

Sept. 8, 1936.

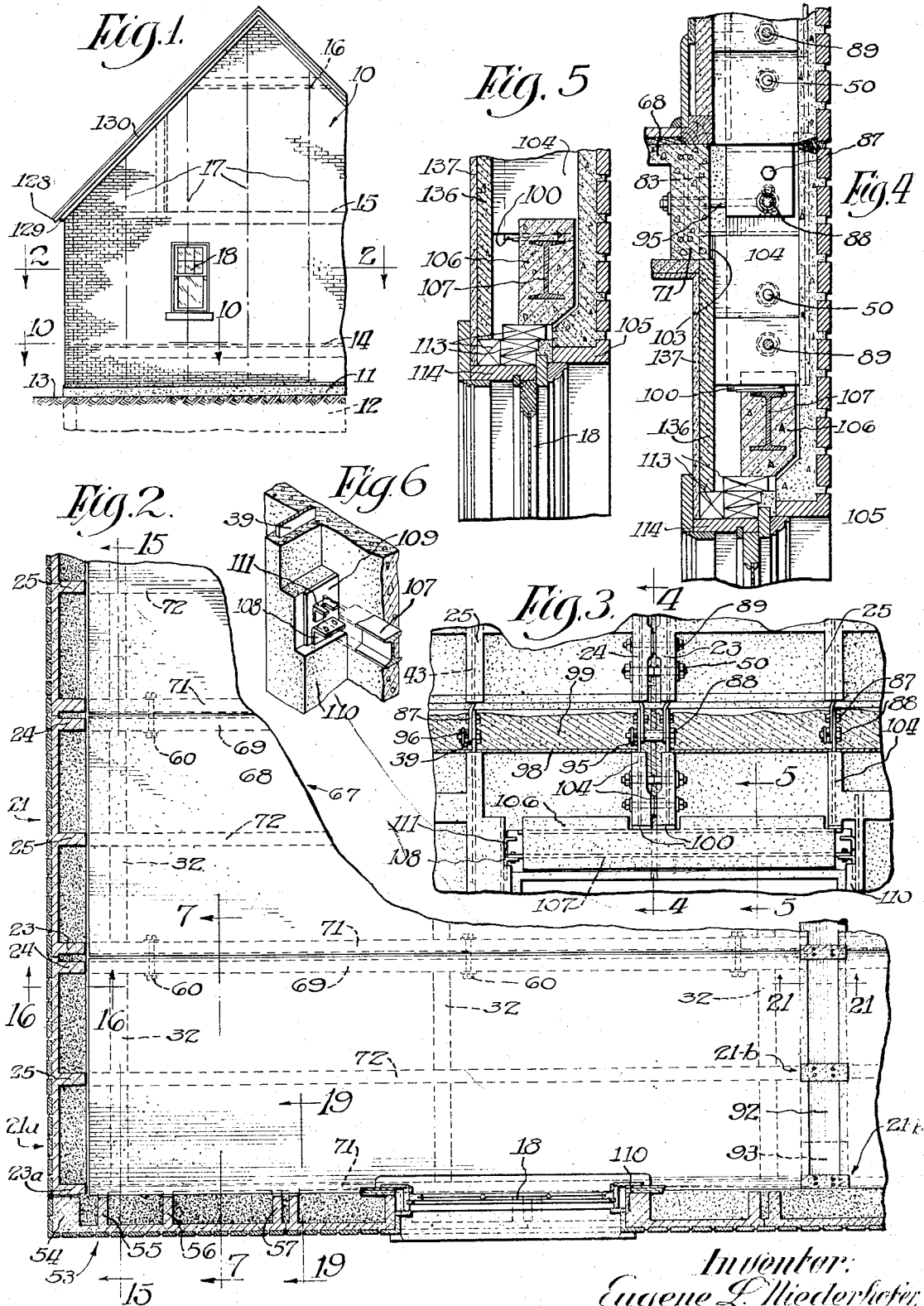
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2,053,873

BUILDING STRUCTURE

Filed June 19, 1934

7 Sheets-Sheet 1



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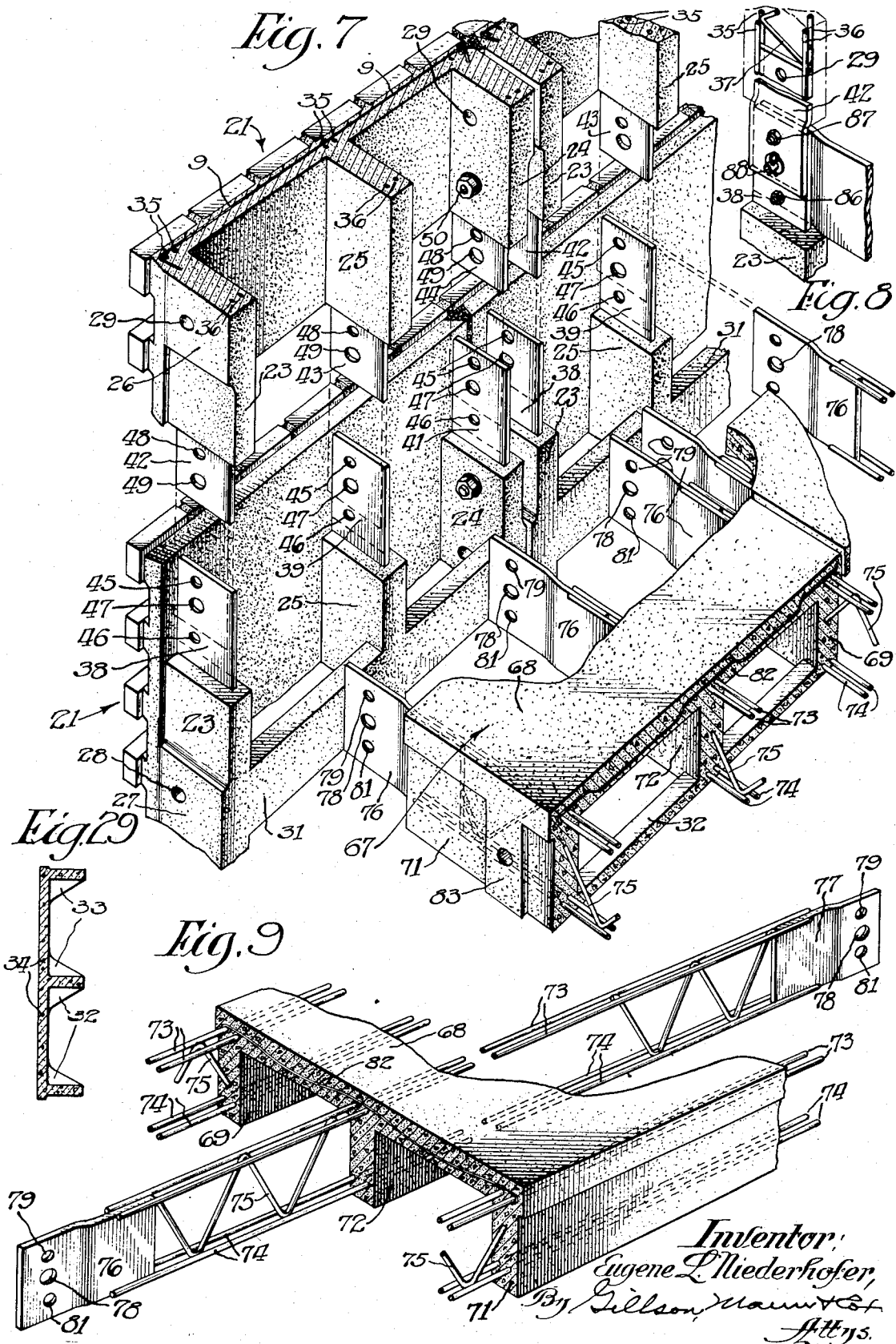
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Fig. 10

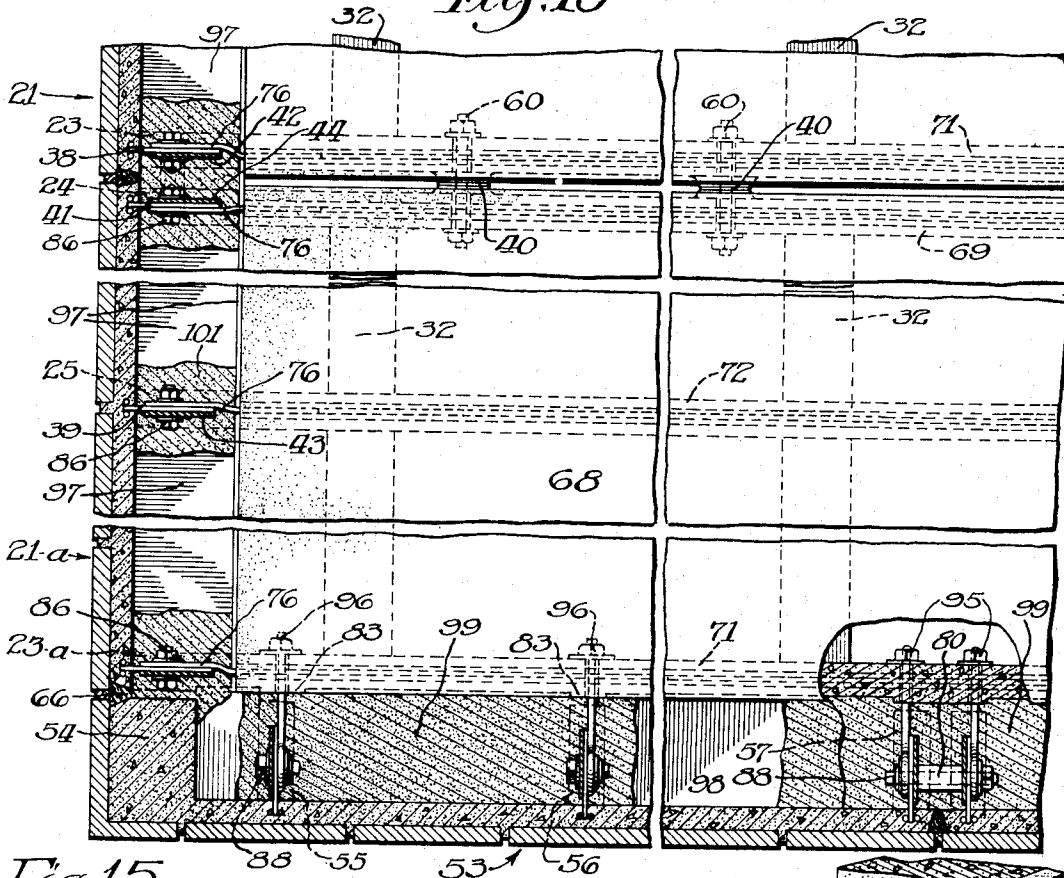


Fig. 15

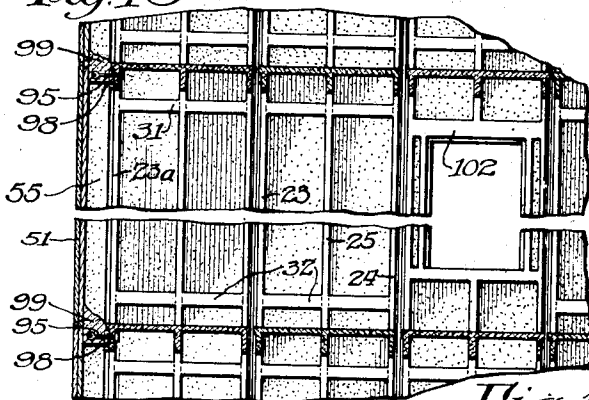


Fig. 12

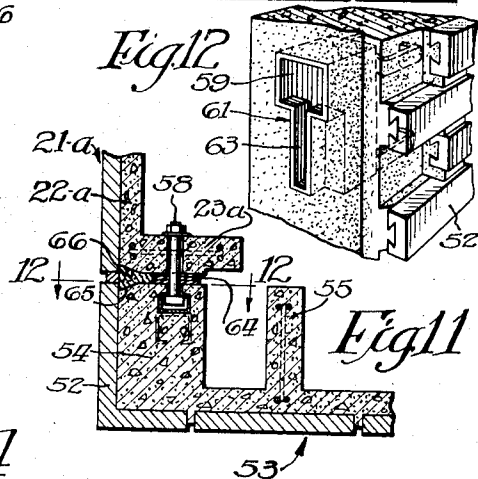


Fig. 11

Fig. 14

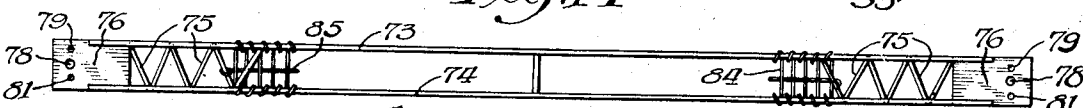
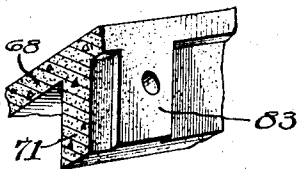


Fig. 13



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Fig. 16

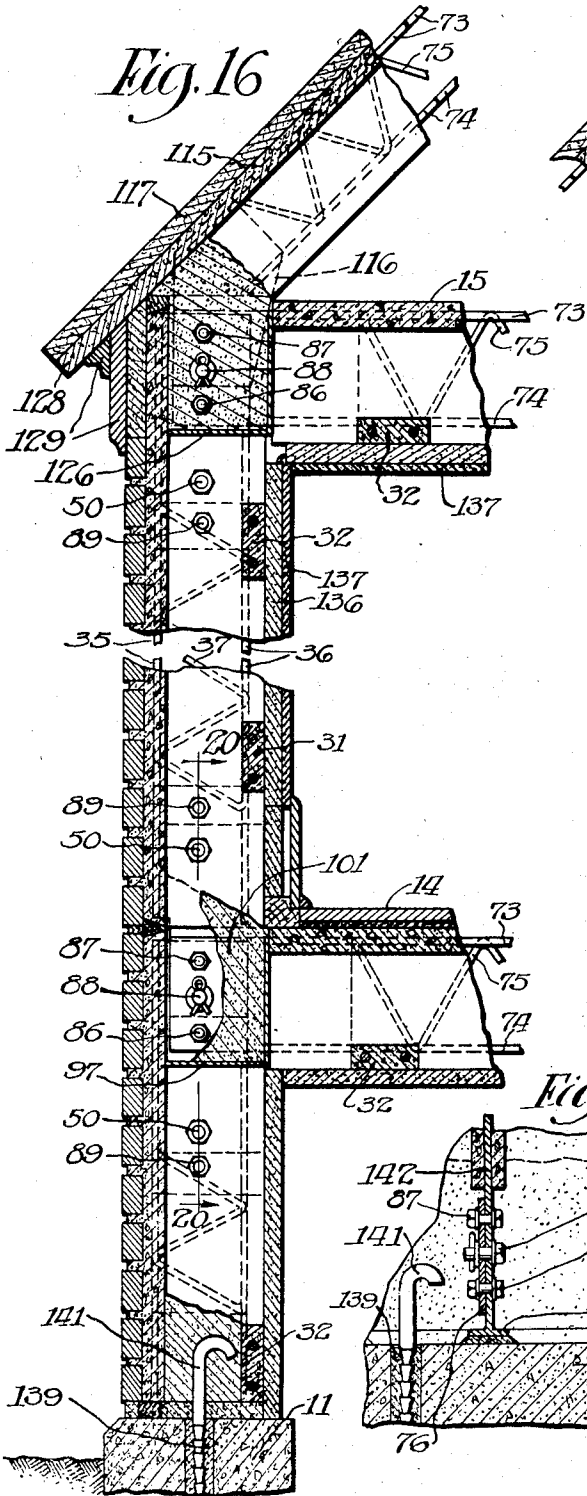


Fig. 17

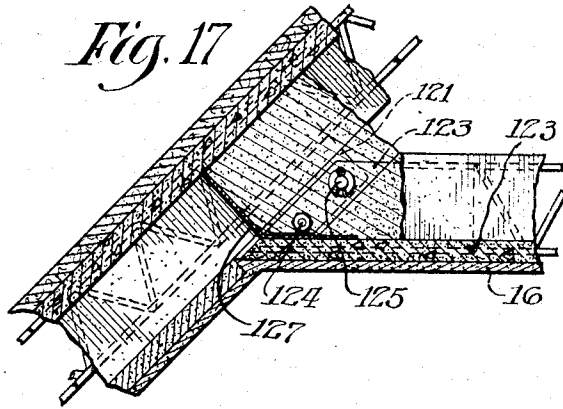


Fig. 18

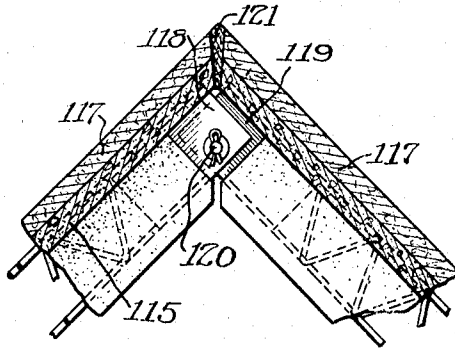


Fig. 27

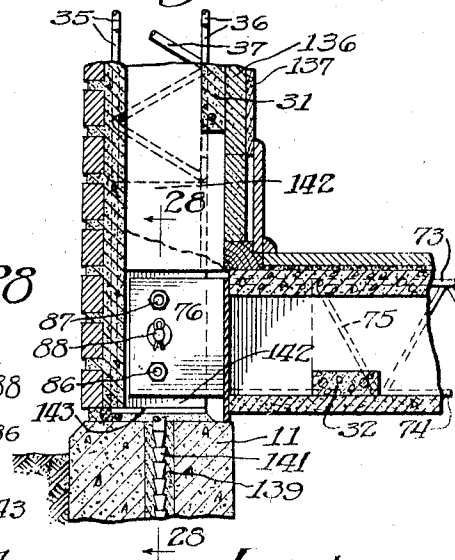
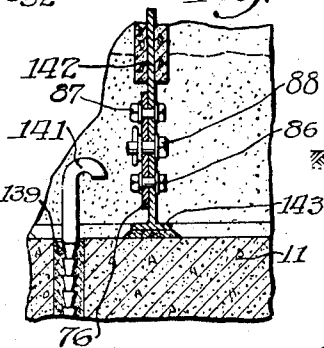


Fig. 28



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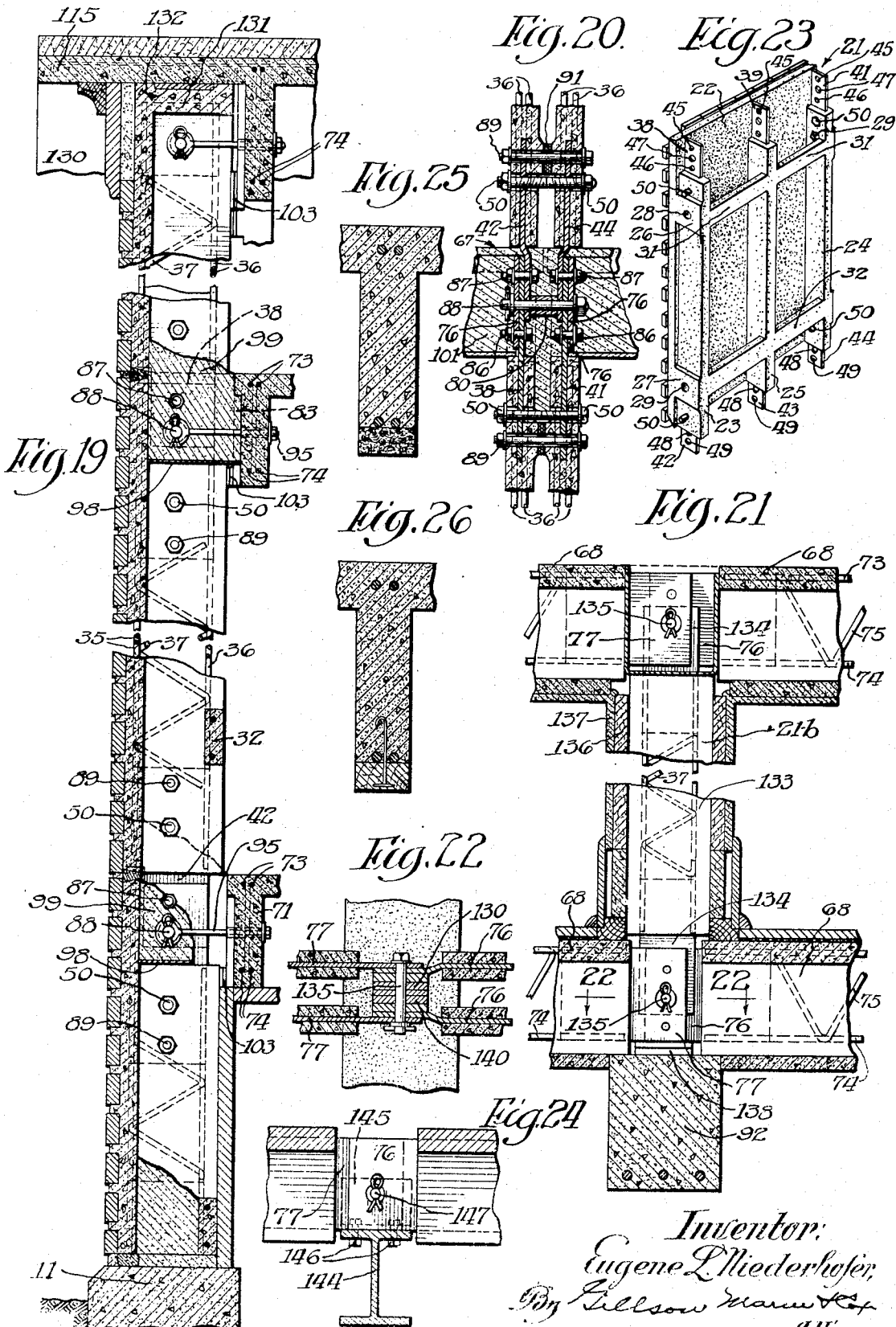
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BUILDING STRUCTURE

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Fig. 30

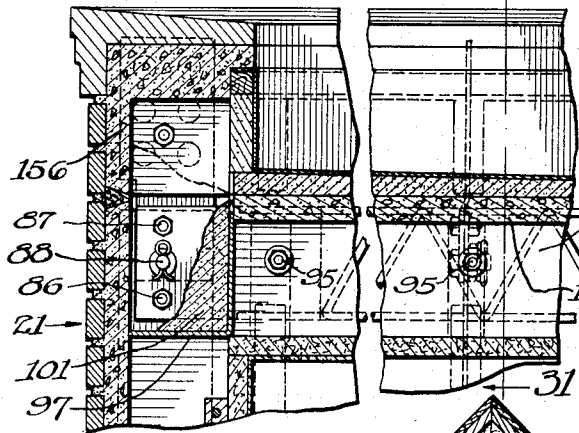


Fig. 31

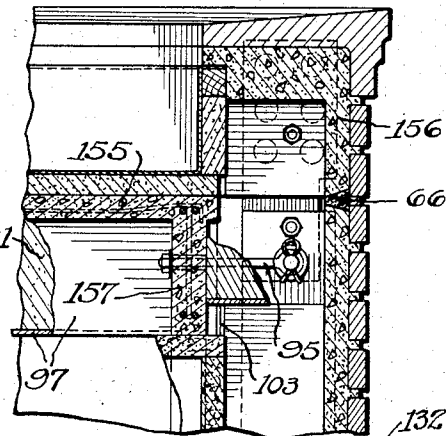


Fig. 32

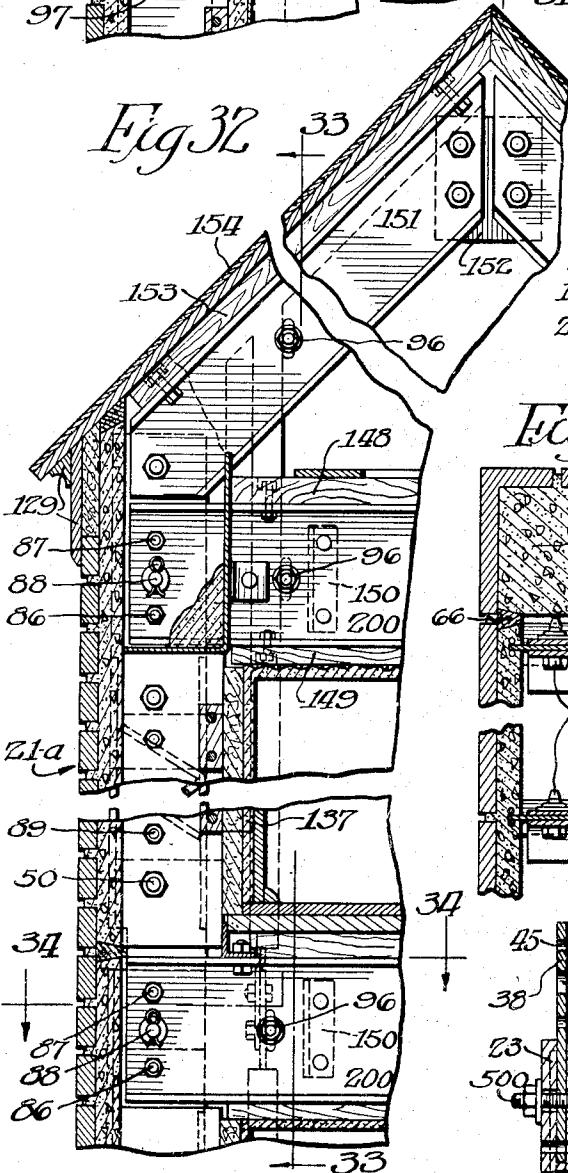


Fig. 33

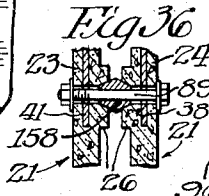


Fig. 34

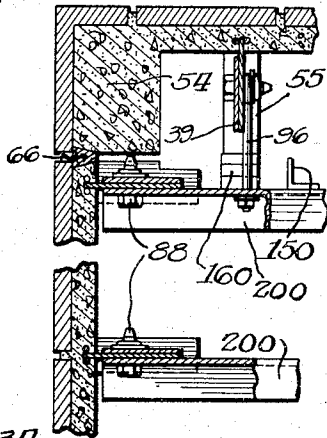
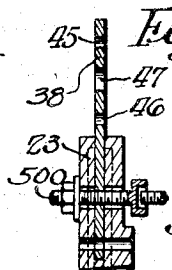
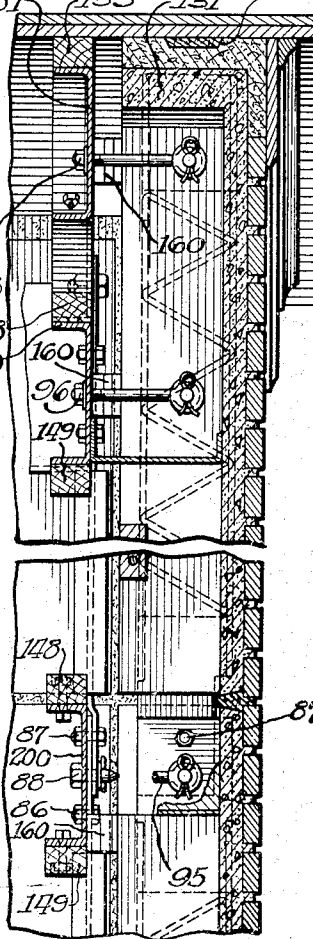


Fig. 35



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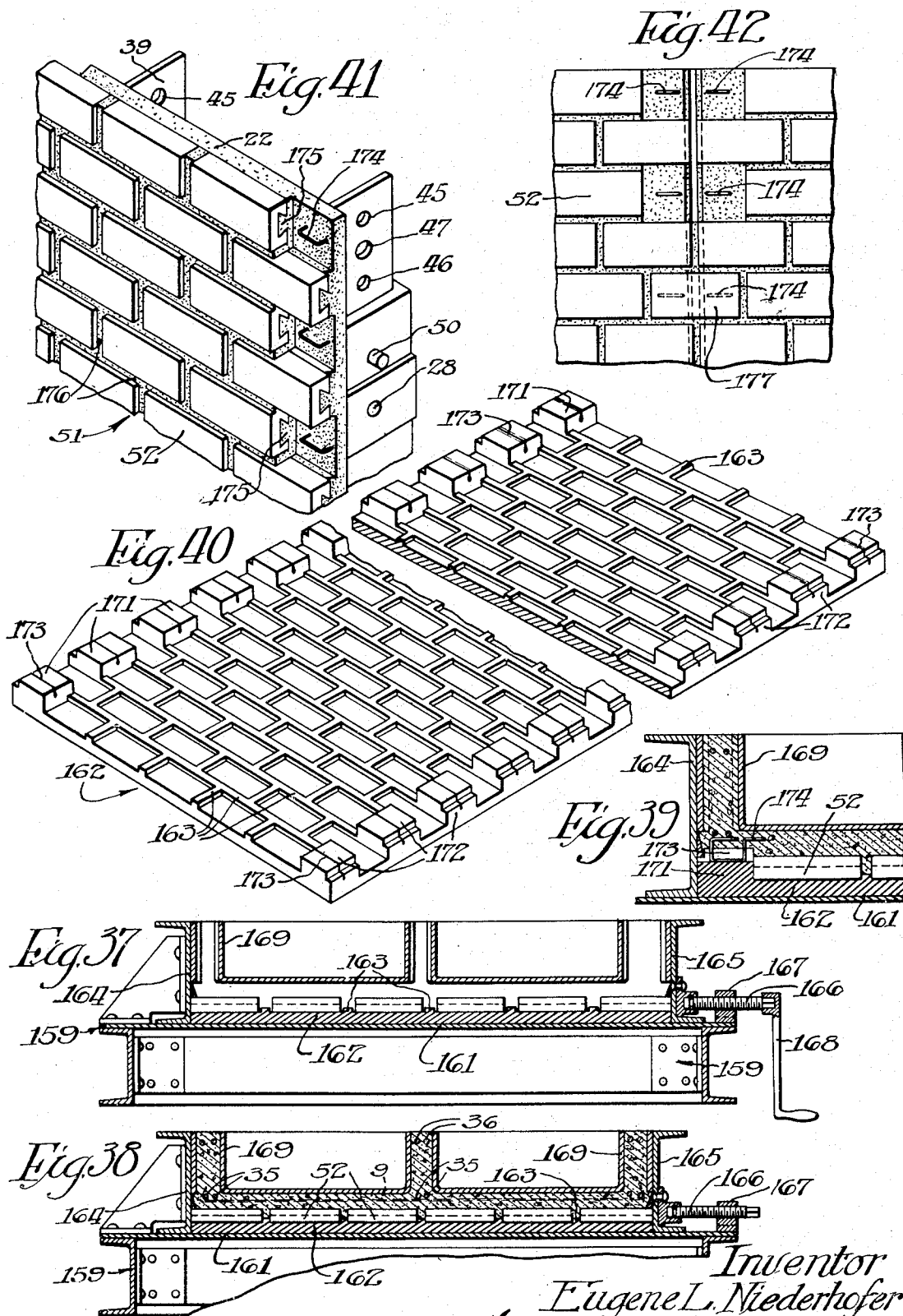
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BUILDING STRUCTURE

Filed June 19, 1934

7 Sheets-Sheet 7



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UNITED STATES PATENT OFFICE

2,053,873

BUILDING STRUCTURE

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Application June 19, 1934, Serial No. 731,270

11 Claims. (Cl. 72-1)

This invention relates to building structures. One of the objects of the invention is the provision of a new and improved building unit, or slab, for use in the construction of buildings.

Another object of the invention is the provision of new and improved means for connecting together building slabs or units in the construction of the sides, walls, floors and roofs of buildings of various types and designs.

A further object of the invention is the provision of new and improved means for alining, reinforcing, and bracing the side walls of buildings constructed of units or slabs precast from cementitious material.

A still further object of the invention is the provision of new and improved means for temporarily connecting the units or precast slabs of a building preparatory to applying the permanent connections.

A further object of the invention is the provision of a cementitious building unit having new and improved means for reinforcing and bracing the same together with novel means for connecting the same to adjacent slabs or units in building constructions.

Other objects of the invention are the provision of new and improved method and means of fabricating buildings from precast units or slabs of cementitious reinforced material, whereby buildings may be erected at a minimum of expense and wherein such buildings will be sightly, strong, permanent and durable.

Other and further objects and advantages of the invention will appear from the following description taken in connection with the accompanying drawings, in which

Fig. 1 is an elevation of a building embodying applicant's invention;

Fig. 2 is a section on the line 2-2 of Fig. 1;

Fig. 3 is an inside view of one of the walls of the building showing the construction above the window with parts in section and parts broken away;

Fig. 4 is a section on the line 4-4 of Fig. 3;

Fig. 5 is a section on the line 5-5 of Fig. 3;

Fig. 6 is a perspective detail of the means for securing the window lintel;

Fig. 7 is a perspective view of a portion of one of the walls of the building and a portion of the floor showing the parts in position to be secured together;

Fig. 8 is a perspective view of a connecting means for the units or panels, showing the parts in assembled relation with parts broken away;

Fig. 9 is a perspective view of one of the floor

units or slabs with parts in section and parts broken away;

Fig. 10 is a section on the line 10-10 of Fig. 1;

Fig. 11 is a horizontal section through one corner of the building with parts broken away;

Fig. 12 is a section on the line 12-12 of Fig. 11.

Fig. 13 is a perspective view of a portion of one of the floor slabs or units, showing an interlocking lug thereon;

Fig. 14 is an elevation of one of the reinforcing members for the floor slab or unit;

Fig. 15 is a section on the line 15-15 of Fig. 2;

Fig. 16 is a section on the line 16-16 of Fig. 2;

Fig. 17 is a vertical section of a portion of the roof and of the ceiling structure, with parts broken away;

Fig. 18 is a vertical section of the ridge of the roof with parts broken away;

Fig. 19 is a vertical section of the building substantially on the line 19-19 of Fig. 2;

Fig. 20 is a section on the line 20-20 of Fig. 16;

Fig. 21 is a vertical section through the floor and ceiling in the interior of the building showing the supporting beam for the floor and with parts broken away;

Fig. 22 is a section on the line 22-22 of Fig. 21;

Fig. 23 is a perspective view of one of the building slabs or units;

Fig. 24 is a section through the first floor of the building, showing a modified form of supporting bar for the floor;

Fig. 25 is a cross section through one of the ribs of the building unit, showing the edge of the rib as being provided with a composition nailing strip molded or cast integral with the rib;

Fig. 26 is a similar view, but showing a wooden nailing strip rigidly secured to the rib;

Fig. 27 is a vertical section through an outer wall in the floor of a modified form of construction;

Fig. 28 is a section on the line 28-28 of Fig. 27;

Fig. 29 is a top plan view of a modified form of a building slab or unit;

Fig. 30 is a vertical section through the roof and one wall section of a modified form of building;

Fig. 31 is a section on the line 31-31 of Fig. 30;

Fig. 32 is a vertical section transversely to the roof through a still further modified form of building structure;

Fig. 33 is a section on the line 33-33 of Fig. 32;

Fig. 34 is a section on the line 34-34 of Fig. 32;

Fig. 35 is a section through connecting plates

showing a modified form of gauge or positioning member;

Fig. 36 is a vertical section through the connecting mechanism for the panels showing a modified form of construction;

Fig. 37 is a vertical section through a press for molding the building slabs or units showing the same in released position;

Fig. 38 is a similar view, but showing the same in operative position with the material in place for forming the slab;

Fig. 39 is a vertical section through a portion of the press showing one of the brick attaching means in position in the slab;

Fig. 40 is a perspective view of the bottom wall of the press for holding the brick veneer in position while the slab is being cast;

Fig. 41 is a perspective view of a portion of one of the panels with the brick veneer in position thereon; and

Fig. 42 is an elevation of a portion of the building at the joint between two adjacent building units, showing one of the bricks extending across the meeting line and showing other blanks for the sealing bricks.

Referring now to the drawings, the reference character 10 designates a building, which, for convenience of illustration is a dwelling constructed in accordance with the invention and represents one embodiment of the same by way of example only. In this form of construction, the building is supported on a foundation 11 which may be a continuation of the wall 12 of the basement extending below the level of the ground 13, as shown in Fig. 1, or it may be supported by pillars or columns set in the ground. The building is illustrated as being provided with a first floor, shown in dotted lines at 14, a ceiling and second floor, shown in dotted lines at 15, and a second floor ceiling shown in dotted lines at 16. The building is constructed of building units or slabs of cementitious material faced with brick, as will presently appear.

The building units or slabs may be of uniform form size and construction, or they may be varied as to shape and size, depending on conditions and circumstances. Under ordinary building conditions, some, at least, of the units must be changed to meet the exigencies of the different requirements for the varied plans and specifications.

In the type of building units selected to illustrate one embodiment of the invention, the units are not all of uniform size, neither are they all of the same shape due to the type of roof shown, the height of the first floor above the foundation, the height of the other floor and ceilings, the provision for a window opening, etc. However, the form of construction disclosed in Fig. 1 will serve to illustrate the invention. In this form of structure, the vertical dotted lines 17 show the widths of the building units and the lengths or heights thereof are indicated by the horizontal dotted lines 14, 15 and 16. They preferably extend from floor to floor of the building, and the means for connecting the units together are utilized for connecting the walls to the floor units, as will presently appear.

A window in the end wall of the building is shown at 18, the opening for which is partly in two adjoining panels or units, as clearly shown in Fig. 1.

A typical building slab unit or panel is shown at 21 in Fig. 23, portions of which are shown on an enlarged scale in Fig. 7, and comprises a plate

or web portion 22 having vertical ribs 23 and 24 adjacent the side edges thereof. The slab or building unit is cast or molded as a unitary structure from suitable cementitious material. If the slab is of sufficient width, one or more intermediate ribs may be employed. In the panel shown, one intermediate rib 25 is provided. The ribs 23 and 24 are each preferably provided, though not necessarily, with thickened portions or bosses 26 and 27 adjacent the upper and lower ends, respectively, to strengthen the ribs at these points and through which extend openings 28 and 29 for bolts for connecting adjacent panels together, as will appear hereinafter.

The ribs may be braced by the reinforced bars 31 and 32 adjacent the ends of the unit. These bars may be cast or molded with the unit and may be spaced from the web or panel, as shown in Fig. 23, or, if desired, they may be integral with the web portion, as shown at 32 and 33 on the slab 34 in Fig. 29.

The ribs 23, 24 and 25 constitute columns for supporting the weight of the building and for transferring the stress of said weight and of the weight of the floors to the supporting foundation. Suitable means are provided for reinforcing the units or slabs. Any suitable means may be employed for this purpose.

In the form of construction shown, a pair of rods 35 extend longitudinally of the slab or unit adjacent the base of each rib, and another pair 36 adjacent the outer edge of each rib (see Figs. 8 and 7). The arrangement is also shown in Fig. 9 which shows a floor slab, but since the arrangement of the reinforcing ends is substantially the same, the showing in Fig. 9 will assist in understanding the arrangement. Adjacent to the ends of the rods, bracing rods 37, arranged diagonally and welded to the rods 35 and 36 (see Figs. 8 and 19) are provided for reinforcing the ribs at the points of greatest shearing stress and also where the stress in concrete is transferred to the steel. These lateral brace members may be formed from a single rod bent to extend diagonally from one set of rods to the other, and vice versa, as shown in said figures. Reinforcing rods 9 (see Fig. 7) extending transversely of the slabs may also be employed.

Appropriate means are provided for connecting the units together. As shown, it is accomplished by the provision of plates 38, 39 and 41 at the upper end of the unit and by plates 42, 43 and 44 at the lower end of the unit. These plates have their inner ends within the ribs and secured to the reinforcing rods. Their outer ends project beyond the upper and lower ends of the ribs 23, 25 and 24, respectively. They are embedded in the concrete of the unit and extend along the ribs beyond the openings 28 and 29 and are provided with openings in alignment with the openings 28 and 29 through the concrete, as clearly shown in Fig. 20.

Each of the plates at the upper end of the panel 21 (see Figs. 7 and 23) is also provided with openings 45 and 46 outwardly of the ribs (see Figs. 20 and 23) for receiving the holding or positioning bolts and with an enlarged opening 47 for receiving the supporting keys or bolts, as will presently appear.

The exposed ends of the plates 42, 43 and 44 at the lower end of the slab or panel are each provided with an opening 48 (see Figs. 7 and 23) for receiving a positioning bolt and an enlarged opening 49 for receiving a supporting key or bolt. Each of the plates at the ends of the outer ribs 7,

is provided with a threaded opening in which is adjustably secured gauging or positioning studs 50 (see Figs. 20 and 23) for positioning the units relative to each other. The studs about each other or one may have a socket on its end for receiving the other, as shown at 500 (see Fig. 35). Suitable nuts on the ends of the studs 50 are adapted to hold the studs in adjusted position.

The unit or slab may have a coat 51 of any suitable finishing material on its outer side. As shown more particularly in Figs. 7, 23, 41 and 42, the panel 21 is covered with a brick veneer 52, each alternate row of bricks stopping short of the edges of the panel a distance of one-half brick, as clearly shown in Fig. 42, so that when the slabs or units are in position, additional bricks may be applied to occupy the space formed by the adjoining spaces of two adjacent units.

The plates 42, 43 and 44 have their lower ends offset, as shown in Fig. 20, so that when the parts are assembled, the ribs of the vertically aligned slabs will be held in vertical alignment or the plates at one end of rib may be arranged at one side of the center line of the same.

The corner slabs or units 53 may, if desired, be constructed with heavy corner posts, as shown at 54 in Figs. 2 and 10. The unit 53 is provided with the usual ribs 55, 56 and 57 which correspond to the ribs 23, 25 and 24 of the panel 21, see Fig. 23, with the exception that the rib 55 is moved inwardly from one edge of the panel in spaced relation to the post 54. As shown more clearly in Figs. 11 and 12 of the drawings, the panel 53 of one end of the building is secured to the rib 23a of the panel 21a of a side of the building by suitable bolts 58 which are anchored in the post 54 by a metal insert 59 having a keyway 61 for receiving the head of the bolt. In attaching the parts together, the bolt is inserted in the enlarged opening 62 of the keyway and is slid into the restricted opening 63 which retains the head in position, as shown more particularly in Fig. 11. A suitable nut engaging the end of the bolt secures the parts in adjusted relation. If desired, shims 64 may be inserted between the rib 23a and the post 54 to prevent breakage of the rib 23a when the parts are drawn together. The adjacent corners of the post 54 and the web portion 22a of the panel 21a are beveled and form a recess 65 having inclined walls for receiving a mastic 66 of any suitable waterproofing material for preventing the entrance of moisture at the joint.

Preferably, though not necessarily, the floor supports are similar to the building units and comprise a plurality of floor slabs or units which are adapted to be attached to the walls of the building and engage supports within the building. Each of the floor slabs 67 (see Figs. 7 and 9) comprise a web or plate portion 68 having ribs 69 and 71 extending along the side edges thereof and one or more intermediate ribs 72. The ribs are provided with reinforcing rods or bars 73 and 74 which correspond to the reinforcing rods 35 and 36 of the building unit 21. These rods may be provided with a bracing member 75 arranged diagonally between the two sets of rods, as in the previous construction. Attaching plates 76 and 77 rigidly attached to the rods embedded in the ribs, extend outwardly beyond the units to form attaching means, as clearly shown in Fig. 7. Each of these plates is provided with an opening 78 for the reception of the supporting key or bolt and with openings 79 and 81 above and below the opening 78 for receiving the securing or positioning bolts. The web portion 68 of the slab may

be provided with reinforcing rods 82 extending transversely of the slab. The slab that extends alongside the inner wall of the building is preferably provided with a lug or projection 83 (see Figs. 7 and 13) for constituting means for connecting the floor to the side wall, as will presently appear. The projection 83 is flush with the outer edge of the web 68 which extends slightly beyond the face of the rib 71. The web 68 also extends inwardly slightly beyond the rib 69, as shown in Fig. 9 of the drawings.

In floors having long spans or carrying heavy loads either uniformly distributed or concentrated, it may be necessary to provide additional shear reinforcement for the slabs. This may be accomplished by providing additional reinforcing rods 84 extending between the reinforcing rods 73 and 74, as shown in Fig. 14 of the drawings. An additional reinforcing rod 85 between the rods 73 and 74 and extending longitudinally of the ribs, may also be provided for reinforcing said ribs.

Suitable means are provided for connecting the building and floor units together to form a building structure. In the erection of the building, it is desirable that means be provided for temporarily holding certain of the parts together while the other parts are being placed in position. In the form of construction selected to illustrate one embodiment of the invention, suitable bolts or pins are provided for this purpose. Assuming that a wall of the building has been partially erected, the building and floor units 21 and 68 are erected in a manner that will now be described. The floor unit 68 is moved into position and positioning or erection bolts 86 are placed through the openings 46 and 81 (see Figs. 7, 8 and 20) for holding the parts in assembled relation. A building unit 21 may then be placed in position and the bolts 87 passed through the openings 48, 45 and 79 for holding the plates on the units in position, as clearly shown in Fig. 8 of the drawings. A key or bolt 88 may then be placed in position through the bearing openings 49, 47 and 78 (see Fig. 8) of the plates on the center ribs of the building units and floor slabs. Adjacent units are attached in the same manner to the units below and are secured together by bolts 89 which extend through openings 29 in the outer ribs, as clearly shown in Fig. 20. If desired, shims 91 may be provided between adjacent ribs for forming a rigid connection between the same. After these units are attached to the floor and walls, as described, the supporting keys 88 are driven into position. These keys make a tight fit. A spacer block 80 between the supporting plates on the bolt 88 is provided for each bolt that connects adjacent slabs.

The floor slabs are connected together by suitable bolts 60 extending through adjacent ribs of adjacent slabs, as shown in Fig. 10. Shims 40 may be inserted between the ribs. The gauging bolts or studs 50 are so adjusted that the ends of the same will come in contact for limiting the edgewise movement of the units and for insuring the vertical alignment of their meeting edges. Suitable shims are provided between the wall and floor slabs, as shown at 103 in Fig. 19. These shims not only prevent weaving or collapsing of the walls due to wind pressure, but they are useful in plumbing the walls and for maintaining them in vertical position.

The inner ends of the floor slabs 68 rest on suitable supports or beams 92, which in turn may be supported by posts 93, shown in dotted lines in Fig. 2.

The side edges of the outermost floor slabs are secured to what for convenience of description will be termed the end walls of the building by anchoring bolts 95 (see Figs. 10 and 19) which extend through the rib 71 of the floor unit and has its outer end provided with an eye for receiving the supporting bolt 88 of the end panels. Additional I-bolt 96 may also be provided for anchoring the floor slab to the other ribs of the building units in the end wall of the structure, as clearly indicated in Fig. 10 of the drawings.

Suitable forms 97 and 98 (see Figs. 16 and 19) are provided adjacent to the connections between the floor and building slabs and when connecting plates have been secured together, these forms are filled with concrete which embeds the plates, bolts and nuts, and also fills in the space around the keys or projections 83, as indicated in Fig. 19 for locking the parts together. This concrete forms struts 99 between the ribs of the building units at the end of the building and also struts 101 extending longitudinally of the building between the ribs of the building units thereof, as shown more clearly in Fig. 10 of the drawings. In this figure, the struts 99 and 101 are broken away for the sake of clearness. Since they extend entirely around the building, they will prevent chimney action in removing the warm air from the building during the cold season, and, as a result, dead air space will be provided between the ribs.

The window opening may be located entirely within one of the panels, as shown in Fig. 15, or it may be located partly in one panel and partly in another, as shown in Figs. 1 and 3 of the drawings. When the opening is entirely within one of the panels, the window frame 102 may be molded integral with the side panel, as shown in Fig. 15. The usual wooden window frame may be inserted in this window opening.

When the window opening is formed in two adjacent panels, each panel has a laterally extending portion over the window frame 105 having short ribs 104. The lintel 106 of the window may be formed of cement, embedded within which is an I-beam 107. The I-beam 107 has its upper flange cut away at each end and projects at each end beyond the concrete of the lintel 106. The lower flanges of the ends of the I-beam 107 each rest on and are secured to brackets 108 (see Fig. 6). Each bracket 108 is carried by a plate 109 embedded in concrete rib 110. A bifurcated plate 111 is also rigidly secured to the plate 109 and before the parts are assembled extends upwardly adjacent to and parallel with the plate 109. When the lintel 106 is secured in position, the upper end of the plate 111 is bent outwardly and downwardly to cause the bifurcated portions to engage on each side of the web 112 of the I-beam 107. Wedge shims 100 are driven between the lintel and the metal plates in the ribs 104 for transmitting the stress of the weight to the lintel and to the side ribs of the adjacent panels. Suitable filler members 113 may be inserted between the inner portion 114 of the window casing and the window lintel. The reinforcing ribs of the slabs at each side of the window may be modified to accommodate the window opening and its frame.

The supporting portion of the roof may also be slabs or building units 115 (see Figs. 16 to 19) having the attaching plates 116 at the lower ends of the roofing slabs or units turned down vertically, as shown in dotted lines in Fig. 16 for attachment to the corresponding attaching plates

of the floor and building units or slabs. Each of the roof slabs or units has cast monolithically therewith a layer of light material 117 capable of receiving nails for holding the roofing material in position on the slabs. The roofing slabs are connected together in a manner similar to that already described. At the upper or ridge portion of the roof, the securing plates 118 and 119 of adjoining slabs from opposite sides of the roof overlap and are secured by pins or keys 120 for holding the parts together. If desired, the upper ends of the slabs may be beveled to form a groove along the ridge of the roof for receiving a waterproof mastic 121, as shown in Fig. 18.

In buildings where the ceiling for the upper room is secured to the roof portion of the building, the roof slabs are provided with downwardly and inwardly extending plates secured to the reinforcing rods of the ribs, as shown in dotted lines in Fig. 17, to which the attaching plates 122 of the ceiling slabs 123 are secured by the positioning bolts 124 and the keys 125.

Forms 126 and 127 are provided beneath the connecting portions of the roof and side wall slabs and between the roof and ceiling slabs which are filled with concrete for embedding the exposed portions of the metal connecting plates and for strengthening the connecting parts.

The lower ends of the roof slabs are extended to form the eaves 128 of the roof beneath which suitable finishing material 129 may be provided. The roof slabs at the ends of the roof are also extended outwardly beyond the end wall of the building as shown at 130 in Figs. 1 and 19.

The building slabs in the gables of the roof each has its upper end provided with an inwardly extending flange 131 (see Fig. 19) conforming to the inclination of the roof and this flange is recessed as at 132 for receiving a waterproof mastic, as asphalt or the like, for rendering the joint between the end and roof slabs waterproof.

When the parts are assembled, the recesses 132 in the adjacent slabs form a continuous groove the full height of the roof, as will be understood from an inspection of Figs. 19 and 33.

The building may be provided with load carrying partitions 133 (see Fig. 21). These partitions are preferably located above one of the supporting beams 92 at the juncture of the floor slabs 68. The partition comprises the building unit or slab 21—b which may be similar to the building slab 21 (shown in Fig. 23). The reinforcing plates 134 of the slab 21—b is connected to the plates 77 of the floor slabs by the means above described, including the keys 135 which support the load. The slab 133 is provided on each side with the usual plaster base 136 having insulating properties and on which the plaster 137 for the wall is secured.

Wedge shims 138 may be driven beneath the plates 77 and the slab 133 for transferring the stresses directly to the beam 92.

Filler or spacer plates 130 and 140 are welded to the supporting plates 76 of adjacent floor slabs (see Fig. 22) and constitute means for preventing the bending of the bolt 135 by placing the same under shear.

Suitable means are provided for anchoring the building to the foundation, as shown more particularly in Figs. 16, 27 and 28. The foundation 11, 12 is provided with an enlarged opening 139 which is adapted to receive the lower end of an anchor 141. In securing the parts in assembled relation, the wall slabs are placed in position, after which the anchor 141 is inserted in the opening 139 and grout or cement placed in the opening around the

lower end of the anchor 141, as clearly shown in said figures.

The upper end of the anchor 141 which is bent laterally after being placed in position is enclosed in cement, as shown in said figures, thereby anchoring the walls to the foundation. A suitable number of these anchoring devices are employed along both the sides and ends of the building for properly anchoring the same to the foundation.

Where the floor is at the ground level, as shown in Figs. 27 and 28, the connecting plates 142 of the ribs of the building unit adjacent to the foundation may be provided with feet or flanges 143 for resting on said foundation, as clearly shown in Fig. 28.

Instead of using floor supporting beams of cementitious material, as shown at 92 in Fig. 21, metal beams 144 may be provided as shown in Fig. 24.

Suitable angle plates 145 (see Fig. 24) have their horizontal flanges connected to the flanges of the beam 144, as by means of bolts 146, and have their vertical portions provided with an opening for receiving the supporting key or bolt 147, thus rigidly securing the floor slabs together and to the metal beam 144.

In Figs. 32, 33 and 34 is shown a modification of the device in which the floors and roof are supported by metal beams or bars instead of floor and roof slabs. As shown, these members are channel bars 200 and have their web portions provided with openings for the reception of the positioning bolts 86 and 87 and the supporting key or bolt 88, as shown in Fig. 32. These supports are anchored to the end walls of the building by the eye-bolts 95 and 96 (see Fig. 33) which extend through the webs of the channel bars, as clearly shown in said figures. The flanges of these bars may have nailing strips 148 and 149 (see Fig. 32) to which the floors and ceilings may be attached.

The roof supporting bars 151 may also be U-shaped in cross section and have their web portion attached to the upper ends of the supporting plates of the building units at the side of the building. Their upper ends are connected together by a plate 152 (see Fig. 32) which is bolted to the upper ends of adjacent bars. These bars or beams may have nailing strips 153 secured to their upper flanges to which the roof 154 may be attached. The floor supporting beams may have angle bars 150 secured thereto which function as keys similar to the keys or lugs 83 (see Fig. 13). Shims 160 between the floor beams and walls slabs are employed to function as the shims 103, Fig. 19.

In Figs. 30 and 31 is shown a further modified form of structure. In this construction the roof is flat and supported by the roof slabs 155. The roof slabs 155 are connected to the building units or slabs 21 in the manner already described. An additional wall slab 156 is attached to the slab 21 and extend upwardly therefrom to form a finished appearance to the upper portion of the building. The roof slab 155 is similar to the floor slab 68 and is provided with a flange 157 which is adapted to be attached to the end wall by eye bolts 95 similar to the floor slabs.

In Fig. 36 is shown a modified form of spacer member for the ribs of the building units 21. Instead of using the shims 91 (see Fig. 20), a suitable member 158—preferably, compressible—such as fiber or composition material is employed. The adjacent bosses 26 of adjacent ribs 23 and 24 of the units 21 are provided with conical recesses for receiving the spacer member 158, and when

the holding bolt 89 is attached, the nut is screwed down to cause the compressible material to occupy the entire space of these recesses, thereby holding the building slabs or units firmly together, and preventing uneven settling of the building with the consequent cracking of the walls.

In Figs. 37 to 40 is shown a means of casting the brick veneer onto the slab 21. As shown, the reference character 159 indicates a mold having a bottom wall 161 on which is adapted to rest a plate of rubber or other compressible material 162.

The plate 162 is provided with a series of ribs 163 outlining recesses for receiving brick which are placed in position therein before the casting operation. The mold is provided with fixed side walls 164 and with a movable side wall 165. The wall 165 is moved in and out by means of a screw 166 extending through a fixed lug 167.

The screw 166 is adapted to be operated by a hand crank 168. A slab form 169 is adapted to be detachably inserted in the mold 159. The recesses for the bricks are arranged in rows and each alternate row is provided at its ends with projections 171 and 172, respectively. Each of these projections is provided with a recess 173 for receiving an anchoring member 174.

The projections 171 and 172 at each alternate row are substantially one-half the length of a brick, so that when the slab is cast, each alternate row of brick will be flush with the end of the slab and each of the other rows will stop short of the end of the length of one-half brick, as shown at 174 in Fig. 41.

In molding the slab, the bricks are placed in position in the recesses in the mold 162 and the movable wall advanced to cause the ribs 163 to be clamped between the bricks, thereby preventing cementitious material from passing to the underside of the brick when the slab is cast.

Cement or cementitious material is then poured in the mold, thereby casting the slab with the brick veneer on its outer surface. In order to locate the brick more firmly in position, brick having dove-tail slots 175 therein (see Fig. 41) may be employed. The ribs 163 leave sufficient space between the bricks, as shown at 176, for receiving a suitable mortar trim, as may be desired.

It will thus be seen that when the slabs are connected together to form a wall, as shown in Fig. 42, the space 174 will form a recess for receiving an additional brick, thereby completing the wall. This brick, as shown at 177, is attached by cement and the anchoring member 174 entering the groove 175 and cement contained therein will anchor the brick in position.

While forms for the concrete struts are not shown about all of the slab connecting plates, it is understood that such construction is desirable although in some instances not necessary. Embedding these plates in concrete will protect them and the concrete will also form struts between the ribs.

Preferably, though not necessarily, all four edges of the slabs or units are beveled and that a mastic of waterproof material as asphalt or the like is inserted in the grooves or channels formed by these beveled edges, thereby rendering the joints waterproof. Mortar of the desired color to match the brick veneer or finishing surface of the building may be applied in the outer portions of these grooves to cause the walls to have a finished appearance.

It will thus be seen that with a minimum of ef-

fort a building may be erected and that when erected it will be strong and durable and if the slabs have a brick veneer on their outer surface, the walls when finished will have the appearance of solid brick walls.

It will also be appreciated that by the use of the connecting plates extending from the reinforcing ribs the openings for the load supporting bolts or keys and for the holding and gauging bolts may be accurately drilled so that with the aid of wedging shims the walls will be true and the load supporting keys will be maintained under shear and will not be subjected to a bending action. This is considered an important feature of the invention since these keys constitute an important element in the load supporting structure. Furthermore, the weight on the floors will be transferred to the walls and from there through the plates, keys and ribs of the building units of the walls directly to the foundation.

It is thought from the foregoing taken in connection with the accompanying drawings that the construction and operation of my device will be apparent to those skilled in the art and that changes in size, shape, proportion and details of construction may be made without departing from the spirit and scope of the appended claims.

What I claim, therefore, is:—

1. In a building structure formed of concrete building slabs, each slab having vertically extending strengthening ribs, means including plates for connecting said ribs together whereby a wall is formed, said wall having a window opening therein, a lintel extending across the top of said opening, said lintel having an iron bar extending through said lintel, means on adjacent ribs for connecting said bar thereto for supporting the same, and means on said ribs for positioning said bar.

2. In a building structure formed of concrete building slabs, each slab having vertically extending strengthening ribs, means including plates for connecting said ribs together whereby a wall is formed, said wall having a window opening therein, a lintel extending across the top of said opening, said lintel having an iron bar extending through said lintel, means on adjacent ribs for connecting said bar thereto for supporting the same, a bifurcated plate on an adjacent rib bent outwardly for engaging said bar for positioning the same, and wedge shims driven between said bar and certain of said plates.

3. In a building structure, a plurality of building slabs, each slab comprising a plate portion, ribs adjacent the edges of said plate portion and at least one other rib between said first-named ribs, reinforcing members embedded within said plate portion and ribs, attaching plates extending outwardly from the ends of said ribs, certain of said plates having their outer ends offset, a plurality of floor slabs having strengthening ribs, reinforcing members embedded within said ribs and slabs, said members comprising a pair of parallel rods adjacent the base of said ribs, another pair of rods adjacent the outer edge of said ribs and rods extending diagonally from one pair of rods to the other adjacent the ends thereof, connecting plates welded to the ends of said pairs of rods, means for connecting ribs of laterally adjacent slabs together, positioning bolts for connecting said plates together and supporting keys for connecting said plates together and for supporting said slabs, and means for preventing bending action on said keys, said means maintaining said keys under shear.

4. In a building structure, a concrete slab having a plurality of parallel ribs extending longitudinally thereof, one adjacent each edge of said slab, reinforcing rods within each rib, attaching plates rigidly secured to the ends of said rods and extending outwardly beyond the ends of said ribs, each of said plates having an opening for the reception of a supporting key and an opening above and below said first-named opening for the reception of retaining bolts, bosses on the sides of said ribs having openings extending therethrough and through the inner ends of said plates for the reception of slab connecting bolts, and positioning bolts adjustably mounted in certain of said ribs and extending laterally therefrom.

5. In a building structure, a concrete slab having a rib extending along each longitudinal edge of the slab, reinforcing rods within each rib extending longitudinally thereof, attaching plates welded to said rods and extending outwardly beyond the ends of said ribs, and a layer of light cementitious nail retaining material cast on the outer surface of said slab.

6. In a building structure, a plurality of concrete building slabs arranged in horizontal and vertical rows, each slab having a plate portion and strengthening ribs along the side edges of said slab, reinforcing rods extending longitudinally of said ribs, reinforcing rods extending transversely of said plate portion, attaching plates embedded within the ends of said ribs and extending outwardly therefrom, means for connecting the ribs of laterally adjacent slabs together, metallic floor supporting beams, and means for connecting the ends of said beams and connecting plates together.

7. In a building structure, a plurality of concrete building slabs arranged in horizontal and vertical rows, each slab having a plate portion and strengthening ribs along the side edges of said slab, reinforcing rods extending longitudinally of said ribs, reinforcing rods extending transversely of said plate portion, attaching plates embedded within the ends of said ribs and extending outwardly therefrom, means for connecting the ribs of laterally adjacent slabs together, roof supporting metallic beams and means for connecting said beams to certain of the upper plates of the upper horizontal row of said slabs, and means for connecting the inner ends of said beams together for supporting a roof.

8. A building unit comprising a pre-cast slab of concrete having a rib extending along each side edge thereof and each terminating at one end short of the end of said slab and at the other end flush with the end of said slab, reinforcing rods within each of said ribs, and plates secured to said rods within said ribs and extending outwardly beyond the ends of said ribs, each plate being provided with an opening for receiving a supporting key and other openings for receiving assembling bolts, each of said ribs being provided adjacent each end with adjustable positioning studs extending through the inner ends of said plates.

9. A building unit comprising a pre-cast slab having a rib along each side edge of said slab on one side thereof, said ribs having bosses on their outer sides at their ends and having openings therethrough for connecting bolts, said ribs having metallic reinforcing elements extending longitudinally thereof, plates having their inner ends within said ribs and secured to said elements and having their outer ends extending outwardly

beyond said ribs, said plates having openings through their outer end portions for receiving assembling bolts and supporting keys, and adjustable positioning bolts extending through said ribs for positioning said slab when the same is used in a building structure.

10. A building unit comprising a pre-cast slab of concrete having ribs disposed on a face along the longitudinal edges thereof and provided with reinforcing members within said ribs terminating in apertured connecting portions projecting beyond the respective ends of the ribs for connection to similar connecting portions of subjacent and superjacent slabs, and positioning members projecting laterally from the slab adjacent the

ends thereof for abutting contact with similarly positioned cooperating members of adjacent slabs.

11. A building unit comprising a pre-cast slab of concrete, having ribs disposed on a face adjacent the longitudinal edges thereof and provided with reinforcing members within said ribs terminating in apertured connecting portions projecting beyond the respective ends of the ribs for connection to cooperating connecting portions of subjacent and superjacent slabs, and spacing members at the lateral edges of the ribs for spacing and aligning the unit with respect to adjacent units during erection.

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