like comprising a plurality of wall structures each comprising a horizontal base sill, uniformly spaced vertical pillars projecting from and secured to said base sill, each pillar comprising at least one lateral groove, a number of wall panels arranged one above another between any two adjacent pillars, each panel having lateral end portions received in said lateral grooves, and a beam connecting the outer top portions of said pillars together said beam having an outwardly projecting horizontal flange, the end portion of each wall structure being

joined to the adjacent end portion of an adjacent wall structure; a roof structure comprising a frame surrounding the same and sheetings secured to said frame; a connecting closure frame comprising inverted L-shaped members, each L-shaped member having a horizontal leg and a downwardly depending vertical leg, said horizontal legs being fixed to said roof structure and said vertical legs surrounding the horizontal flanges of said horizontal beams and means for exerting on said panels pressure to urge the same towards said base sill.

3. A building or the like comprising a plurality of wall structures each comprising a base sill, uniformly spaced vertical pillars of H-shaped cross-section secured to said base sill, end pillars of U-shaped cross section secured to the lateral ends of said sill, a number of horizontally extending panels arranged between any two adjacent pillars and between either end pillar and the respective adjacent pillar, each panel having lateral end portions received in the grooves defined respectively by said H and U sections, a horizontal beam connecting the top portions of said pillars together, the beam having a horizontally and outwardly extending flange, means joining each end pillar to an end pillar of an adjacent similar wall structure; a roof structure comprising a frame surrounding the same and sheetings secured to said frame a connecting structure securing said roof structure to said horizontal beams, said connecting structure including a connecting closure frame comprising inverted L-shaped members, each L-shaped member having a horizontal leg and a downwardly depending vertical leg, said horizontal legs being fixed to said roof structure and said vertical legs surrounding the horizontal flanges of said horizontal



beams; and means for exerting on said panels pressure to urge the same towards said base sill.

4. A building or the like according to claim 1, wherein said horizontal legs and said horizontal flanges are secured to each other.

5. A building or the like according to claim 1, wherein said means for exerting pressure exerts pressure from said horizontal beams to said panels.

6. A building or the like according to claim 1, wherein said means for exerting pressure exerts pressure on said panels from said pillars.


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