May 26, 1964 L. MARKLE 3,134,464

COMBINED JOIST-PANEL STRUCTURE

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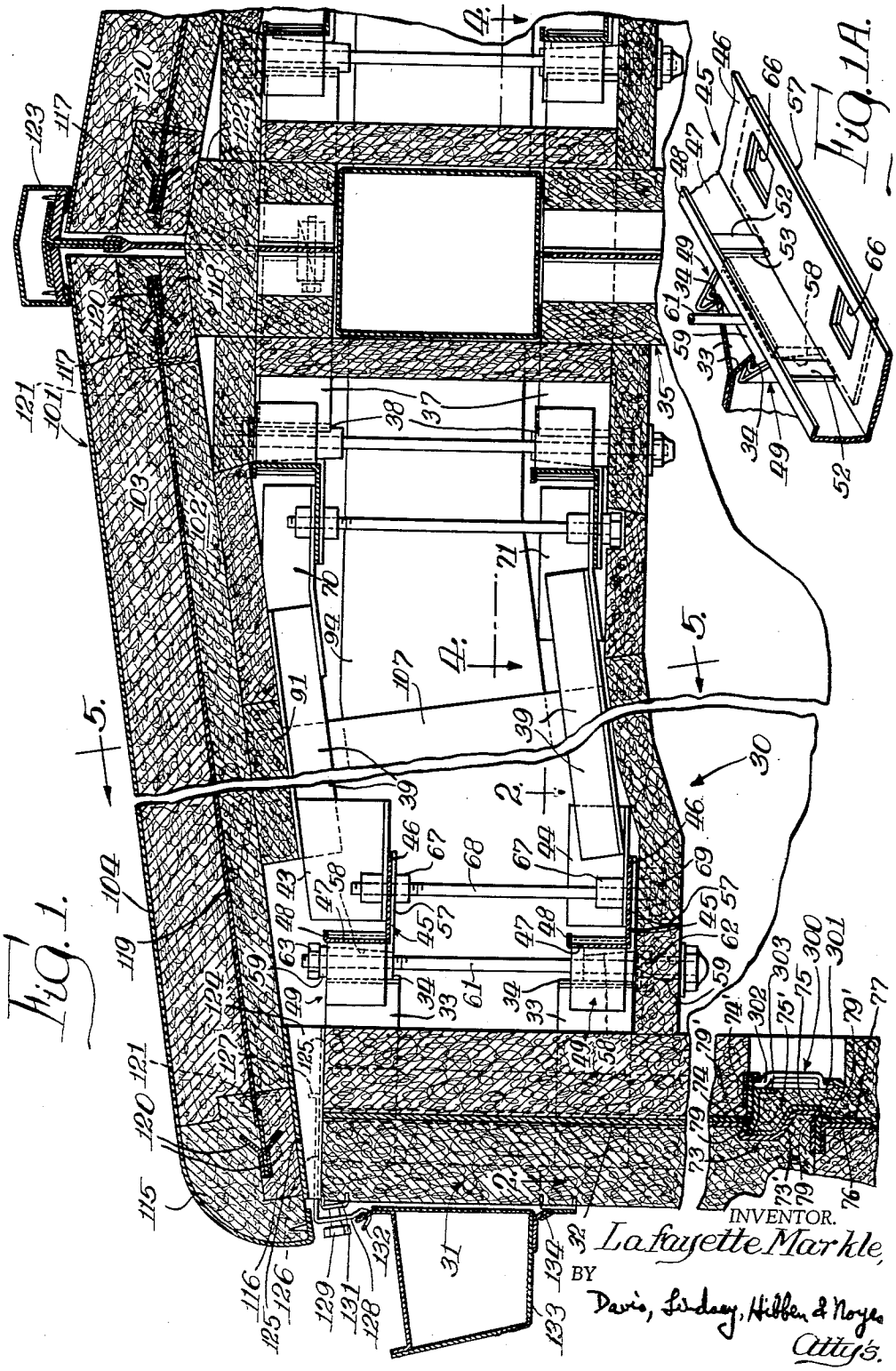


Fig. 1.

Fig. 1A.

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COMBINED JOIST-PANEL STRUCTURE

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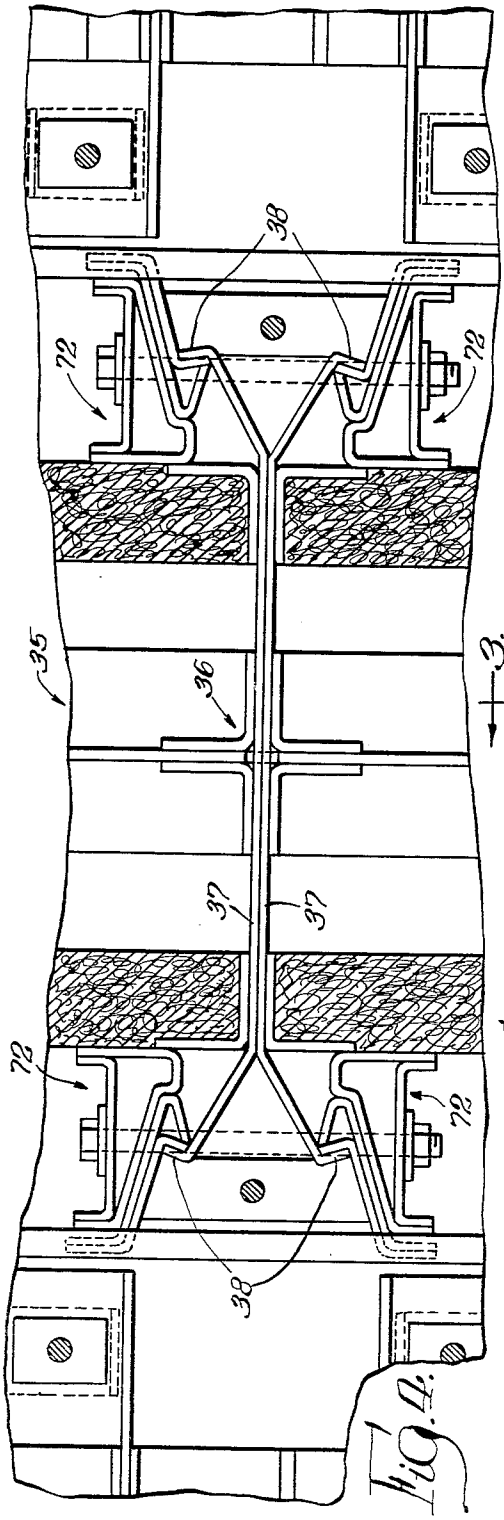


Fig. 4.

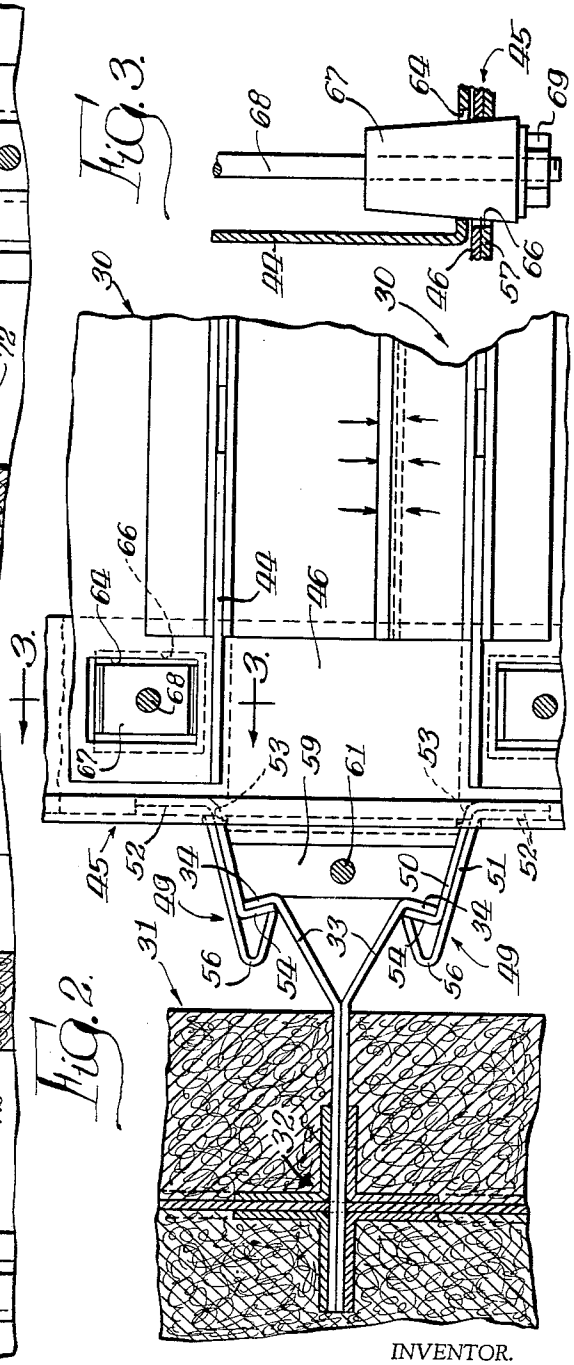


Fig. 2.

Fig. 3.

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COMBINED JOIST-PANEL STRUCTURE

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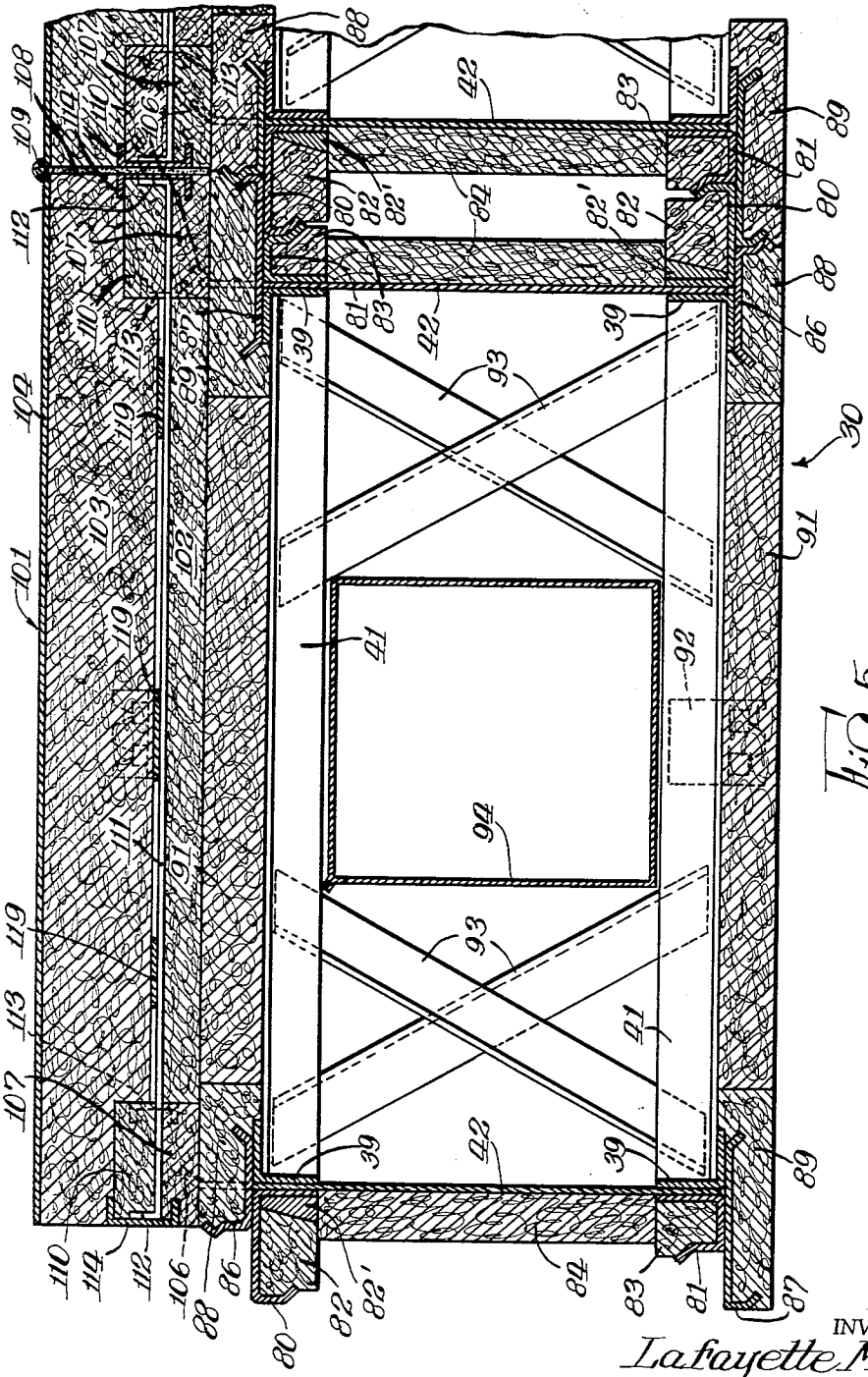


Fig. 5.

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COMBINED JOIST-PANEL STRUCTURE

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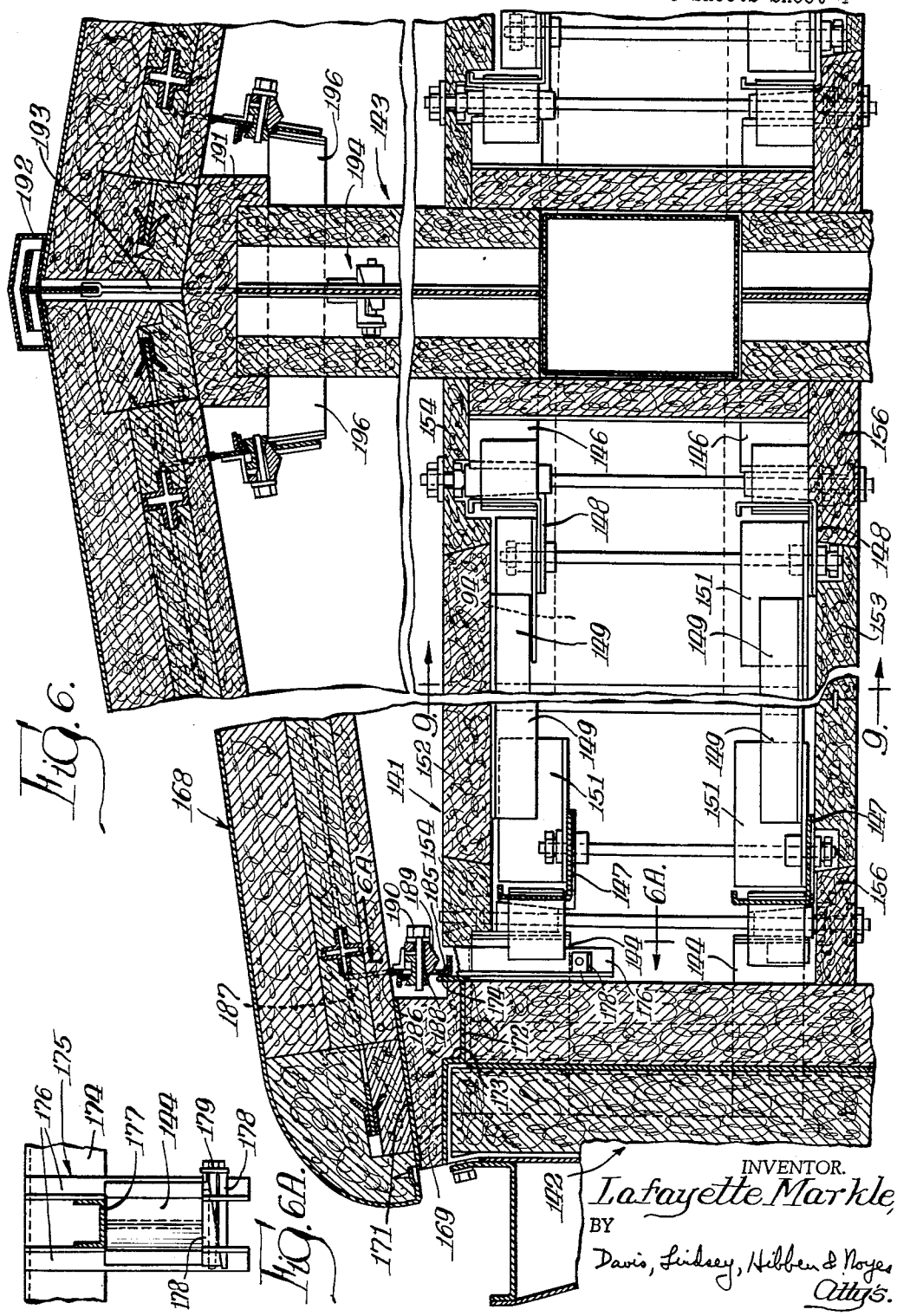


FIG. 6.

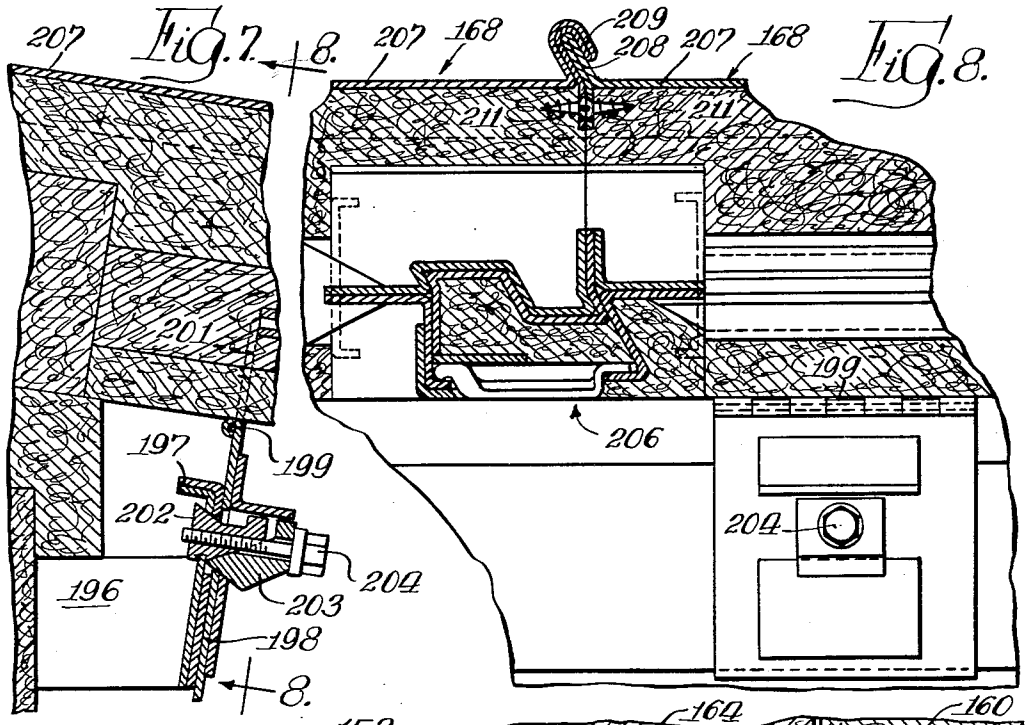
FIG. 6A.

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COMBINED JOIST-PANEL STRUCTURE

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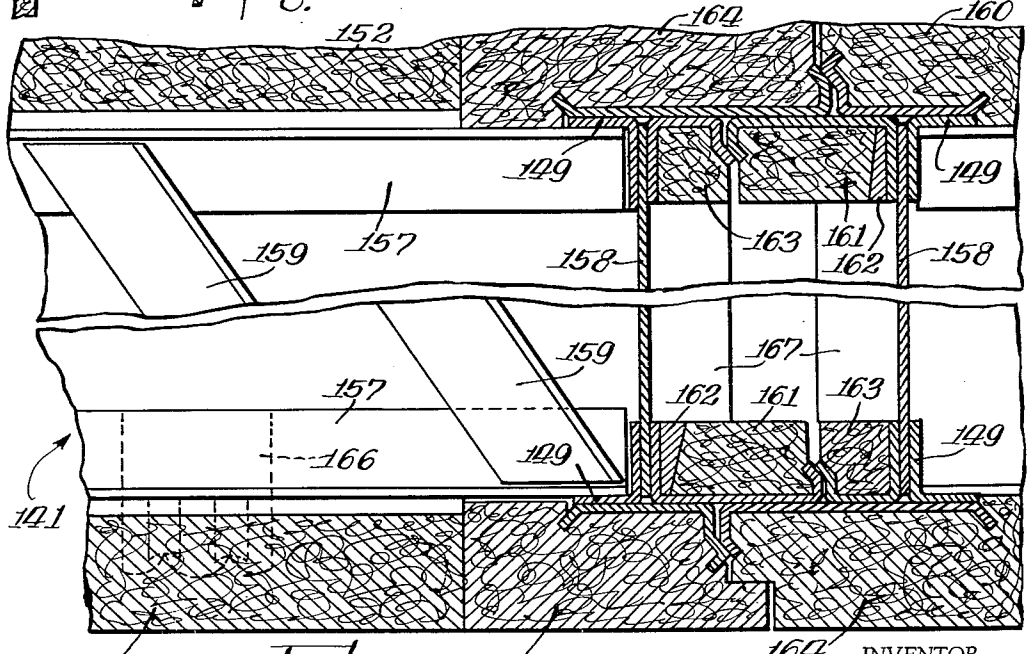


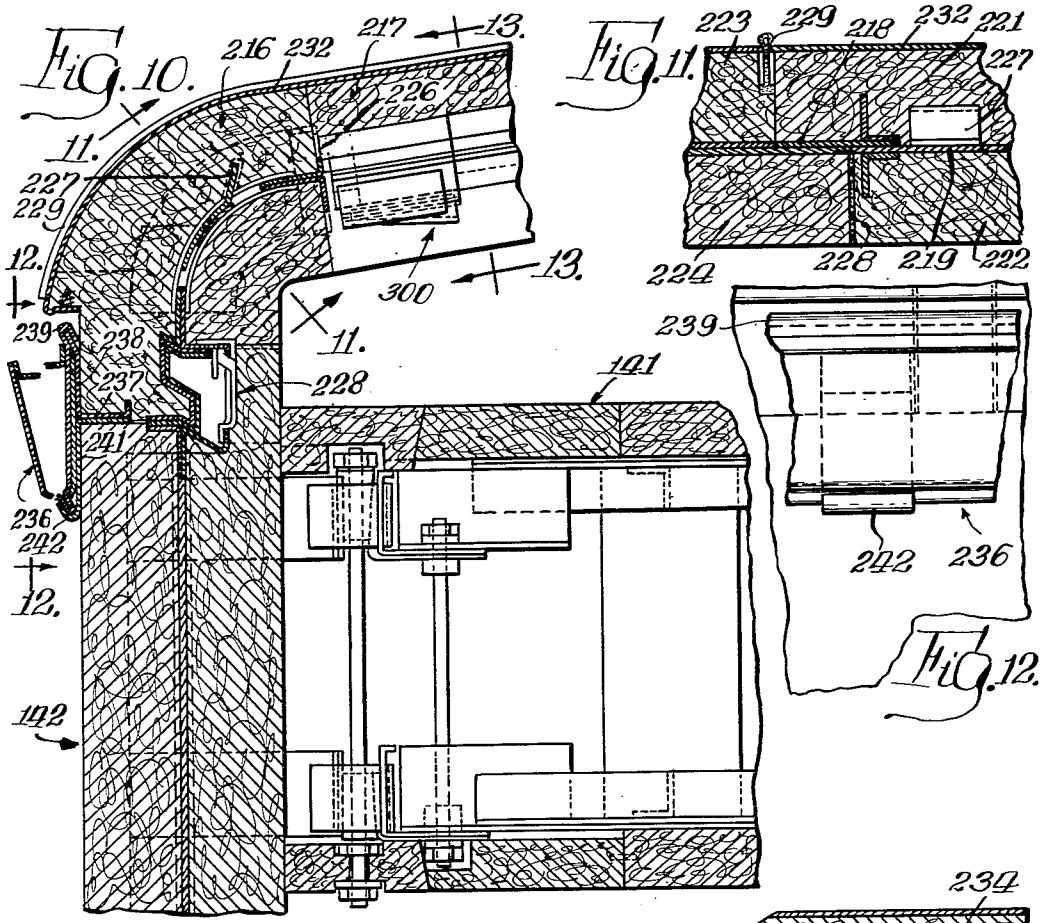
Fig. 9.

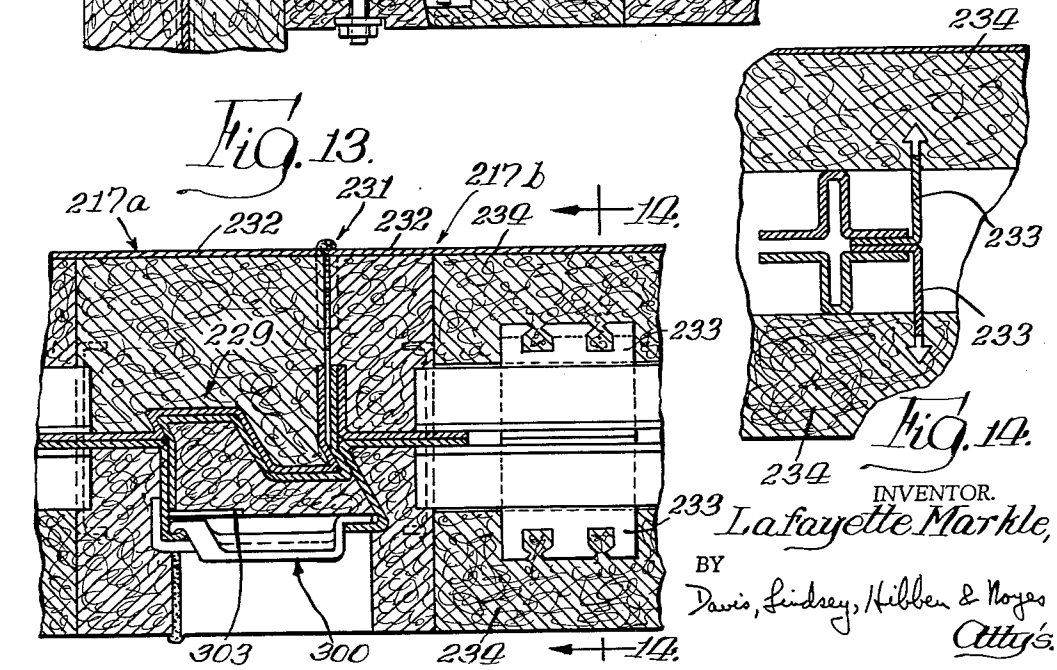
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COMBINED JOIST-PANEL STRUCTURE

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May 26, 1964 L. MARKLE 3,134,464

COMBINED JOIST-PANEL STRUCTURE

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Fig. 15.

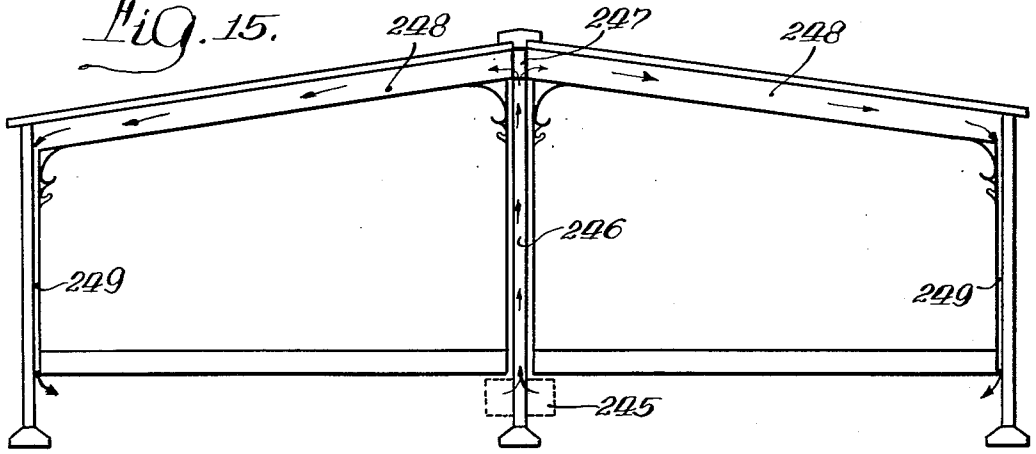
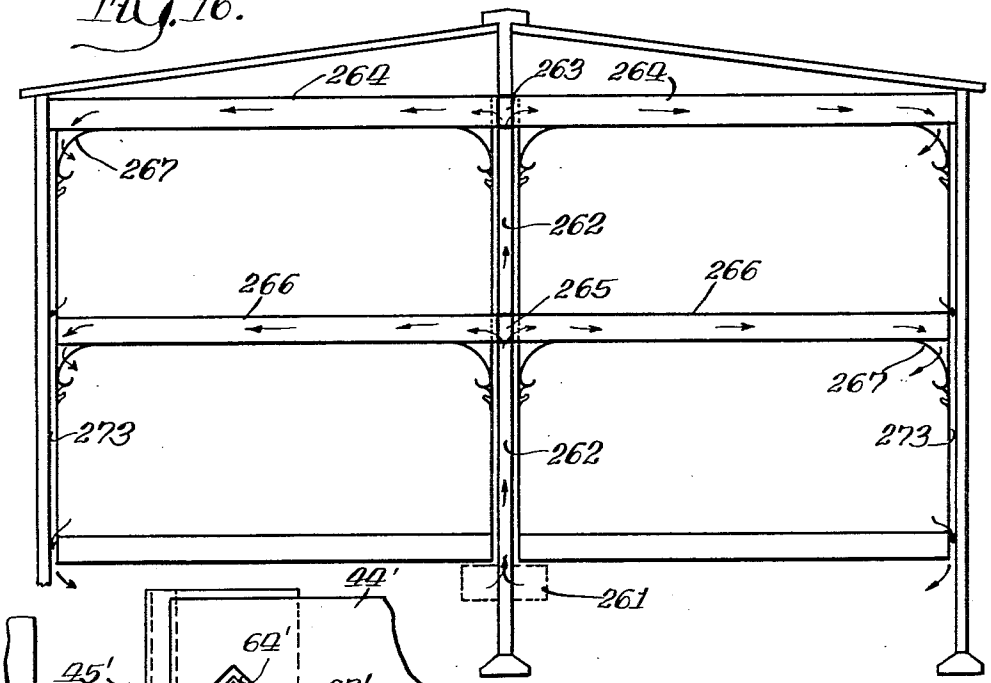


Fig. 16.



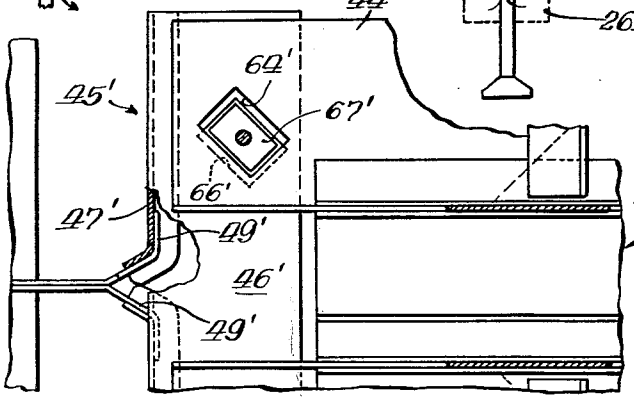


Fig. 2A.

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COMBINED JOIST-PANEL STRUCTURE

Filed Jan. 8, 1959 9 Sheets-Sheet 8

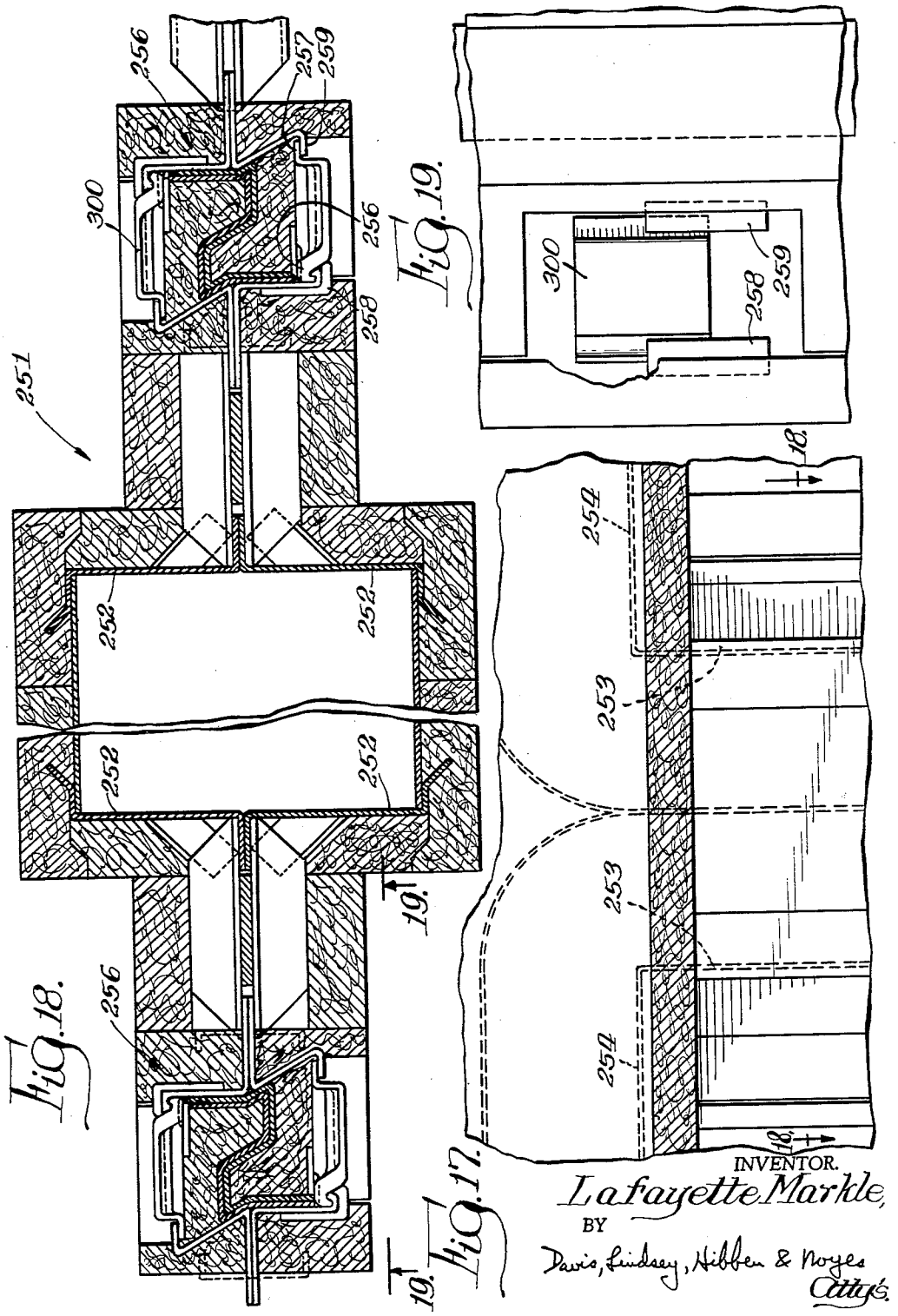


Fig. 18.

Fig. 19.

Fig. 17.

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COMBINED JOIST-PANEL STRUCTURE

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Fig. 20.

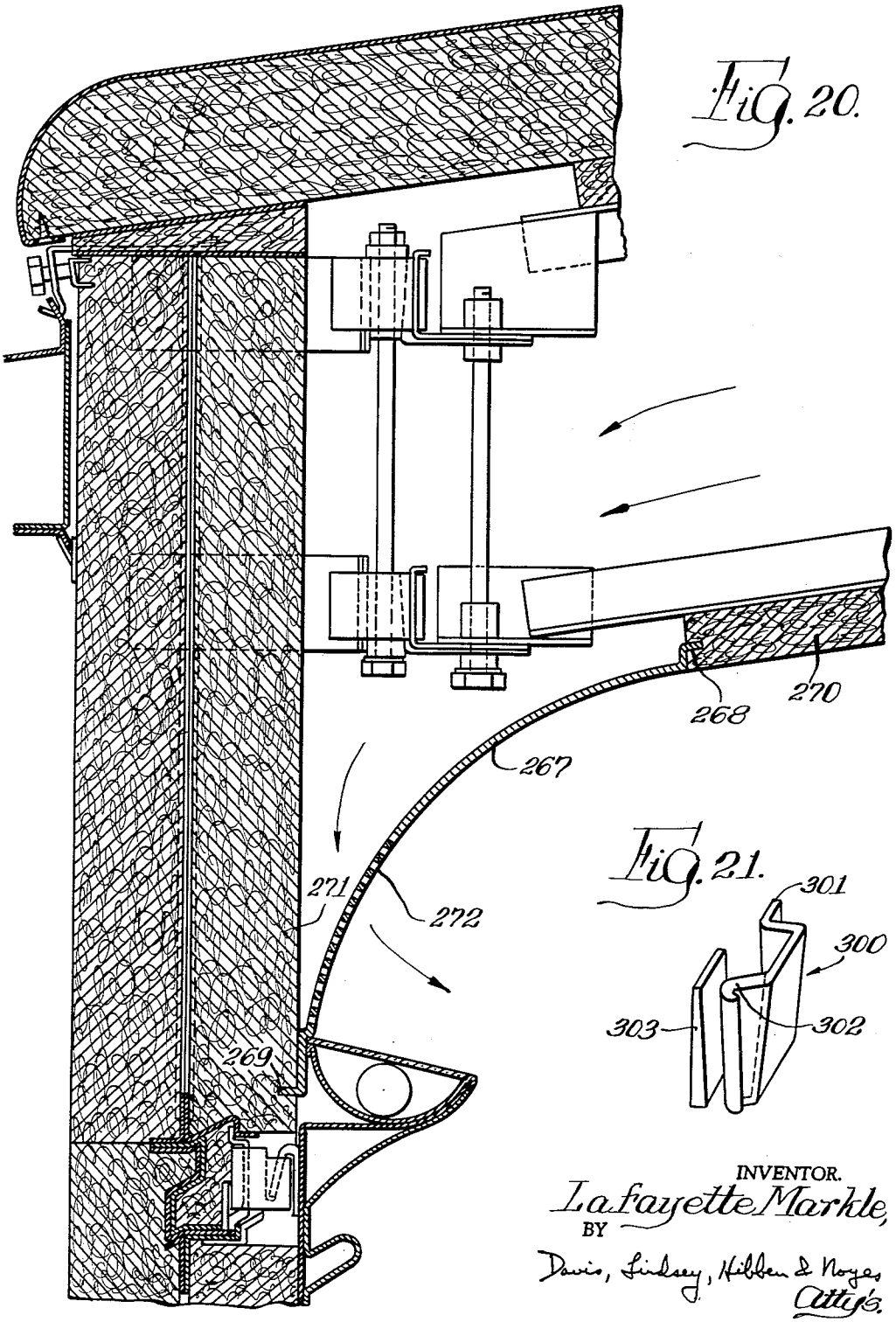


Fig. 21.

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United States Patent Office 3,134,464 Patented May 26, 1964

3,134,464

COMBINED JOIST-PANEL STRUCTURE

Lafayette Markle, % Markle & Co., Barrington, Ill.

Filed Jan. 8, 1959, Ser. No. 785,748
20 Claims. (Cl. 189—1)

This invention relates to improvements in a prefabricated building system and more particularly to a novel combined joist-panel structure for use in such a system.

In my copending application Serial No. 406,413, filed January 27, 1954, now U.S. Patent No. 2,950,786, issued August 30, 1960, I have described and claimed a comprehensive building system wherein the various component parts of the building structure are adapted to be fabricated in the factory or shop by modern high-speed production techniques and are capable of rapid assembly and erection in the field with minimum labor and expense. At the same time, the previously described system affords wide latitude of architectural treatment and choice of materials of construction.

One of the more important features of my previously described building system resides in the concept of a basic preformed core panel unit comprising a rigid peripheral frame, cover strips enclosing the frame and forming beds at opposite sides of the panel, and panel members press-fitted into these beds so as to provide a prestressed condition with the frame in tension and the panel members in compression. The metal frame constituting the panel perimeter has an interlocking edge configuration so that adjacent panels can be securely joined by a wedge locking arrangement to form a wall, roof, ceiling, or floor structure, as the case may be. The rigid framework of a selected panel unit may also be provided with one or more hanger elements projecting transversely from the plane of the panel unit for interconnection with suitable beams or joists as an integral part of the building construction.

Even in a building system of the aforementioned character wherein the basic fabrication of the component parts of the building is carried out in the factory or shop and wherein the necessary labor involved in field erection and assembly is greatly minimized as compared with conventional building construction methods, it is still desirable to achieve further economy, if possible, in connection with the field work. One of the major elements in the cost of field work is the installation of floors, roofs, and ceilings where much time and labor is involved and which is frequently restricted by unfavorable weather conditions and the like. In order to introduce additional economies in my previously described building system, I have now devised a further improvement whereby joist members are combined with lower ceiling panels and upper roof or floor panels in an integral unitary structure which can be fabricated and preassembled in the factory. As will hereinafter appear, many advantages are gained by the use of such combined joist-panel units.

Accordingly, a primary object of the present invention is to provide still further improvements in the basic building system of my prior invention so as to reduce to an even greater extent the labor and cost involved in the field assembly work.

Another object of the invention is to provide a novel combined joist-panel unit which is particularly adapted for use in a building system of the aforementioned character.

A further object of the invention is to provide a novel combined joist-panel unit of the aforementioned character which is adapted to furnish either floor-ceiling portions or roof-ceiling portions of a building structure.

An additional object of the invention is to provide a novel combined joist-panel unit of the above-described

character which also forms a part of the heating, cooling, or air-conditioning system of the building.

Other objects and advantages of the invention will become apparent from the subsequent detailed description taken in conjunction with the accompanying drawings, wherein:

FIG. 1 is a broken vertical cross-sectional view through a building structure and showing a combined joist-roof-ceiling unit comprising one specific embodiment of the invention;

FIG. 1A is an enlarged perspective view of a structural detail shown in FIG. 1;

FIG. 2 is a fragmentary horizontal sectional view on an enlarged scale as taken substantially along the line 2—2 of FIG. 1;

FIG. 2A is a fragmentary sectional view similar to FIG. 2 but showing a modification of the structure;

FIG. 3 is a fragmentary vertical sectional view showing a structural detail as taken substantially along the line 3—3 of FIG. 2;

FIG. 4 is an enlarged fragmentary horizontal sectional view taken substantially along the line 4—4 of FIG. 1 and illustrating the manner in which the combined joist-roof-ceiling units are connected at the mid-wall of the building;

FIG. 5 is a fragmentary transverse sectional view as seen substantially along the line 5—5 of FIG. 1;

FIG. 6 is a broken vertical sectional view similar to FIG. 1 but illustrating a further embodiment of the invention comprising a combined joist-floor-ceiling unit;

FIG. 6A is a fragmentary sectional view taken along the line 6A—6A of FIG. 6;

FIG. 7 is an enlarged view of a structural detail shown in FIG. 6;

FIG. 8 is an elevational view as seen substantially along the line 8—8 of FIG. 7;

FIG. 9 is a fragmentary transverse sectional view as seen substantially along the line 9—9 of FIG. 6;

FIG. 10 is a fragmentary view generally similar to FIG. 6 but showing a modification of the roof construction;

FIG. 11 is a fragmentary sectional view taken substantially along the line 11—11 of FIG. 10;

FIG. 12 is a fragmentary elevational view of a structural detail as seen substantially along the line 12—12 of FIG. 10;

FIG. 13 is a transverse cross-sectional view as taken along the line 13—13 of FIG. 10;

FIG. 14 is a fragmentary sectional view showing a further structural detail as taken along the line 14—14 of FIG. 13;

FIG. 15 is a schematic view of a one-story building construction showing the heating or cooling arrangement;

FIG. 16 is a view similar to FIG. 15 for a two-story building construction;

FIG. 17 is a fragmentary elevational view showing a modified mid-wall panel construction for accommodating a pair of vertical ducts;

FIG. 18 is an enlarged fragmentary sectional view as seen substantially along the line 18—18 of FIG. 17;

FIG. 19 is a fragmentary elevational view showing a structural detail and taken substantially on the line 19—19 of FIG. 18;

FIG. 20 is an enlarged vertical sectional view showing a structural detail of an internal cove portion of the building structure; and

FIG. 21 is a perspective view of a wedge means comprising a structural detail of the invention.

Referring first to FIGS. 1 to 5 of the drawings, the invention is first illustrated in connection with a combination joist-roof-ceiling unit 30 for a building having a

pitched roof. The outer wall of the building includes an eaves panel, designated generally at **31**, which may have the same basic core panel construction described in my copending application Serial No. 406,413. The panel **31** includes a central vertical stud structure **32** (FIG. 2) from which a yoke type or generally Y-shaped hanger projects rigidly, the hanger comprising a pair of diverging plates **33** having outwardly flanged end portions **34**. The mid-wall portion of the building is formed from similar core panel units, the uppermost panel unit being indicated generally at **35** and including a similar vertical stud structure **36** (FIG. 4) from which a yoke type hanger projects rigidly on opposite sides of the mid-wall panel unit **35**. The hanger construction again includes a pair of diverging plates **37** having outwardly flanged end portions **38**. As described hereinafter in greater detail, the elongated joist-roof-ceiling unit **30** extends transversely between the outer wall panel unit **31** and the mid-wall panel unit **35** and is rigidly interconnected at its opposite ends with the hanger yokes **33—34** and **37—38** so as to form an integral part of the skeletal framework of the building while at the same time providing cooperating sections of the roof and ceiling of the building. In FIG. 1 it will be understood that the central portion of this elongated combination unit is broken away for the sake of convenience.

As best seen in FIGS. 1 and 5, the framework of the combination joist-roof-ceiling unit **30** is made up of a plurality of elongated angle members **39** disposed at the respective corner portions of the unit and interconnected transversely at suitable intervals by a plurality of horizontal angle members **41** and vertical web members **42** so that the entire unit **30** has an elongated, generally rectangular, box-like configuration. The opposite ends of the elongated angle members **39** (which constitute the chords of the joist) have rigidly affixed thereto, as by welding, suitable ledge plates which are adapted to rest on and be supported from cooperating ledge members which are in turn secured to the yoke hangers **33—34** and **37—38** attached to the outer wall and mid-wall of the building, respectively. Thus, the outer end of the combination unit **30** is provided with upper and lower angular ledge plates **43** and **44**, respectively (FIG. 1), which are rigidly secured to and form extensions of the upper and lower joist chords **39**. The ledge members for receiving and supporting the ledge plates **43** and **44** are in the form of transversely extending upper and lower angle members **45** (FIG. 1A) each having a horizontal ledge or shelf portion **46**, an upright or vertical leg portion **47**, and an inturned top flange portion **48**. The ledge plates **43** and **44** seat against the shelf portions **46** and are wedge locked in place as hereinafter described.

The ledge members **45** may be mounted on the outer wall hangers **33—34** by any suitable means such as by welding. However, in FIGS. 1 and 1A I have shown a detachable mounting which utilizes a wedge locking arrangement of the same general type described in my aforementioned U.S. Patent No. 2,950,786. The vertical leg portion **47** of each ledge member **45** has a pair of spaced angular hooks **49** (FIG. 2) projecting outwardly therefrom for coaction with the flanged hanger ends **34**. Each of the hooks **49** comprises a pair of juxtaposed strips or plates **50**, **51** with a bent inner end portion **52** welded or otherwise rigidly affixed to the inner face of the upright leg **47**, the latter being provided with a pair of spaced apertures **53** through which the hooks **49** extend. The outer end of the strip **50** has an inwardly turned flange **54** adapted to interfit with an oppositely extending hanger flange **34**, and the outer end of the reinforcing strip **51** is bent sharply, as at **56**, and coacts with the hook end **54** for strengthening the latter.

As best seen in FIG. 1A, the central portion of each ledge member **45** has secured thereto an external angle member **57**, the upright leg portion of which provides a tapered or inclined wedging surface **58** in between the hooks **49**. A complementarily tapered wedge block **59** is interposed between the flanged hanger ends **34** and the tapered surface **58** for retaining the parts in rigid locked engagement. As will be clear from FIG. 1, the wedge blocks **59** at the upper and lower hangers **33—34** are drawn toward each other in locking relation by means of an elongated bolt **61** having a lower shoulder portion or abutment **62** adapted to engage the lowermost wedge block **59** and a cooperating nut or retainer **63** adapted to engage the uppermost wedge block **59**. By tightening the nut **63** relative to the bolt **61**, the two wedge blocks **59** are drawn toward each other thereby rigidly mounting the hooks **49** and their attached ledge members **45** on the hangers **33—34**.

A wedge locking arrangement is also utilized for securing the ledge plates **43** and **44** to their corresponding ledge members **45**. Thus, the horizontal leg portion of each of the angular ledge plates **43** and **44** and the underlying shelf portions **46—57** of the ledge members **45** are provided with superimposed openings, designated at **64** and **66**, respectively (FIGS. 2 and 3). A tapered wedge member or plug **67** extends through the superimposed openings **64** and **66** at both the upper and lower portions of the combination unit **30** and the wedges are drawn together in locking relation by means of an elongated bolt **68**. In this instance the bolt **68** has a head portion **69** (FIG. 1) coacting with the lowermost wedge **67** and the bolt extends loosely through the latter but is threaded into the uppermost wedge member **67** so that by tightening the bolt **68** the wedges **67** are drawn toward each other. In the illustrated embodiment, the openings **64** and **66** are rectangular in shape and the wedge members **67** have a corresponding rectangular cross-sectional shape with two straight sides (FIG. 1) and two tapered sides (FIG. 3). However, it should be understood that these configurations may be varied.

The wedge locking means **67—68** not only connects the ends of the combination unit **30** to the ledge members **45** but also accomplishes a lateral or transverse shifting movement of each combination unit so that adjacent units are pressed together sidewise and locked in firm engagement with each other. For accomplishing this result, it is important that the superimposed openings **64** and **66** be slightly out-of-register in a lateral direction, as best seen in FIGS. 2 and 3, so that as the wedge members **67** are urged inwardly through the openings, there is a predetermined sidewise camming action which impels the entire combination unit in a lateral or sidewise direction relative to the ledge members **45**. Preferably, each ledge member **45** supported from a hanger yoke **33—34** has a double set of apertures **66** (FIGS. 1A and 2) with dual wedge means **67—68** for urging adjacent combination units **30** laterally toward each other in interlocking relation as indicated by the arrows in FIG. 2. In the final wedge-locked position, as shown on an enlarged scale in FIG. 3, the apertures **64** and **66** are still slightly out-of-register with the result that each wedge member **67** exerts a permanent camming action so as to retain adjacent combination units in sidewise engagement while at the same time firmly securing the ends of each combination unit to the corresponding ledge members.

In FIG. 2A a modified wedge lock arrangement is illustrated which applies both lateral and endwise pressure on the units **30**. In this instance the ledge member **45'** is inverted relative to the position of the ledge member **45** in FIG. 1 so that the ledge or shelf portion **46'** is uppermost. The vertical leg portion **47'** is welded to the diverging end portions **49'** of a hanger instead of the wedge lock mounting previously described. The ledge plate, designated at **44'**, and the underlying shelf portion **46'** are provided with superimposed rectangular openings **64'** and **66'**, respectively, but in this case the openings are angularly oriented relative to the longitudinal axis of the unit **30**, as clearly seen in FIG. 2A. An angularly oriented wedge member **67'**, similar to the wedge **67**,

coacts with the openings 64'—66' to provide both a lateral camming action and a longitudinal camming action on the unit 30 so as to urge the latter sidewise toward the adjacent combination unit and also to place the unit 30 in longitudinal tension while securing it endwise on the shelf portion 46'.

To recapitulate, two separate wedge locking systems are employed at the outer end of the combination joist-panel unit 30 in the embodiment of FIGS. 1 and 2. The wedge lock means 59—61 serves primarily to connect the combination unit 30 to the outer wall 31 so as to hold the combination unit against endwise movement but also serves to mount the upper and lower ledge members 45 rigidly on the corresponding hanger brackets 33—34. The wedge lock means 67—68 serves primarily to lock adjacent combination units together laterally but also provides a rigid interconnection between the ledge plates 43, 44 and the corresponding ledge members 45. In the modification of FIG. 2A the ledge member 45' is welded to its hanger but the wedge lock means 67' connects the end of the unit 30 to the ledge member 45' while at the same time exerting sidewise and lengthwise pressure on the unit 30.

Although the description thus far has been confined to the details of the connections between the combination unit 30 and the outer wall 31, it will readily be seen from FIGS. 1 and 4 that a similar dual wedge locking scheme is employed for connecting a pair of ledge plates 70, 71 at the opposite or inner end of the combination unit 30 to the hanger brackets 37—38 on the mid-wall 35. In order to simplify the description, the reference numerals have been omitted from the connecting structure at the mid-wall end of the combination unit, but it will be apparent that a substantially identical arrangement of ledge members, attached reinforced hooks, and interconnected wedges is employed. The wedge locking means at each end of the combination unit 30 holds the walls 31 and 35 by a cantilever effect in perpendicular relation to the combination unit and in parallel relation to each other. In this connection, it is important to note that each end of the combination unit 30 is connected to the wall at spaced upper and lower points which contributes materially to the cantilever action and thereby insures the desired perpendicularity. As seen in FIG. 4, a pair of complementary vertical free-studs 72 may be fitted into the juncture between the mid-wall 35 and the adjacent end of the combination unit 30 in order to strengthen or stiffen the mid-wall as more fully described in my aforementioned U.S. Patent No. 2,950,786.

At the lower left-hand corner of FIG. 1 is shown a modified form of interlocking joint provided in the outer wall 31 of the building below the point where the wall is connected to the combination joist-panel unit 30. This joint is of the same general type described and claimed in my aforementioned U.S. Patent No. 2,950,786, e.g. FIG. 3 of the latter, where the metal frames of adjacent panel units have angular configurations providing interfitting recessed and projecting edge portions which are locked together by an appropriate wedge lock arrangement. However, in the present application the cross-sectional configuration of the panel frame is provided with an extra angular or offset corner portion to impart additional resistance to twisting forces. Thus, in FIG. 1 the upper panel portion of the wall 31 has a reversely bent metal angle 73 with an inclined central cam portion 73' at the projecting edge portion of the panel and a companion angle member 74 at the recessed edge portion of the panel. The lower panel portion of the wall 31 has a reversely bent angle member 75 with a cam portion 75' in its projecting edge portion and an oppositely extending angle member 76 at its recessed edge portion. Another angle member 77 is welded to the angle 76 and has an inturned flange portion at its outer end for retaining one edge of a wedge member, designated generally at 300. A similar inturned flange portion is provided on the angle 74 and is reinforced by a smaller angle element 74'.

The wedge member 300 (shown more fully in FIG. 21) is of generally U-shaped cross-sectional shape but is tapered longitudinally. One side edge of the wedge member 300 is provided with a lateral flange portion 301 and the opposite side edge of the wedge member has a thickened curled flange portion 302 which is tapered longitudinally and cooperates with an oppositely tapered wedge plate 303. The wedge plate 303 is secured by screws, barbs, or the like to the adjacent cover strip for engagement by the flanged edge 302 of the wedge member 300. When the panel edges are positioned in interlocking relation the wedge member 300 is forced into position with the flanged edges 301 and 302 behind the flange portions of the angle members 77 and 74. As the wedge member 300 is driven longitudinally, the tapered flange portion 302 coacts with the tapered wedge plate 303 so as to urge the respective panel sections laterally toward each other. At the same time the coacting angular cam portions 73' and 75' cause the panel sections to be drawn together edgewise in firm interlocking relation.

The particular feature of the joint which differs from the structures shown in my prior application is the provision of angular offsets 79 and 79' at the corner portions of each of the reversely bent angle members 73 and 75, respectively. Thus, when the two halves of the joint are wedge locked in nested relation, the interfitting of these angular offsets 79 and 79' provides an advantageous extra degree of firmness and enhanced resistance to twisting or racking forces. The extra strength and rigidity of this joint is particularly important at the location shown in FIG. 1 because of the stress of cantilever forces from the unit 30 acting on the wall 31. In other words, the combination of the interconnected joist-panel unit 30 and outer wall 31 with the special panel joint located in the outer wall just below the unit 30 provides an exceptional degree of structural strength under load. Although not shown in the drawings, it is contemplated that free studs, such as shown at 72 in FIG. 4, may also be provided adjacent the inside of the outer wall 31 for additional strengthening, the studs being arranged in the same general manner as shown in FIG. 4 in connection with the mid-wall 35.

Returning now to the description of the combination joist-panel unit 30, it will be seen from FIG. 5 that the angle frame work of the combination unit is provided with cover strips and panels for enclosing the elongated top, bottom, and sides of the unit in the same general manner described in my aforementioned copending application in connection with the basic core panel construction. These strips and panels may be made of any suitable material of construction but it is generally preferred to utilize a cementitious fibrous composition which provides an insulating and fire-proof enclosure having the required structural rigidity. Thus, at the vertical sides of the combination unit elongated generally U-shaped channel members 80 and 81 are secured to the web members 42 to form elongated pockets into which are fitted suitable elongated cover strips or blocks 82—82' and 83, respectively. In the bed provided between the blocks 82—82' and 83 a rectangular panel member 84 is press fitted so as to place the panel in compression and the corresponding framework in tension, the panel 84 thereby functioning as a web member for strengthening the unit. At the right-hand side of the unit as viewed in FIG. 5, a similar arrangement is provided with the exception that the channels 80 and 81 of the cross-member 42 are reversed in position. In other words, at the left-hand side of the unit the channel 80 projects outwardly from the top of the unit whereas the channel 81 is in recessed relation at the bottom of the unit, but at the opposite side of the unit the projecting channel 80 is located at the lower edge and the recessed channel 81 is

disposed at the upper edge. Thus, each lateral side of the elongated combination unit has a projecting edge portion and a recessed edge portion so that two adjacent combination units can be fitted together in complementary fashion. This is fully illustrated at the right-hand side of FIG. 5 wherein a fragmentary portion of another combination joist-panel unit is shown in interfitting relation with the unit **30**. In this connection it will be noted that the exterior configurations of the channels **80** and **81** are always congruent or complementary so as to provide the desired snug interfit.

At the upper and lower sides of the combination unit elongated angular strip-retaining members **86** and **87** are welded or otherwise rigidly affixed to the members **39—80** and **39—81** and are fitted with elongated cover strips **88** and **89**, respectively. Intermediate each parallel set of strips **88** and **89** a cover panel **91** is press-fitted to complete the enclosure of the combination unit. In this particular instance the lowermost surface **89—91—88** of the combination unit may constitute a finished ceiling surface. To prevent bulging of the lowermost panel **91**, pointed barbs or fasteners **92** are secured to the cross-members **41** of the unit framework and extend at their pointed retaining ends into the panel **91**. Any suitable number of barbs **92** may be used as required for a particular installation. It should be understood that supplementary covering material may be applied over the surface **89—91—88** where necessary or desirable to provide a particular type of ceiling. It will also be noted that the hollow interior of the combination unit as seen in FIG. 5 may be provided with bridging comprising a plurality of cross-braces **93** extending between upper and lower frame members **41** for strengthening and stiffening purposes. Also, in this instance, a hollow duct **94** of rectangular configuration extends longitudinally throughout the hollow interior of the combination unit and may constitute part of the heating, ventilating, or air conditioning system of the building as hereinafter described in greater detail. The projecting metal edges of the members **80** and **87** serve to protect the combination units during handling and storage.

Inasmuch as the combination joist-panel unit illustrated in FIGS. 1 to 5 is a joist-roof-ceiling unit, additional roof covering must be provided over the uppermost surface **88—91—89**. The details of this supplementary roof covering are best seen in FIGS. 1 and 5 wherein a multiple layer supplementary roof panel **101** is shown which spans the distance between the mid-wall **35** and the outer wall **31** and at the same time constitutes an integral part of the combination joist-panel unit **30**. The supplemental roof panel **101** consists of a relatively thin lower panel element **102**, a thicker upper panel element **103**, and an outermost protective layer **104**. The panels **102** and **103** may likewise be a fibrous or cementitious material having good insulating value and fireproof qualities. The outer layer **104** may be a thin metallic sheet or any suitable weatherproof membrane. As seen in FIG. 5, the supplementary roof panel **101** is attached to the combination unit **30** by means of the vertical webs **42** which are provided at their upper ends with angular extensions **106** which fit into complementary pockets in a pair of cover strips **107** disposed along the side edges of the panel **102** and forming a bed for the latter. These angular projections **106** of the web strips **42** also serve to exert sidewise or lateral pressure against the supplementary roof panel **101** so that the same is urged laterally into tight contact with the corresponding supplementary panel portion of the adjacent combination unit when the framework of the combination unit is urged laterally by the wedge locking means **67—68** heretofore described. A compressible sealing or gasket material **108** is provided between the side edges of the abutting roof panel sections **101** and as the panel sections are pressed together the gasket material is extruded slightly, as at **109**, to provide a water-tight seal. The outermost panel **103** has similar bed-forming strips **110** which are retained in assembled relation by a plurality of transverse metal straps **111** extending between the panel elements **102** and **103** and provided with upturned ends **112** engaging the strips or blocks **110**. A plurality of U-shaped clip members **113** extend into the strips **107** and **110** for holding the latter on the straps **111**, and a pair of channel members **114** are rigidly fastened to the ends **112** at the outer edges of the roof panel for interconnecting the panel elements **102** and **103**. At the outermost end of the roof panel section **101** overlying the outer wall **31** a pair of suitably formed transverse strips **115** and **116** are provided which interfit with each other and with the panels **102** and **103** to provide a curved corner portion at the eaves region (see FIG. 1). Similarly, at the ridge or mid-wall end of the roof panel **101** a pair of transverse strips **117** and **118** are provided. The strips **115** and **117** cooperate with the strips **110** (FIG. 5) to form the bed for the outer panel member **103**, and the strips **116** and **118** cooperate with the strips **107** (FIG. 5) to provide the bed for the panel member **102**. The transverse strips **115**, **116**, and **117**, **118** at opposite ends of the roof panel **101** are held in place by means of longitudinal straps **119** extending the full length of the unit **30** and having angularly extending lugs or retainer flanges **120** at their opposite ends which fit into corresponding pockets in the strips **115**, **116**, **117**, and **118**. Clips **121** are also provided for holding together the strips **115**, **116** and **117**, **118** at opposite ends of the unit.

At the mid-wall **35** of the roof panel **101** rests on an insulating block **122** (FIG. 1) and is clamped tightly thereagainst by a ridge cap strip **123** which is wedge locked to the mid-wall panel in the same general manner described in my aforementioned copending application. At the outer wall **31** of the roof panel **101** rests on a triangular or wedge-shaped top plate **124** which is disposed at the upper edge of the wall. The upper and lower faces of the top plate **124** are provided with gasket sealing surfaces **125** in order to make a tight sealed joint between the outer wall and the roof panel. For tightening this sealed joint, an angular metal bracket is provided having a horizontal leg **126** which extends into the top plate **124** and has an upturned end **127**. The bracket also has a downwardly extending leg **128** at the exterior of the building, and a tightening screw **129** is threaded through the leg **128** and bears against an abutment member **131**. As will be understood, when the screw **129** is tightened, the entire bracket is urged outwardly of the wall **31** thereby drawing the triangular top plate **124** into snug sealed relation between the outer wall and the roof. The lower end of the bracket leg **128** is preferably formed with an integral hook **132** from which a gutter **133** may be suspended at the outside of the building wall. Clip means, as at **134**, is also provided for retaining and supporting the gutter **133** from below.

In FIGS. 6 to 9 a further embodiment of the invention is shown wherein the combination unit comprises a joist-floor-ceiling unit. As illustrated in FIG. 6, the combination unit is shown installed in conjunction with a sloping or pitched roof type building construction having an attic space between the sloping roof and the upper or floor side of the combination unit. However, it will also be understood that the same type of combination joist-panel unit may be employed between the first and second stories of a building and also as a combination joist-roof-ceiling unit in a building having a horizontal or flat roof.

The structural details of the combination unit, designated generally at **141** in FIG. 6, are substantially identical with the previously described embodiment of the invention and only a brief additional description will be required. As seen in FIG. 6, the combination unit **141** spans the gap between an outer wall **142** and a mid-wall

143 each having the same basic core panel construction heretofore mentioned. The metal framework of each wall panel is provided with laterally projecting yoke-type hangers 144 and 146 for wedge-locking connection with and cantilever type support of the opposite ends of the combination unit 141. As before, upper and lower ledge members 147 and 148 are wedge locked to the hangers 144 and 146, respectively. The joist chords at the corners of the unit 141 are designated at 149 and have rigidly affixed to the ends thereof angular ledge plates 151 which seat on the horizontal shelf portions of the ledge members 147 and 148. The same type of wedge locking arrangement as described previously is provided for connecting the ledge members and the ledge plates while at the same time urging the entire unit 141 laterally for tightly joining an adjacent unit. In this instance the top and bottom cover panels of the combination unit 141 comprise flooring and ceiling surfaces, respectively. Thus, the top of the combination unit has affixed thereto suitable flooring panels 152 and the bottom of the combination unit has affixed thereto suitable ceiling panels 153. At the extreme ends of the combination unit appropriate filler strips 154 and 156 are provided and are held in place by the bolt and nut connections of the wedge locking means which connects the wall hangers with the ends of the combination unit.

As best seen in FIG. 9, which is a fragmentary cross-sectional view similar to FIG. 5 of the first described embodiment, the metal angle framework of the combination unit 141 includes a plurality of cross-members 157 which are connected to the joist chords 149 and the latter are also interconnected by vertical web members 158 to provide the same elongated box-like frame configuration of the previous embodiment. Angular cross braces 159 are also provided for stiffening and strengthening purposes. At each corner of the framework are secured suitable channels or angular flange members providing pockets into which are fitted elongated cover strip members as designated at 160, 161, 162, 163, and 164. The ceiling panel unit 153 is press-fitted into the bed formed by the strips 160 and 164 and a barbed retainer 166 is affixed to the cross-member 157 and extends into the panel 153 for resisting bulging of the latter. Similarly, the floor panel members 152 are press-fitted into the bed formed between the strips 160 and 164 at the upper side of the combination unit. In the same fashion, the sides of the combination unit 141 are enclosed by suitable panels 167 which are press fitted into the beds formed between the cover strips 161—162 and 163. As will be evident from the joint illustrated at the right-hand side of FIG. 9, the side edges of each combination unit 141 have the same projecting and recessed edge configuration previously described for providing an interlocking fit with a complementary edge configuration on an adjacent combination unit.

As seen in FIG. 6, separate roof panel units, designated generally at 168, are provided in this embodiment of the invention. As before, the sloping roof panels extend between the outer wall 142 and the mid-wall 143 but in this instance special means must be provided for securing the roof panels 168 at their opposite ends. At the eaves end of the roof panel, a wedge-shaped or triangular top plate 169 having gasket-like sealing surfaces 171 and 172 is interposed between the top of the wall 142 and the roof panel 168. Preferably, the lower surface of the plate 169 has a stepped configuration, as at 173, for accurately positioning the plate. Referring to FIG. 6A, an upright ribbon or mounting strip 174 is supported on the uppermost hanger bracket 144 by means of an inverted U-shaped support 175 comprising a pair of spaced vertical angle members 176 rigidly connected at their upper ends by a channel-shaped piece 177. The support 175 is disposed on the hanger bracket 144 with the members 176 depending along opposite sides of the diverging hanger arms and the piece 177 resting on the upper edges of the hanger arms. The lower ends of the members 176 are interconnected by means of a pair of complementary tapered wedge blocks 178 which extend through openings in the members 176. A screw 179 coacts between the blocks 178 for forcing the latter into tight frictional engagement with the edges of the openings so that the support 175 is quickly secured in place. It will be understood that similar supports are located on other hanger brackets and the ribbon 174 is secured, as by welding, to the upper ends of the members 176 of the respective supports. A locking plate 185 (FIG. 6) depends from the roof panel 168 and has a hinged connection 186 with a strap 187 which extends rigidly from the panel framework. The ribbon 174 and the locking plate 185 are provided with coacting apertures, and a two-piece wedge lock 188—189 is provided for coaction with the apertures to firmly lock the plate 185 against the ribbon 174. An adjustable screw 190 coacts with the wedge blocks 188—189 for urging the same together whereby to tighten the connection between the plate 185 and the ribbon 174.

At the ridge end of the roof panel 168, the panel rests on an insulating block 191 which overlies the mid-wall 143 and this end of the panel is held down by means of an elongated ridge cap 192. The ridge cap 192 is firmly secured to the metal framework of the mid-wall panel 143 by means of an elongated connector 193 and a wedge lock means 194. Although not always necessary, an additional locking means may be provided at the ridge end of the roof panel 168 as shown in greater detail in FIG. 7. For this supplementary locking means, a flanged bracket 196 extends outwardly on both sides of the mid-wall 143 and has mounted on each end thereof an apertured upwardly extending mounting plate 197 which, in this instance, has a double thickness construction for added strength. Each of the mounting plates 197 at opposite sides of the mid-wall 143 is adapted to be wedge-locked to a hinged locking plate depending from the ridge end of the roof panels in the same general manner as heretofore described for the roof panel connection at the eaves end. Thus, a locking plate 198, also in this instance having a double thickness construction, has a hinged connection 199 with a strap 201 secured to the framework of the roof panel. The locking plate 198 is likewise apertured, and a wedge locking arrangement comprising a pair of complementarily tapered blocks 202 and 203 are fitted in the corresponding apertures of the elements 197 and 198, respectively. An elongated screw 204 extends loosely through the block 203 and is threaded into the block 202 for drawing the blocks together and thereby forcing the outer edges of the blocks tightly against the edges of the openings in the plates 197 and 198 for rigidly clamping the latter together.

In FIG. 8, an enlarged cross-section is seen of a joint 206 between adjacent roof panel units 168, the joint in this instance being of the same interlocking wedge-retained type heretofore described in detail in connection with FIG. 1. In this case also, the outermost sealing means between the side faces of adjacent roof panels 168 is of a different form from that shown in FIG. 5 wherein the roof panels comprise an integral part of the combination joist-panel unit. Thus, in FIG. 8, the outer waterproof membrane of the roof panel, as designated by the reference numeral 207, may be made of light metal or other suitable material. At the edge of the right-hand panel, as seen in FIG. 8, the membrane 207 is folded back upon itself to provide an upstanding inclined rib portion 208, and at the adjacent edge of the left-hand panel as seen in FIG. 8 the membrane 207 is folded back upon itself and the double fold is crimped over the rib 208 as shown at 209 whereby to provide a tightly sealed upstanding joint. The outer edges of the membranes 207 are fastened to their respective panel edges, as by screws 211. Also, the folded

portions of the membranes may have a coating of a suitable sealing or gasket-like material for insuring a water impervious seal between the rib **208** and the crimped over portion **209**.

FIGS. 10 to 14 illustrate a modification of the separate roof panel as required when the combination unit is a joist-floor-ceiling unit of the type illustrated in FIG. 6. In the present modification, as seen in FIG. 10, a separate curved shoulder section **216** interconnects the eaves panel **142** of the outer wall and a roof panel, designated at **217**, so as to provide a more streamlined configuration at the roof corner for added protection against high winds or the like. As will be evident from FIGS. 10 and 11, the corner section **216** has the same general structural features as the flat panel units characteristic of the present invention and also described in my aforementioned copending application. Thus, there is a central framework comprising oppositely extending and suitably curved pairs of angle members **218** and **219** onto which are fitted preformed curved strips and blocks of an insulating composition such as at **221**, **222**, **223**, and **224** in FIG. 11. The blocks are retained on the angle framework by means of clips **226** and angularly extending lugs or spline portions **227** and the various blocks are also formed to interfit in lapping relation to provide the desired overall configuration. Thus, in FIG. 11 the uppermost cover strip **221** overlaps the underlying cover strip **224**. Moreover, the butting edges between cover strips **222** and **224** have a gasket material or sealing composition **228** therebetween and the outermost cover strips **221** and **223** have a similar seal **229** compressed therebetween. The curved corner section **216** may be permanently secured to the roof panel **217** by means of welded connections between the respective metal angle members which form the frameworks of the respective sections. However, the connection between the eaves panel **142** and the corner section **216** comprises a detachable connection **228** of the wedge-locked interfitting splice joint type described more fully heretofore with respect to FIGS. 1 and 8. Inasmuch as the roof panels **217** in the FIG. 10 embodiment are independent of the combination joist-floor-ceiling unit **141**, it will be understood that special means must be provided for joining the roof panels **217** along their lateral or side edges just as was the case in the FIG. 6 embodiment. Thus, in FIG. 13 a fragmentary section is shown at the joint between a pair of adjacent roof panel units **217***a* and **217***b* and it will be seen that the joint, designated at **229**, is of the same character already described in connection with FIGS. 1, 8 and 10. The joint differs from that shown in FIG. 8 only to the extent that the abutting edges of the panels **217***a* and **217***b* have a gasket sealing material compressed therebetween to provide an extruded waterproof joint **231**. An outermost waterproof membrane **232** extends the full length of each roof panel **217** and also over the curved corner section **216** as seen in FIG. 10. FIG. 14 shows the manner in which a pair of angular barbs **233** may be rigidly secured to the framework of the panel **217***b* and extend into the respective panel covers, designated at **234**, for retaining the latter in place.

In FIGS. 10 and 12 the details of an alternative gutter mounting are also shown, the gutter being designated at **236** and being suspended from an angular bracket having a horizontal leg **237** embedded in the curved roof section **216** and an upright leg **238** portion disposed at the exterior of the building and fitting into an overhanging lip portion **239** on the gutter. Another angular bracket **241** extends downwardly from the outer wall of the building and fits around the lower edge of the gutter, as at **242**.

As previously mentioned in connection with the description of FIGS. 1 and 5, the combination joist-panel units of the present invention have a generally box-like configuration with a hollow interior. Consequently, these units are well adapted to be included in the ventilating, heating, or air conditioning system of the building. Air may be circulated through the hollow interior of the enclosed open-ended combination units, or if desired the interior of selected combination units may be provided with separate elongated ducts, such as shown at **94** in FIG. 5, which may extend through the entire length of the unit.

FIGS. 15 to 20 illustrate in a generally schematic fashion further details of an air distribution arrangement which utilizes the combination units as part of the system. Thus, FIG. 15 is a schematic cross-section of a one-story building having an air heating device, indicated diagrammatically at **245**, from which hot air flows upwardly either by convection or by forced flow through a vertical duct **246** in the mid-wall of the building to a horizontal duct **247** extending lengthwise of the building ridge. It will be understood that the midwall may be constructed from panels having lateral enlargements for accommodating the necessary ductwork **247**, e.g. as seen in FIGS. 1 and 6. At the roof of the building the heated air passes in opposite directions, as indicated by the arrows, through the hollow combination joist-panel units or through communicating laterally extending ducts **248** mounted in certain of the combination joist-roof-ceiling units. The main duct **247** may conveniently be formed with short stubs or boot portions (not shown) for providing adjustable telescopic connection with the hollow interior of the combination units or with the ducts **248** when the latter are used. At the outside walls of the building the path of air flow is downwardly through passages **249** and thence beneath the floor of the building to be recirculated through the heating means **245**. In the event that the temperature regulating means **245** is a cooler or air conditioner, it will be understood that the flow of air will be in the reverse direction from that shown in FIG. 15. In either instance, however, the arrangement shown in FIG. 15 provides for heating or cooling of the wall, ceiling, and floor surfaces of the rooms of the building by means of an external curtain of conditioned air without passage of the air through the rooms themselves.

FIGS. 17 to 19 show a special vertical wall panel **251** which may be utilized either as a mid-wall or an outside wall to house chimney flues or the communicating vertical ducts of the air circulating system, e.g. the duct **246** of FIG. 15. The panel **251** has the same basic core construction already described in detail in this application and in my aforementioned copending application, but the central part of the panel is laterally enlarged by means of outwardly extending angle members **252** connected to the panel framework so as to provide a panel of increased thickness in the duct region. The enlarged space within the panel **251** may be provided with a single or double duct arrangement as required. As indicated in FIGS. 17 and 18, a diverging pair of vertical ducts **253** are provided for directing the conditioned air in opposite directions from the wall **251** into oppositely arranged ducts **254** which extend lengthwise of the building similar to the duct **247** in FIG. 15. It may also be mentioned that FIGS. 17 and 19 show the interlocking joint construction, designated at **256** for connecting adjacent panel units of the same type previously described in connection with FIGS. 1, 8, 10, and 13. However, in this instance the joints **256** are provided with double wedge lock means on opposite sides of the joined panels, this arrangement being particularly useful where the wedge pockets of the wedge lock means are utilized for hanging or mounting fixtures or supplemental wall covering as described more fully in my aforementioned copending application. In FIG. 19 one of the wedge elements **300** is shown in the process of being inserted in locking position.

In FIG. 16 the air circulating system is shown with slight modifications as it might be used in a two-story building. Thus, the heating means is designated generally at **261** and the air is forced upwardly through one or more

vertical ducts 262 which may be provided in specially enlarged mid-wall panels of the type shown in FIG. 17. At the upper part of the building, the ducts 262 communicate with a lengthwise duct 263 and laterally extending ducts 264 located in the combination joist-floor-ceiling units. The same thing is true at the middle of the building between the first and second floors were heated air from the ducts 262 is likewise directed to a longitudinal duct 265 and thence laterally through ducts 266 located in combination joist-floor-ceiling units. In this instance, however, the heated air passes directly into the rooms instead of being confined in an exterior curtain flowing along the outside of the room surfaces. As seen on an enlarged scale in FIG. 20, heated air from the lateral ducts 264 and 266 may pass from the ends of the combination units, as indicated by the arrows, downwardly through a perforated cove member 267 which is fitted by angular edge portions 268 and 269 into the adjacent ceiling and wall panels 270 and 271, respectively. The cove member 267 has a plurality of perforations, as indicated at 272, for the passage of the heated air therethrough into the interior of the room. Referring back to FIG. 16, the air is withdrawn from the room at the baseboard level by means of suitable downtake passages 273 and is thus returned below the lower floor of the building to the heating means 261.

I claim:

1. A combined joist and panel unit adapted to extend transversely between a pair of spaced walls, comprising an elongated rigid frame of rectangular cross-section having top, bottom and side portions with elongated corners between said portions, elongated cover strips mounted on said frame adjacent said elongated corners and defining panel-receiving beds at said top, bottom, and side portions, panel means including panel members press-fitted within said beds for substantially enclosing the top, bottom, and side portions of said frame and providing an elongated hollow enclosure, said frame and said cover strips providing recessed and projecting edge portions extending lengthwise along the corners of said frame and adapted to interlock laterally with complementary recessed and projecting edge portions of an adjacent unit, and connecting means comprising spaced upper and lower mounting plates extending endwise from said top and bottom portions at the opposite ends of said frame for connecting the same to the spaced walls.

2. The structure of claim 1 further characterized in that said frame comprises elongated parallel angle members extending along the corners of the frame and interconnected by a plurality of horizontal and vertical members to provide a hollow generally box-like configuration.

3. The structure of claim 1 further characterized in that the panel means at the bottom portion of said frame comprises a ceiling structure and the panel means at the top portion of said frame comprises a roof structure.

4. The structure of claim 1 further characterized in that the panel means at the bottom portion of said frame comprises a ceiling structure and the panel means at the top portion of said frame comprises a floor structure.

5. A combined joist and panel unit adapted to extend transversely between a pair of spaced walls, comprising an elongated rigid frame of rectangular cross-section having top, bottom, and side portions with elongated corners between said portions, elongated cover strips mounted on said frame adjacent said elongated corners and defining panel-receiving beds at said top, bottom, and side portions, a plurality of main panels press-fitted into said beds for substantially enclosing the top, bottom, and side portions of said frame, web members secured to said frame and projecting outwardly therefrom, additional panel means overlying at least certain of said main panels and connected to the projecting ends of aid web members, said frame and said cover strips providing recessed and projecting edge portions extending lengthwise along the corners of said frame and adapted to interlock laterally with complementary recessed and projecting edge portions of an adjacent unit and connecting means comprising spaced upper and lower mounting plates extending endwise from said top and bottom portions at the opposite ends of said frame for connecting the same to the spaced walls.

6. In combination, a joist unit adapted to extend transversely between a pair of spaced walls and including an elongated rigid frame of retangular cross-section having top, bottom, and side portions, panel means mounted at said top, bottom, and side portions for substantially enclosing the same, horizontal ledge means adapted to be rigidly connected to the spaced walls adjacent the opposite ends of said frame and adapted to support the ends of said frame from below, and wedge locking means coacting between said frame and said ledge means for retaining the opposite ends of said frame on said ledge means.

7. In combination, a joist unit adapted to extend transversely between a pair of spaced walls and including an elongated rigid frame of rectangular cross-section having top, bottom, and side portions, panel means mounted at said top, bottom, and side portions for substantially enclosing the same, the side portions of said joist unit having recessed and projecting edge portions adapted to interlock laterally with complementary recessed and projecting edge portions of an adjacent joist unit, horizontal ledge means adapted to be rigidly connected to the spaced walls adjacent the opposite ends of said frame, and wedge locking means coacting between said frame and said ledge means for retaining the opposite ends of said frame on said edge means and urging the joist unit laterally into interlocking sidewise engagement with an adjacent joist unit.

8. In combination, a joist unit adapted to extend transversely between a pair of spaced walls and including an elongated rigid frame of rectangular cross-section having top, bottom, and side portions, panel means mounted at said top, bottom, and side portions for substantially enclosing the same, the side portions of said joist unit having recessed and projecting edge portions adapted to interlock laterally with complementary recessed and projecting edge portions of an adjacent joist unit, horizontal ledge means adapted to be rigidly connected to the spaced walls adjacent the opposite ends of said frame, horizontally disposed mounting plates rigidly secured to the opposite ends of said frame and adapted to seat on said ledge means, said ledge means and said mounting plates being provided with apertures in superimposed relation and slightly out-of-register, wedge means extending into said superimposed apertures, and actuating means for urging said wedge means into wedging engagement with the edges of said apertures for retaining said mounting plates on said ledge means and at the same time bodily urging the joist unit laterally into interlocking sidewise engagement with an adjacent joist unit.

9. The structure of claim 8 further characterized in that said ledge means comprises a pair of apertured upper and lower ledge members at each end of said frame and said frame has cooperating apertured upper and lower mounting plates at each end thereof, said wedge means comprises a pair of upper and lower wedge members at each end of the frame cooperable with the superimposed ledge members and mounting plates, and said actuating means comprises adjustable means for urging the upper and lower wedge members of each pair toward each other.

10. In combination, a joist unit adapted to extend transversely between a pair of spaced walls and including an elongated rigid frame of rectangular cross-section having top, bottom, and side portions, panel means mounted at said top, bottom, and side portions for substantially enclosing the same, the side portions of said joist unit having recessed and projecting edge portions adapted to interlock laterally with complementary recessed and projecting edge portions of an adjacent joist unit, horizontal

ledge means adapted to be rigidly connected to the spaced walls adjacent the opposite ends of said frame, and wedge locking means coacting between the ends of said frame and said ledge means for connecting the same, said wedge locking means including cam portions arranged to exert lateral pressure on said frame for urging the joist unit into interlocking sidewise engagement with an adjacent joist unit, and said cam portions also being arranged to exert tension on said frame longitudinally thereof.

11. In combination, a joist unit adapted to extend transversely between a pair of spaced walls and including an elongated rigid frame of rectangular cross-section having top, bottom, and side portions, panel means mounted at said top, bottom, and side portions for substantially enclosing the same, the side portions of said joist unit having recessed and projecting edge portions adapted to interlock laterally with complementary recessed and projecting edge portions of an adjacent joist unit, horizontal ledge means adapted to be rigidly connected to the spaced walls adjacent the opposite ends of said frame, horizontally disposed mounting plates rigidly secured to the opposite ends of said frame and adapted to seat on said ledge means, said ledge means and said mounting plates being provided with apertures in superimposed relation and slightly out-of-register, wedge means extending into said superimposed apertures, and actuating means for urging said wedge means into wedging engagement with the edges of said apertures for retaining said mounting plates on said ledge means, said wedge means including at least one tapered cam surface disposed at an angle relative to the longitudinal axis of said frame whereby to exert lateral pressure on said frame for urging the frame into interlocking sidewise engagement with an adjacent joist unit and also to exert tension on said frame longitudinally thereof.

12. In combination, an upright wall, a joist unit adapted to extend outwardly from said wall, said joist unit including an elongated rigid frame of rectangular cross-section having top, bottom, and side portions, panel means mounted at said top, bottom, and side portions for substantially enclosing the same and providing an elongated, hollow, duct-like enclosure, a pair of horizontally disposed upper and lower ledge members rigidly mounted on said wall, a pair of horizontally disposed upper and lower mounting plates rigidly secured to the end of said frame and seated on said ledge members, and wedge locking means coacting between each upper and lower set of ledge members and mounting plates for connecting the joist unit to the wall at spaced upper and lower points whereby to provide a cantilever effect for retaining said frame and said wall in perpendicular relation.

13. The structure of claim 12 further characterized in that the panel means at the bottom portion of said frame comprises a ceiling, and perforated cove means is provided at the juncture of said wall and said ceiling for providing fluid communication between the interior of said enclosure and the space below said ceiling.

14. In combination, an upright wall, hanger means extending rigidly from the wall and having a pair of diverging flanged portions, a joist support having a horizontal ledge portion, an upright abutment portion, and laterally extending spaced hook portions interengaged with said flanged portions, wedge means interposed between said abutment portion and said flanged portions for securing the joist support to said hanger means, a joist unit having an elongated rigid frame of rectangular cross-section having top, bottom, and side portions, panel means mounted at said top, bottom, and side portions for substantially enclosing the same, the side portions of said joist unit having recessed and projecting edge portions adapted to interlock laterally with complementary recessed and projecting edge portions of an adjacent joist unit, and wedge locking means coacting between the end of said frame and the horizontal ledge portion of said joist support for retaining the end of the joist unit on the joist support and urging the joist unit laterally into interlocking sidewise engagement with an adjacent joist unit.

15. In a building structure, the combination of an upright wall comprised of interconnected panels, a combined joist-panel unit extending transversely from said wall, said unit comprising an elongated rigid frame of rectangular cross-section having top, bottom, and side portions, panel means at said top, bottom, and side portions for enclosing the same, said panel means including ceiling structure at the bottom portion of said frame and roof or floor structure at the top portion of said frame, connecting means rigidly connecting the end of said frame to said wall, and interlocking joint means in said wall below the juncture thereof with the frame of said combined joist-panel unit, said joint means comprising a pair of interfitting generally S-shaped peripheral frame portions on upper and lower interconnected wall panels and wedge locking means for holding said wall panels rigidly in interlocked relation, said wedge locking means including coacting inclined cam portions on said frame portions, wedge retainer means rigidly connected to one of said frame portions, and wedge means coacting between said wedge retainer means and the other of said frame portions for urging the respective wall panels laterally toward each other whereby said inclined cam portions cause the panel units to be drawn together edgewise and to be rigidly retained in locked relation at the interfitting frame portions thereof, said interfitting frame portions also having angularly offset corner portions in nested relation for increased resistance to twisting and racking forces imposed on said wall by a load acting on said joist-panel unit.

16. In a combination, a joist unit adapted to extend transversely between a pair of spaced walls and including an elongated rigid frame having at its sides recessed and projecting edge portions adapted to interlock laterally with complementary recessed and projecting edge portions of an adjacent joist unit, horizontal ledge means adapted to be rigidly connected to the spaced walls adjacent the opposite ends of said frame, horizontally disposed mounting plates rigidly secured to the opposite ends of said frame and adapted to seat on said ledge means, said ledge means and said mounting plates being provided with apertures in superimposed relation and slightly out-of-register, wedge means extending into said superimposed apertures, and actuating means for urging said wedge means into wedging engagement with the edges of said apertures for retaining said mounting plates on said ledge means and at the same time bodily urging the joist unit laterally into interlocking sidewise engagement with an adjacent joist unit.

17. In combination, an upright wall, an elongated joist unit extending outwardly from said wall, said joist unit including roof panel means at the top thereof and said roof panel means having a portion thereof overlying the upper end of said wall, support means on said wall having the adjacent end of said joist unit supported thereon in laterally movable relation and said portion of said roof panel means being spaced above the upper end of said wall for facilitating lateral movement of said joist unit on said support means, sealing means interposed between the upper end of said wall and said portion of said roof panel means, and adjustable means for effecting tight sealing relation of said sealing means with said portion of said roof panel means and with the upper end of said wall.

18. The structure of claim 17 further characterized in that said joist unit comprises a combined joist-panel unit including an elongated rigid frame of rectangular cross-section having top, bottom, and side portions, panel means mounted at said top, bottom, and side portions for substantially enclosing the same, the panel means at the top portion of said frame comprising said roof panel means.

19. The structure of claim 17 further characterized in

that said portion of said roof panel means is disposed at an angle to the upper end of said wall, said sealing means comprises a wedge-shaped member having upper and lower sealing surfaces and said adjustable means is cooperable with said wedge-shaped member for urging the latter laterally to effect sealing engagement with said portion of said roof panel means and with said upper end of said wall.

20. The structure of claim 19 further characterized in that said adjustable means comprises an angular bracket member having a horizontal leg portion engaged with said wedge-shaped member and a generally vertical leg portion extending along said wall, and adjustable screw means coacting between said wall and said vertical leg portion.

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