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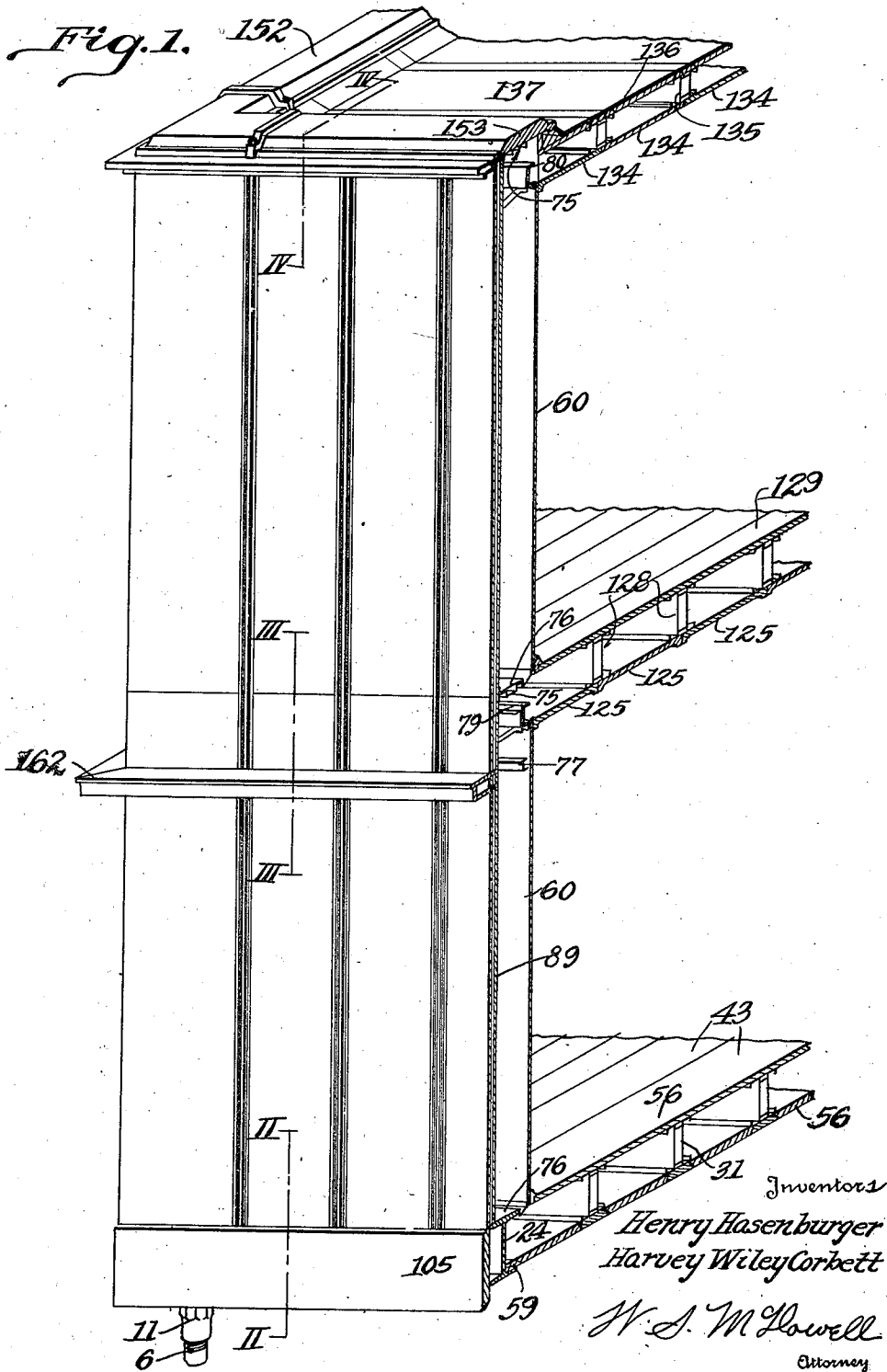
H. HASENBURGER ET AL

2,309,451

METALLIC HOUSING CONSTRUCTION

Filed Oct. 24, 1939

11 Sheets-Sheet 1



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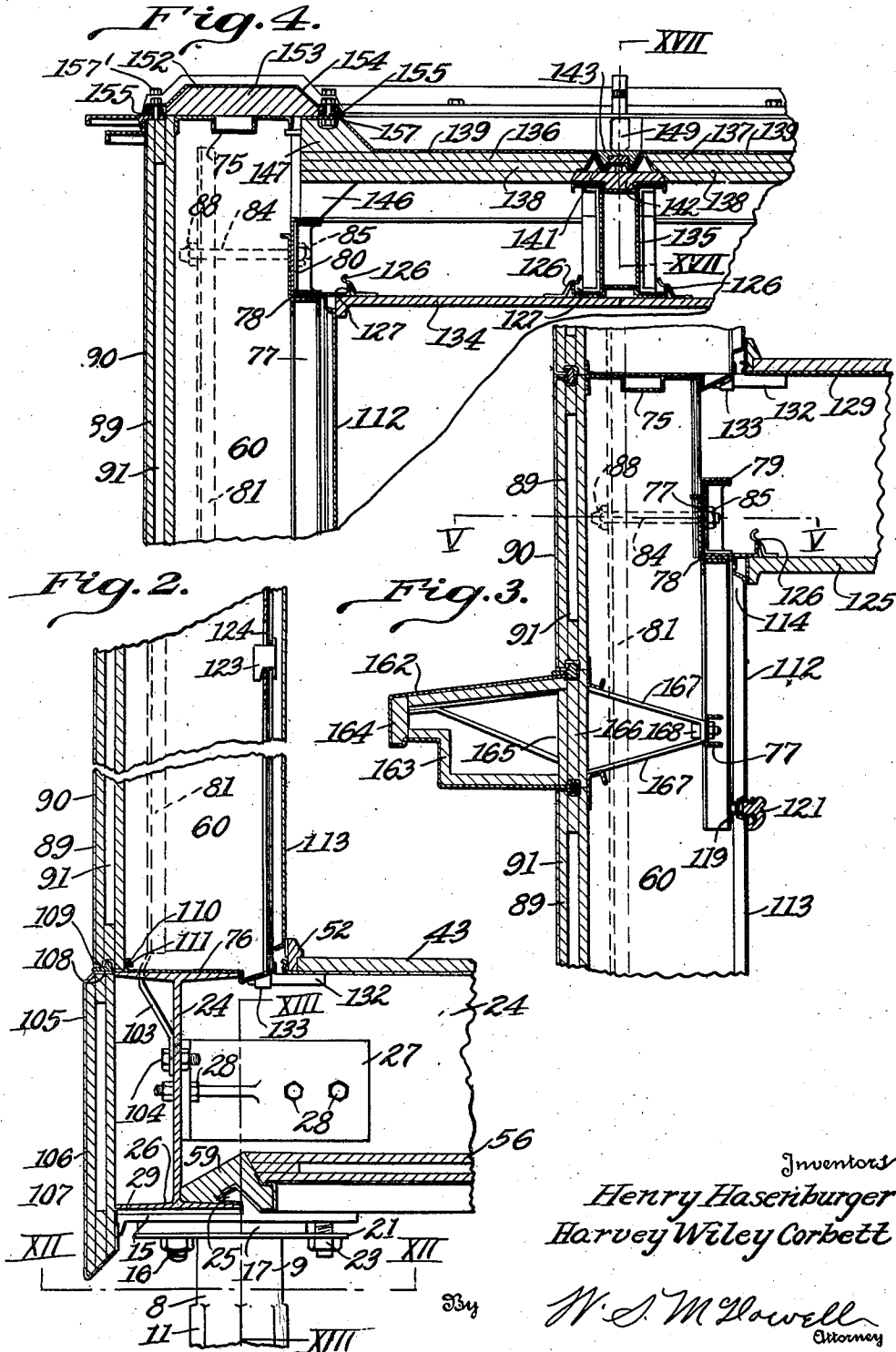
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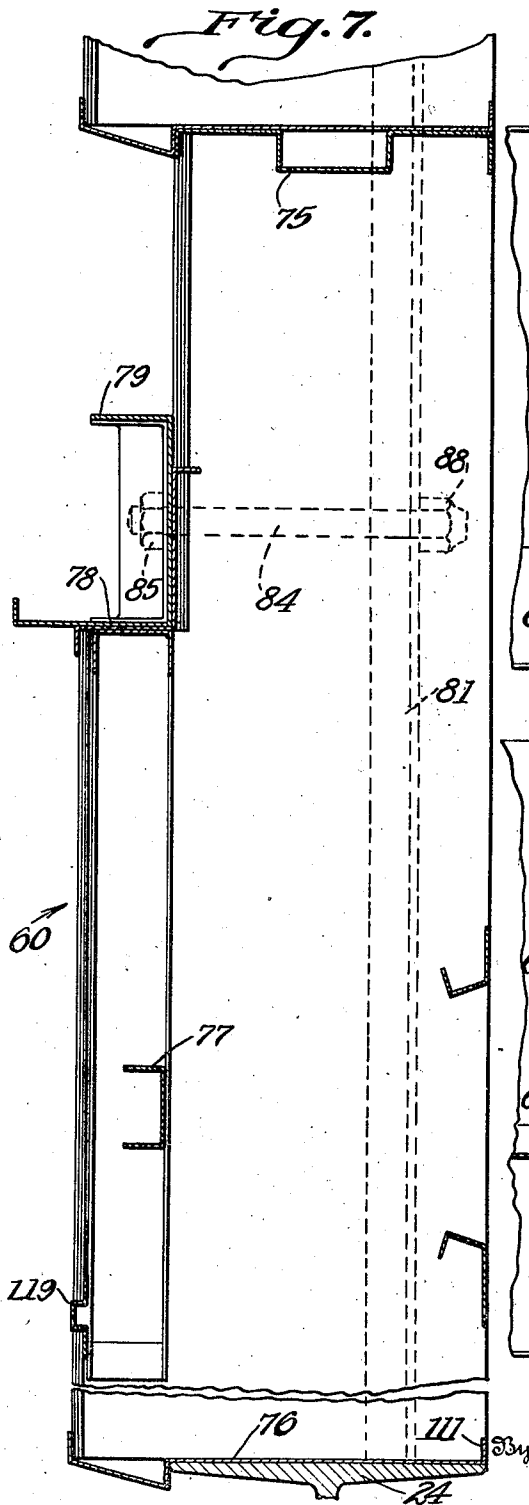
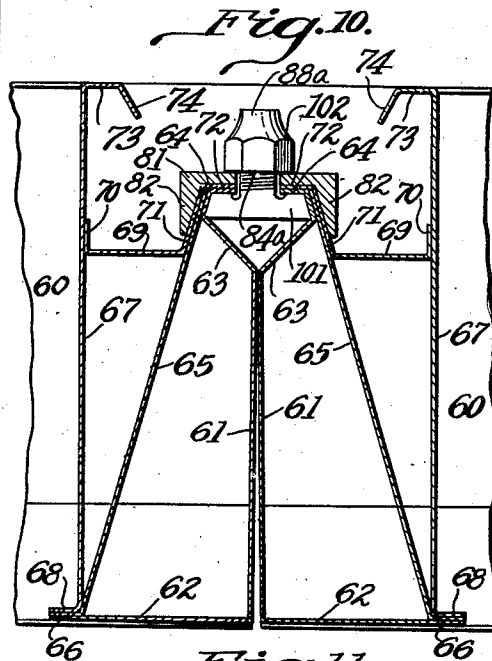
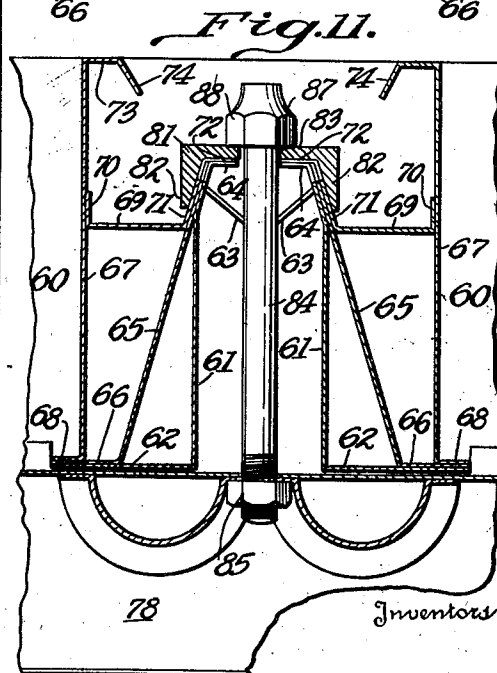
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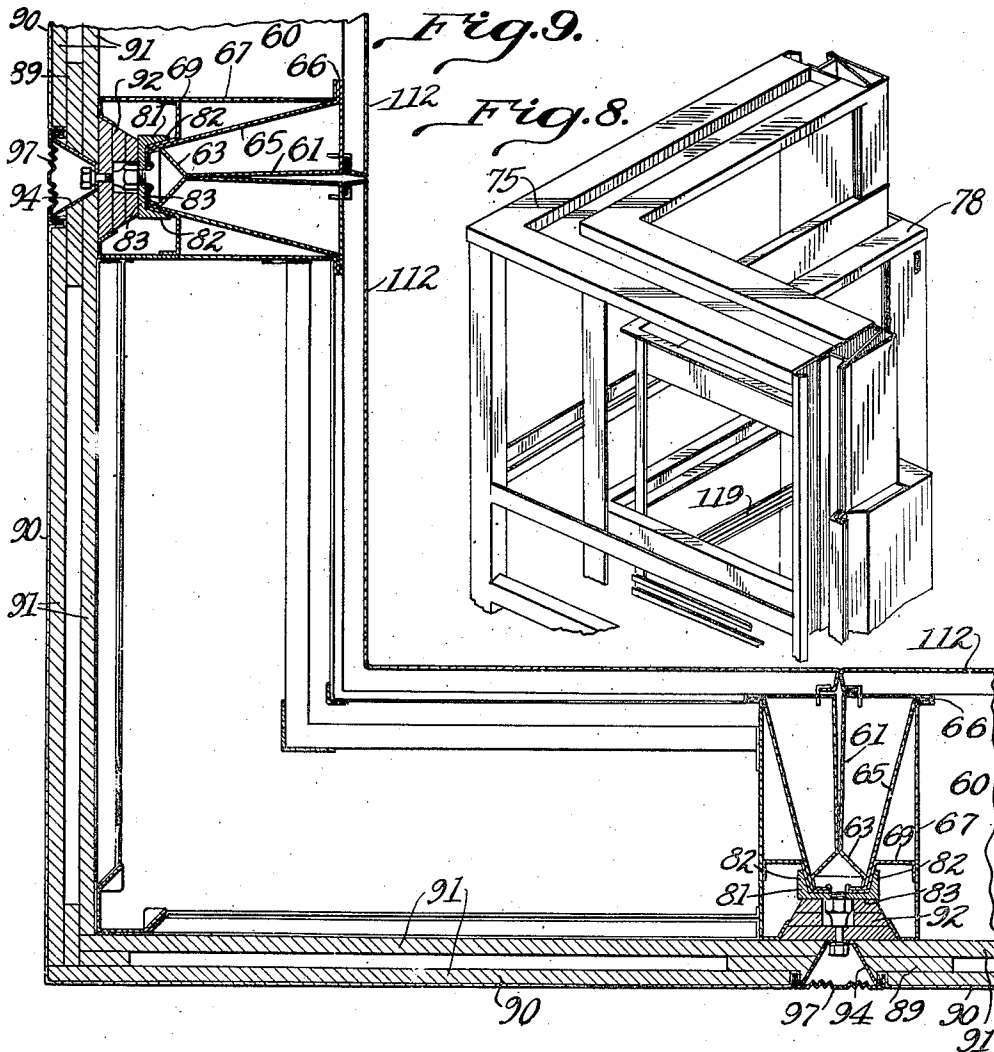
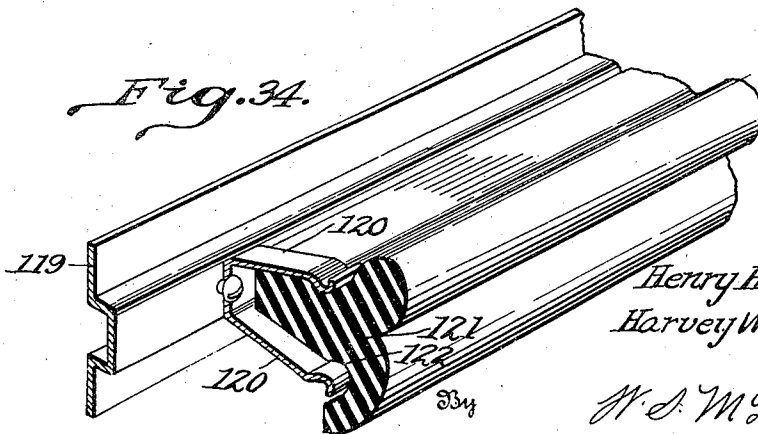
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Fig. 13.

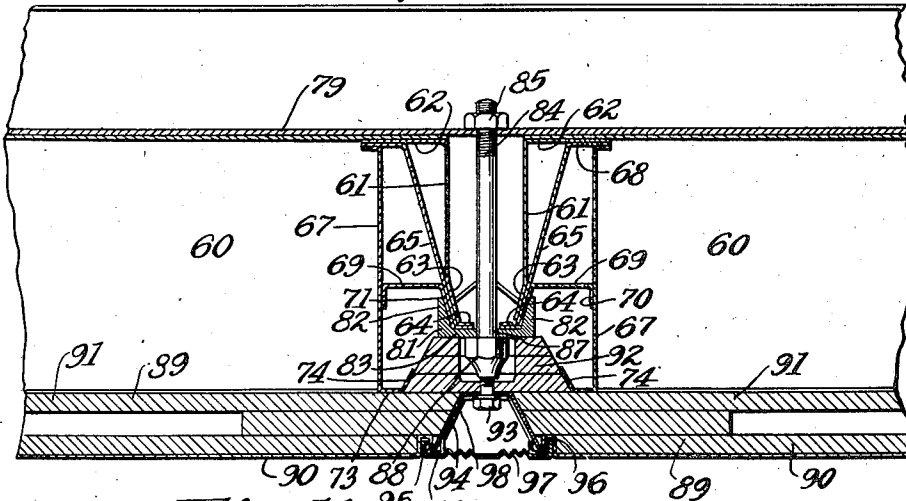


Fig. 14.

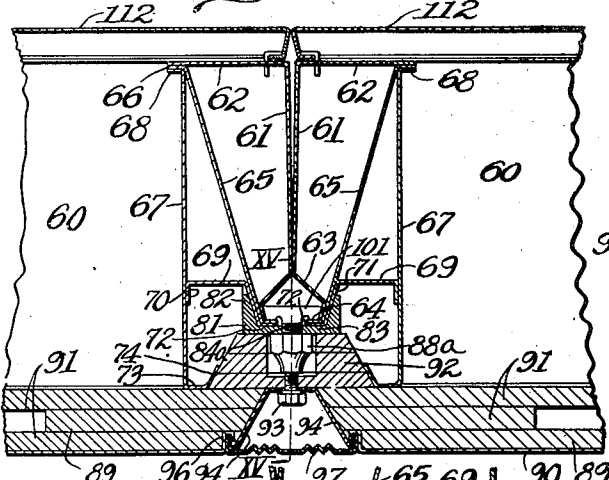


Fig. 15.

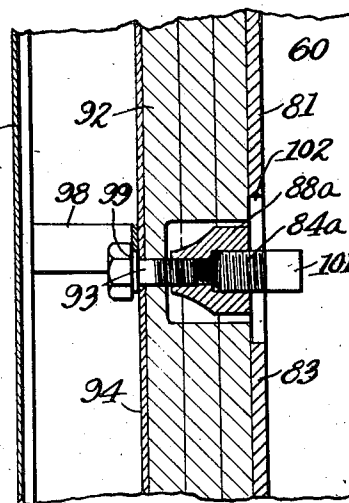
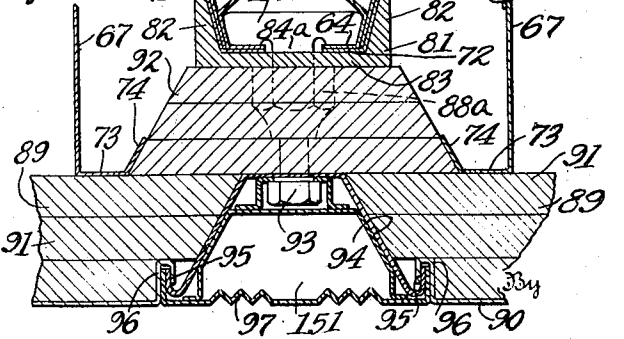


Fig. 16.



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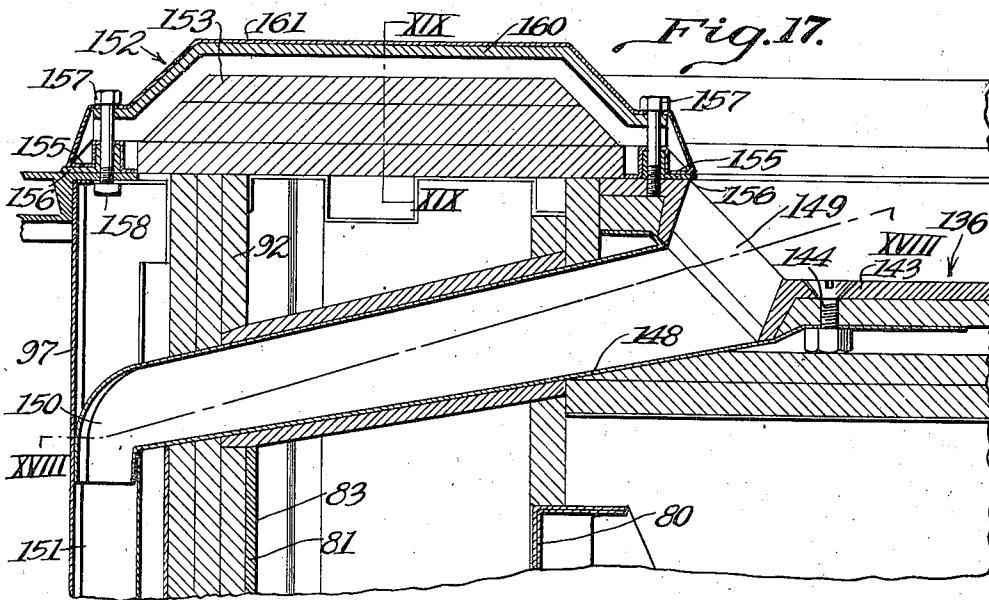
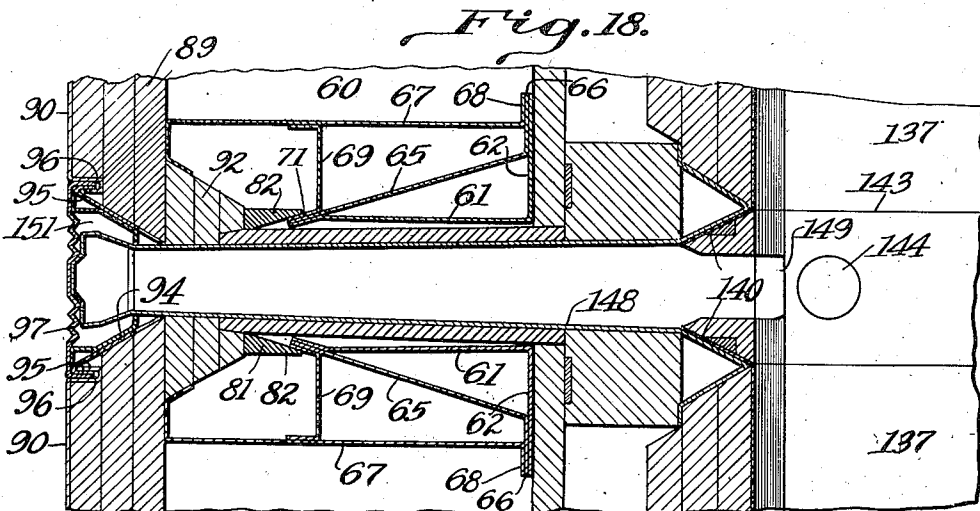
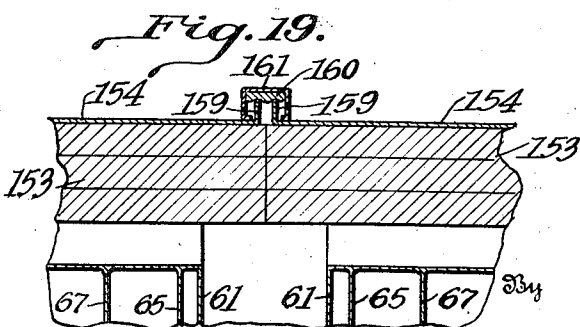
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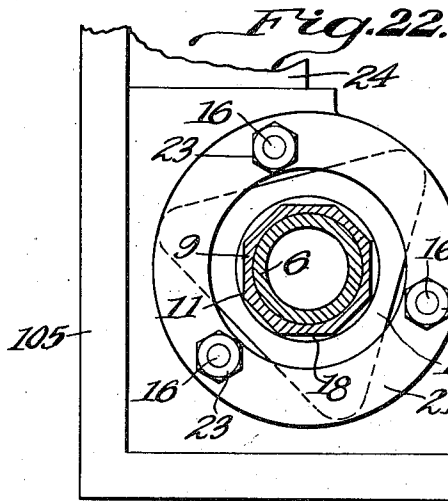
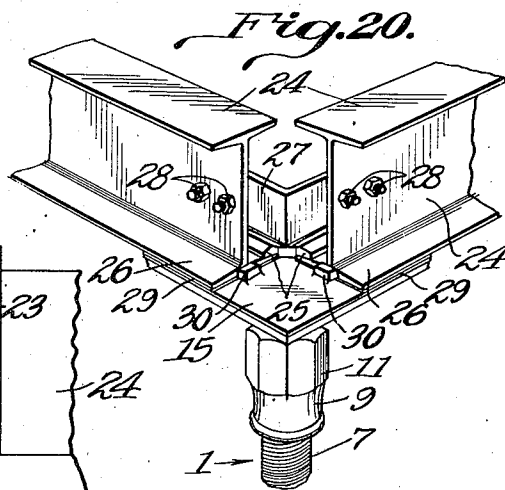
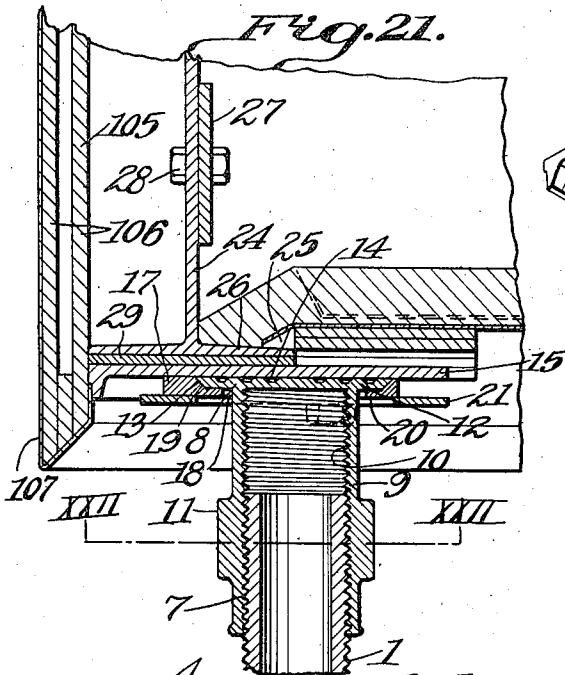
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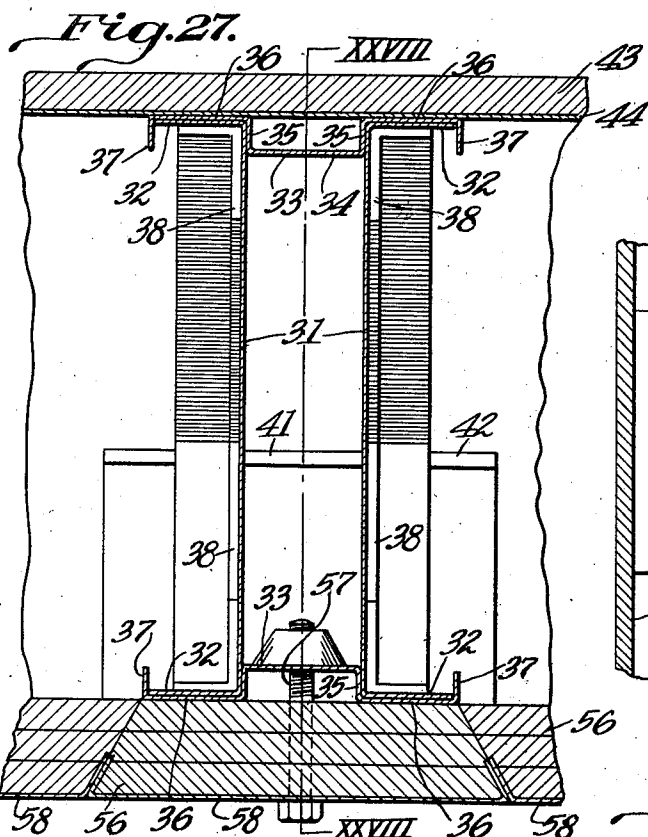
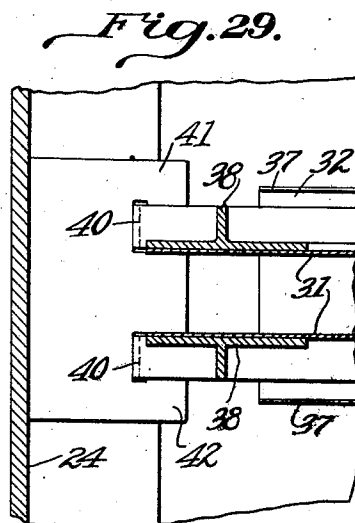
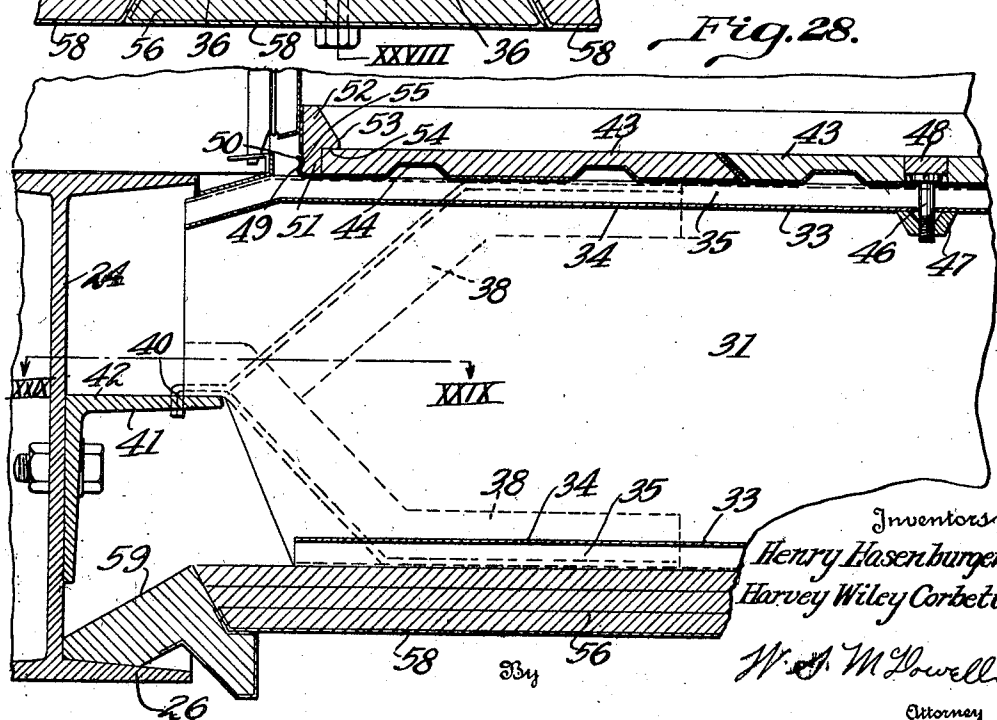
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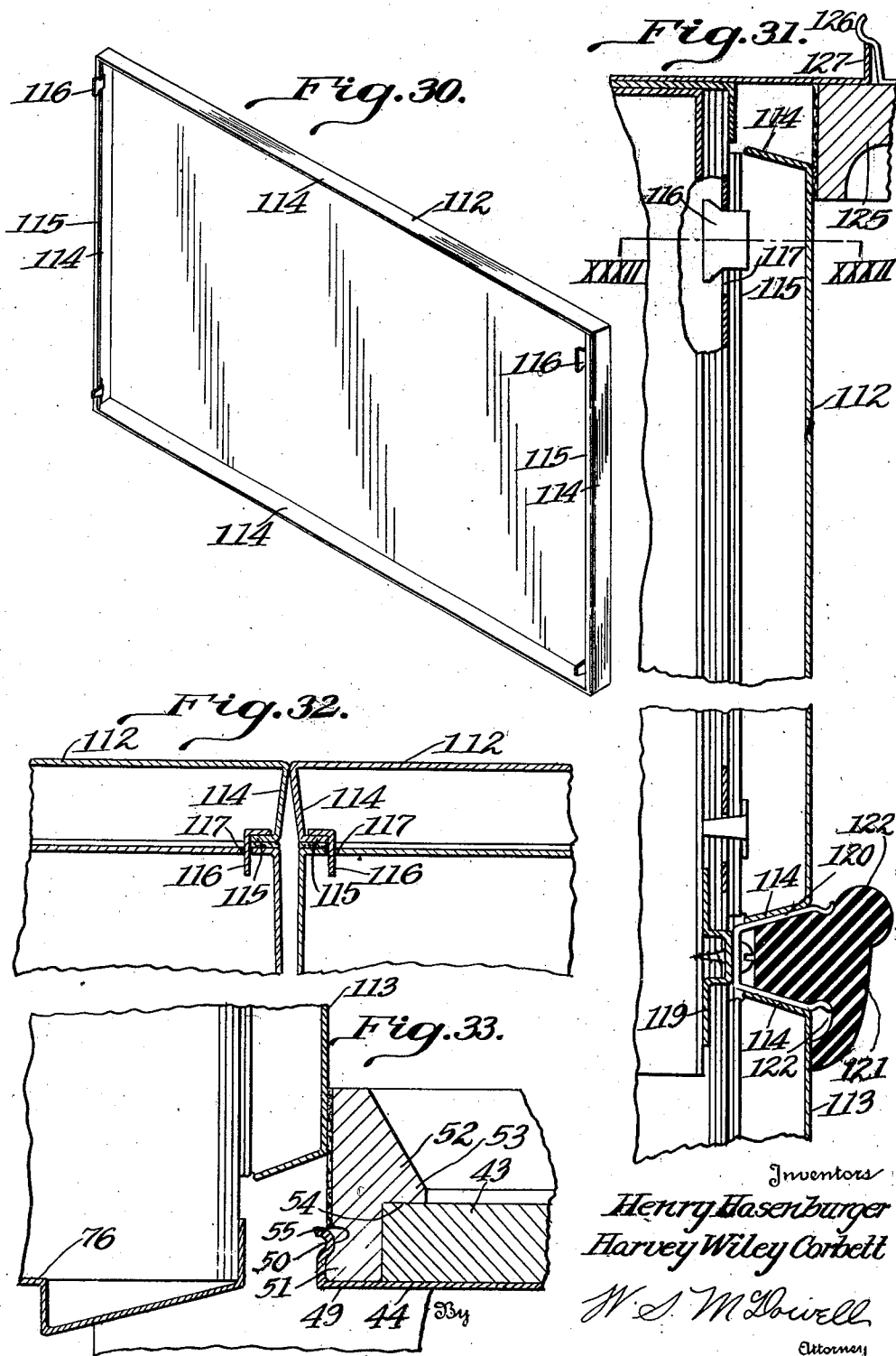
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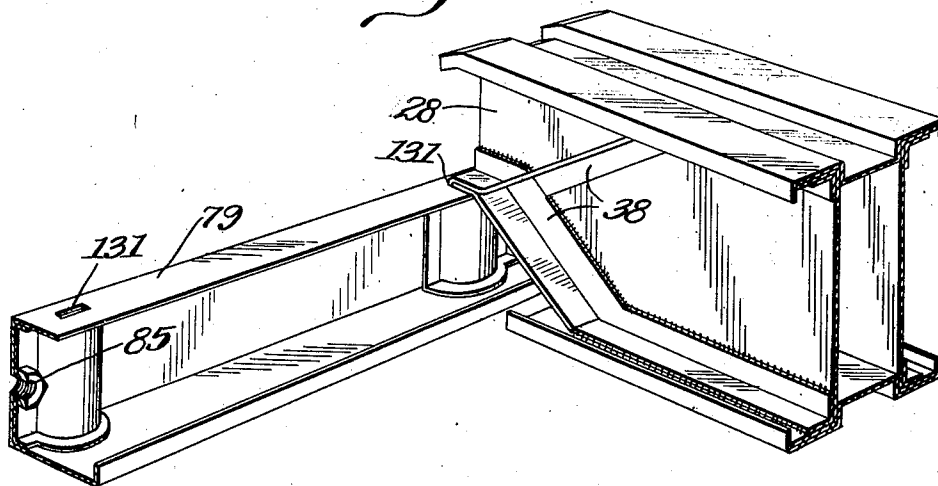
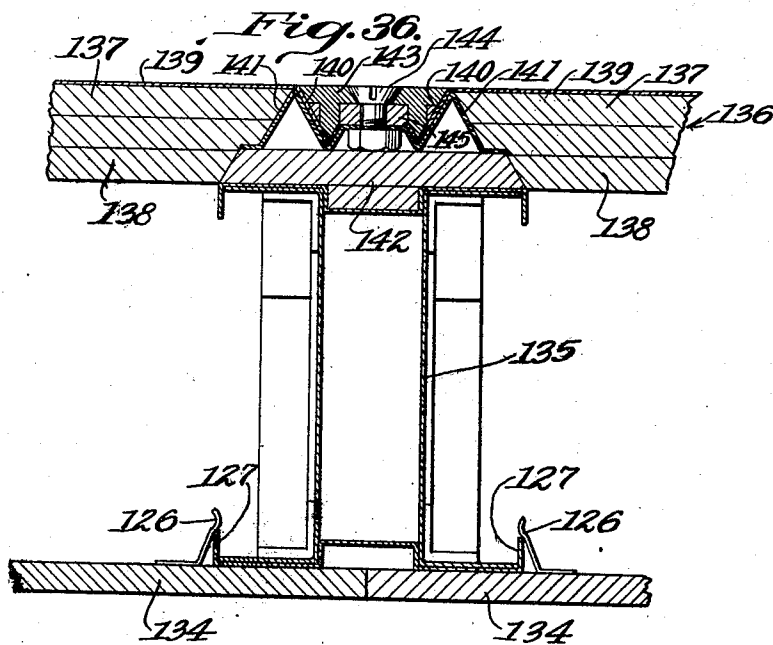
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*Fig. 35.*



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## UNITED STATES PATENT OFFICE

2,309,451

## METALLIC HOUSING CONSTRUCTION

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Application October 24, 1939, Serial No. 300,950

7 Claims. (Cl. 189—1)

This invention relates to prefabricated building construction, and has for its general object the provision of an improved residential building wherein the walls, floors, roof and associated supporting members are composed of prefabricated standardized parts, so designed that they may be readily assembled at the time of the erection of the building to cause the latter to possess a strong unitary construction, an attractive appearance and economical to produce and maintain.

The advantages of erecting buildings from standardized units of prefabricated construction have long been recognized in the industry, particularly from a standpoint of economy. However, systems and constructions hitherto proposed, and to some extent utilized practically, have been characterized by such basically crude and rudimentary features of design and formation as to render the same useful or adaptable mainly in the construction of small portable buildings such as garages, industrial plants and in some instances small residences where constructional economy is of primary importance.

The present invention is readily distinguished from such prior efforts in prefabricated building construction by its provision of novel and improved fabricated building units from which comfortable, complete and beautiful residential buildings may be constructed, the latter having all of the essential details of construction and ornamentation by which modern residences are rendered comfortable and satisfying in both a physical and esthetic sense to the occupants thereof.

Briefly, therefore, it is the aim of the present invention to provide an essentially new type of modern residential building of improved construction and appearance, possessing strong durable wall, floor and roof construction which provide insulation against heat transmission through all of the exterior walls of the building, also further providing constructional units which are interchangeable and of standardized dimensions and design in order to obtain economy in manufacturing and erection costs over traditional types of buildings, and to obtain diversity in external configuration and prolonged life of the building proper.

For a complete understanding of the novel constructional features of the improved building comprising the present invention, reference is to be had to the following description and the accompanying drawings, wherein:

Fig. 1 is a sectional perspective view disclosing the floor, side wall and roof construction of

a residence building formed in accordance with the present invention;

Fig. 2 is a detailed vertical sectional view taken through one of the lower girts of the building and disclosing one of the frame units mounted thereon;

Fig. 3 is a similar view taken through the wall frame units in the region of the second floor girts;

Fig. 4 is a vertical sectional view taken through the roof construction of the building;

Fig. 5 is a perspective view of one of the wall frame units;

Fig. 6 is a front elevation, on a reduced scale, of the frame unit shown in Fig. 5;

Fig. 7 is a vertical transverse sectional view of the wall frame unit in assembled relationship with the first and second floor girts and a superposed wall frame;

Fig. 8 is a perspective view of the upper portion of a wall frame unit used at a corner of the building;

Fig. 9 is a horizontal sectional view of the corner wall frame unit shown in Fig. 8 in assembled relationship with adjoining wall units;

Fig. 10 is a horizontal sectional view illustrating the side edges of two adjoining wall frames clamped together at a point between the girts;

Fig. 11 is a similar view at the location of one of the upper girts;

Fig. 12 is a vertical sectional view of the lower end of a wall frame unit and shows the connection between a channel shaped locking rail used in clamping the wall sections together and the foundation girt;

Fig. 13 is a horizontal sectional view disclosing the clamping means for securing the adjoining vertical sides of adjacent wall frame units and exterior finish units wherein the clamping means for the finish units is secured to one of the girt-carried stay bolts;

Fig. 14 is a similar view taken through a pair of adjoining wall frame units together with the exterior finish units and disclosing the construction and arrangement of the intermediate clamping bolts;

Fig. 15 is a detail vertical sectional view on the plane indicated by the line XV—XV of Fig. 14;

Fig. 16 is an enlarged sectional view disclosing a downspout in one of the vertical grooves formed between a pair of adjacent wall frame units and their exterior heat insulating walls;

Fig. 17 is a detail vertical sectional view disclosing the roof construction, the coping, the wall frame units and the outlet conduits for con-

ducting moisture from the roof to a downspout;

Fig. 18 is a horizontal sectional view on the line XVIII—XVIII of Fig. 17;

Fig. 19 is a detail vertical sectional view on the line XIX—XIX of Fig. 17;

Fig. 20 is a perspective view of one of the foundation columns or piers, used in effecting the support of the building, with a pair of lower girts positioned thereon;

Fig. 21 is a vertical sectional view taken through the foundation column or pier shown in Fig. 19;

Fig. 22 is a sectional view on the line XXII—XXII of Fig. 21;

Fig. 23 is a perspective view of the chair plate for the reception of the lower floor girts;

Fig. 24 is a detail perspective view of the adjustable shoe carried by the foundation pier or column;

Fig. 25 is a similar view of the filler plate;

Fig. 26 is a detail perspective view of the clamping ring;

Fig. 27 is a vertical transverse sectional view taken through one of the pressed steel floor joists or beams;

Fig. 28 is a vertical longitudinal sectional view on the line XXVIII—XXVIII of Fig. 27;

Fig. 29 is a horizontal sectional view on the line XXIX—XXIX of Fig. 28;

Fig. 30 is a perspective view of the inner side of one of the panels used in finishing the interior of the building walls;

Fig. 31 is a vertical sectional view showing the interior finish plate in position together with the mechanism used to secure it in place;

Fig. 32 is a horizontal sectional view through the side edges of two adjoining panels, the plane of the section being indicated by the line XXXII—XXXII of Fig. 31;

Fig. 33 is a vertical sectional view illustrating the lower end of an interior wall finishing panel in applied position;

Fig. 34 is a sectional perspective view of a molding used to lock the interior finish panels in place and to conceal the space between upper and lower panels;

Fig. 35 is a sectional perspective view illustrating one of the upper floor girts with a pressed steel beam in position thereon;

Fig. 36 is a typical vertical sectional view through a joint between two adjoining roof strips.

Referring more particularly to the drawings, the assembled prefabricated building, comprising the present invention, is supported by appropriately spaced foundation members in the form of adjustable columns 1 preferably located at the corners of the building. These columns are so arranged as to effect the support of the building at an appropriate distance above the ground level with the view of dispensing with the usual cellar or basement excavations generally used in residence construction.

Each of the columns or piers 1 comprises a base plate 2 which is adapted to be buried in the ground or soil 3 on the building site at a suitable depth to provide for stability or, in colder climates, protection from freezing or frost. If desired, the said columns or piers may have their lower ends embedded in concrete base blocks, as indicated at 4, to provide for additional strength and stability. Arising from each of the base plates 2 is a sleeve 5 having a flanged lower end, which is suitably joined with the base plate 2, as by welding. Threadedly positioned within the

sleeve 5 is an upstanding pipe member 6, which extends above the ground line of the building site and has its upper end externally threaded, as indicated at 7.

Mounted for vertical adjustment on the threaded upper ends of each of the pipe members 6 is a pier shoe or cap 8. Each of these caps is formed to include a tubular depending extension 9 which is internally threaded as at 10 for cooperation with the threads 7 of the associated pipe member 6. Externally, the extension 9 is formed with wrench-receiving surfaces 11, by which convenient adjustment of the pier shoe or cap 8 vertically on its supporting pipe member 6 may be readily effected after the piers have been set. The upper end of the pier shoe or cap 8 includes a horizontally disposed disk-shaped shoe 12 of greater diameter than the extension 9, said shoe being provided with a beveled annular outer surface 13, the upper surface of the shoe 12 being formed with a plurality of concentric, circularly arranged lubricant receiving grooves 14.

Resting on the disk shoe 12 is a substantially rectangular chair plate 15 which is formed with a plurality of spaced depending threaded studs 16. These studs are spaced to receive between them the sides of a triangular filler plate 17, which is formed with a central opening 18 for the reception of the head 9. The walls of the opening 18 are beveled as at 19 for cooperation with the beveled outer surface 13 of the disk shoe 12 and is additionally formed with an inwardly projecting annular flange 20 acting as a seat for the under surface of the peripheral portion of the shoe 12. Engaging with the under side of the plate 17 is a ring 21, which is formed with openings 22 through which pass the lower ends of the studs 16. Clamping nuts 23 are adjustably carried by the lower ends of the studs 16 and when in their tightened positions bind the chair plate 15 in desired positions of adjustment on the upper ends of the piers or foundation columns 1. By this construction, the chair plate 15 may be turned axially on the thread 8 to a distance limited by the contacting of the studs 16 with the triangular sides of the plate 17.

The nuts 23, when tightened, hold the chair plate in its desired operative positions on the top of its supporting column. The adjustment of the chair plate with respect to the column enables the same to be adapted to alignment irregularities in the positioning of girts 24, comprising structural I-beams, on the chair plates.

These girts extend longitudinally of and beneath the walls of the building in conformity with building outline configurations. That is, if the building is square or rectangular, the girts are arranged in that order, or if the building possesses wings or extensions, the girts are arranged accordingly. The columns 1 and the adjustable chair plates are disposed to unite a pair of adjoining girts, or may be used immediately of the length of the girts to support and strengthen the same intermediately of their length. Each of the chair plates is provided with one or more overhanging lips 25, the latter being adapted to receive and control the positioning of the lower flanges 26 of said girts, the lips being so positioned as to contact with the outer edge of such a flange to prevent undue shifting movement of the girts on the chairs.

When the chair plate is arranged at the corner of a building to provide support for a pair of girts arranged at right angles to each other,

the lips 25 are correspondingly disposed in order to engage with the inner lower flange edges of the adjoining girts. Such right angular girts are united together against relative displacement by the provision of angular brackets 27, which are bolted as at 28 to the webs of the adjoining girts. Preferably, the base flanges of said girts rest upon strips 29 of insulation, such as a rubber composition, preventing metal to metal contact between the base flanges of said girts and the chair plates, whereby to minimize the transmission of heat or cold from the outside to the interior of the building construction. The corner chair plates are also formed with stop lugs 30, which engage with the ends of the girts to limit longitudinal sliding movement thereof, the said lugs serving as positioning members. Due to the adjustability of the chair plates on the upper ends of the foundation columns, convenience is to be had in the matter of placing the girts on the column posts and in effecting proper alignment and registration between adjoining or complementary girt members. The adjustability of the column posts in vertical directions provides for facility in the matter of positioning the girts in true horizontal planes. By this construction, a strong foundation is provided for the erection of the prefabricated building and moreover, the construction is capable of being conveniently set in a quick labor-saving manner.

The first floor construction comprises a plurality of pressed steel supporting joists. Each of these joists is formed to include a pair of transversely spaced vertically disposed channel plates 31—31 which terminate at their upper and lower edges in outwardly turned horizontally extending flanges 32. Longitudinally extending spacing strips 33 are employed to unite the upper and lower portions of the plates 31, and each of these spacing strips is formed to include a horizontal web 34 which terminates at its edges in right angular extending portions 35 which engage directly with the inner faces of the plates 31. The portions 35 terminate in horizontally extending seats 36 offset from the horizontal plane of the web 34, the seats 36 being directly engaged with the outer surfaces of the flanges 32 of the plates 31 and preferably welded or otherwise joined therewith, in order that in combination with the plates 31, the strips 33 will form a unitary hollow steel joist of desired mechanical strength, lightness in weight and of economical design. The outer edges of the seats 36 terminate in vertically disposed short flanges 37.

To secure these hollow pressed steel floor joists at their ends to the girts 24, angle brackets 38 are welded to the outer surfaces of the plates 31 and the flanges 32 at the opposite longitudinal ends of the plates 31. The brackets 38 converge longitudinally to provide hook-shaped extensions 40, which seat upon the outer portion of the horizontally disposed flange 41 of an angular supporting bracket 42, which is bolted or otherwise secured to the web of a girt 24. It will be understood that a bracket 42 is carried by the girts 24 in registration with each end of the hollow pressed steel joists. The flanges 41 of said brackets may be provided with openings for the reception of the down-turned portion of the extension 40 in order to hold the joists against accidental displacement when connected with a support by the girts.

The flooring comprises lengths of wood, composition substances, or other desired material suitable in the formation of floors with due re-

gard to mechanical strength and decorative appearance. A molded material having a hard smooth upper surface is considered preferable, by reason of its improved wearing properties, appearance, fire resistance and manufacturing convenience, although, as explained, other materials may be used. These lengths or strips of floor material, indicated at 43, extend at right angles to the hollow joists and have their lower surfaces and beveled side edges covered by a metallic facing 44, the latter resting directly on the upper flanges of the joists. The adjoining edges of the floor strips are beveled in order that alternate strips may be used as locking strips for holding the floor down upon the supporting joists and in secured relationship with the latter. The fastening strips are formed at appropriate longitudinal intervals with openings providing for the insertion of headed bolts 46, and the threaded shanks of these bolts are received within stationary nuts 47 carried by the under surfaces of the webs 34 of the joist spacers 33. Following the fastening of the bolts 46, the upper ends of the openings in the locking strips of the floor are closed by means of removable plugs 48, the latter constituting finish inserts and preclude any unevenness or interruption in the upper finished surface of the floor.

At the marginal edges of the floor, the facing 44 is extended and provided with an up-turned resilient flange 49 provided with a lip 50. Between the flange 49 and the adjoining floor strip, there is inserted the reduced lower portion 51 of a base mold 52, also formed from a molded plastic, and which strips may be provided with conduits for the reception of electric wiring and outlet receptacles. The mold is provided with an overhanging bevel extension 53 formed with a shoulder 54 which contacts with the upper surface of the floor strips along wall margins in such manner as to conceal joints and produce a finished appearance. The base mold is retained in its operative position by having a socket 55 formed therein in which the resilient lip 50 of the flange 49 is removably received. This construction permits the base mold to be readily inserted in its operative position and securely fastened therein by a simple operation.

To afford improved insulation for the building, there is secured to the under sides of the first floor joists molded strips of a cellular or fibrous heat insulating material 56. These strips are preferably of a light weight material such as highly cellulated clay, mineral wool or cellulose fibers, suitably molded or otherwise formed to present strips having beveled side edges. These insulating strips are retained in position by connecting alternating strips thereof by means of bolts 57 which have their threaded shanks received within stationary nuts carried by the lower spacers of the hollow joists. The under surfaces of the strips 56 may be provided with a metallic facing material 58. The strips when fastened in place are positively retained against displacement and present a horizontally extending, fireproof wall which protects the metallic joists and girders from the elements and insulates in an effective manner the bottom of the building. The opposite longitudinal ends of the strips 56 are beveled for engagement with a corresponding beveled surface of a girt carried insulating strip 59, the latter being supported in connection with the base flange of the girt on which it rests and the construction of the strip 59 is such that it is positively held in its

operative position when the complementary strips 56 are united, as aforesaid, with the lower portions of the floor joists. By this arrangement, the first floor of the building and its supporting joists are enclosed within the confines of heat-insulating walls, all of which are readily susceptible to factory production operations so that nothing more than mere assembly thereof is required during the erection of the building.

The wall construction of the prefabricated building constituting the present invention comprises a plurality of interchangeable load-bearing wall units adapted to be arranged side by side in vertical order. Each of these wall units is of one story height, of ordinary wall thickness and in width is based on a module of 20' or any suitable multiple thereof. Each wall unit, designated generally by the numeral 60, comprises a rectangular metallic frame composed of pressed steel sections. The vertical side stiles of said wall units comprise a sheet metal plate 61 extending transversely of the frame unit and terminating in a back section 62 disposed at right angles to the main body portion of the plate 61. The forward end of the plate 61 includes an inwardly and angularly bent part 63 which terminates in an angular extension 64. Bracing the plate 61 is a diagonally extending reinforcing plate 65, which has its forward edge welded or otherwise joined with the extension 64 of the plate 61. The rear edge of the reinforcing plate 65 is flanged as at 66 to lie flush with the back section 62 of the plate 61 and to which it is welded. Also forming a part of the stile construction of each wall frame is an inner plate 67, which has its inner end flanged as at 68 and welded or otherwise joined with the flange 66 and the back section 62. The inner plate 67 is joined with the diagonal 65 by means of a vertical webbing 69, the said web having a flange 70 which is welded to the inner plate 67 and an angular forward extension or tongue 71 which lies flush with the diagonal 65 and is welded thereto. The outer end of the tongue 71 terminates in a vertical flange 72 which is welded to the flange outer end of the extension 64. This hollow stile construction of welded pressed steel members is arranged at each of the vertical sides of a standard wall unit, providing a load sustaining structure of all requisite mechanical strength and also a construction providing for the convenient assembly and locking together of the adjoining edges of adjacent wall units. The inner plate 67 projects forwardly some distance beyond the vertical plane of the flange 72, as shown in Figs. 5, 10, 11, 13, 14 and 16, and terminates in a vertical longitudinally extending web 73 which, in turn, terminates in an angular and inwardly extending flange 74, the purpose of which will be hereinafter explained.

The side stiles having the horizontal cross sectional configuration described, are united by top and bottom horizontally extending rails 75 and 76, respectively, also of pressed metal construction, which are suitably welded to the side stiles to produce a unitary substantially rectangular frame construction, reinforcing mullions or braces 77 also extend transversely of the wall frames or units. Near their upper end, each of the wall frames or units has the back thereof recessed and shouldered as at 78 across its full width for the reception of second floor and roof girts 79 and 80 respectively. These girts are also preferably formed from pressed steel and are substantially channel-shaped in cross sec-

tion. The girts 79 and 80 are suitably united to form a rigid rectangular frame, or may possess other configurations in accordance with the wall design and arrangement of the building.

The wall frames or units are relatively secured along their vertical adjoining edges and united with the girts 24, 79 and 80 by means of channel-shaped lock rails 81, which extend the full height of the building. The said lock rails comprise structural steel members which have spaced flanges 82—82 and a connecting web 83, the inner surfaces of the flanges 82 being beveled to correspond with the angularity of the securing extensions or tongues formed by the members 63, 65 and 71, while the portions 64 and 72 of the side stiles of said wall units engage with the inner surface of the locking rail web 83.

To hold these vertical lock rails in their operative positions, securing bolts 84 are carried by the girts 24, 79 and 80. These bolts have threaded inner ends which pass through openings in said girts and receive nuts 85 welded on the girts. The shanks of the bolts pass between the adjoining faces of the plates 61, which are suitably spaced in the region of said bolts. The forward ends of the bolts pass between the tongue extensions 64, 71 and 72 of said stiles and project through elongated slots 87 provided in the webs 83 of the lock rails. The outer ends of said bolts are formed with heads 88 which when turned, press the lock rails firmly into securing engagement with the tongue extensions of the wall unit stiles.

Panels 89 of a heat insulating material cover each of the wall forming frames at the front thereof. These panels may be of any suitable decorative design. In the specific embodiment of the invention illustrated, each of the panels 89 comprises an outer metallic facing 90 of a corrosion resisting metal, and to the inner side of this facing there is secured adjacent layers 91 of any suitable heat insulating material, such as mineral wool, bats of cellulose fibers, cellulated clay or the like. Insert strips 92 of similar insulating material are removably positioned between the lock rails 81 and the inner sides of the insulation 91. The inserts are shaped to be received by the flanges 74 of the side stiles.

To hold the exterior finish sheets or panels in their applied operative positions on the wall frame units, the bolt heads 88 have their outer ends reduced and formed with an axially disposed internally threaded bore in which is received the threaded shank of a bolt 93. The bolts 93 retain in position trough-shaped vertically extending metallic finish strips 94, which space the adjoining edge portions of the insulating panels 89. The strips 94 have their outer longitudinal edges provided with inturned flanges 95 which are received within longitudinally extending grooves 96 formed in the edges of the metallic facing plates 90. Cover strips 97 conceal the strips 94 and their associated fastening devices. The cover strips are readily removable from their applied positions by having the same formed on their inner sides with straps 98 in which are formed notches 99. These notches receive the shanks of the bolts 93 immediately adjacent to the heads of said bolts. The outer ends of the straps 98 terminate in laterally directed tongues 100 which are welded or otherwise secured to the inner face of the cover strips 97.

In addition to the bolts 84, which are connected with the girts, supplemental bolts 84a are provided for the purpose of uniting the adjoining ver-

tical edge portions of the wall frames and the exterior removable panels thereof. The bolts 84a are provided with relatively narrow T-shaped heads 101 which are of such configuration that they may be inserted through slots 102 in the lock rails 81 and then by turning the bolts axially for a quarter of a turn, the heads 101 will engage with the tongues 64 and 72 so that the bolts can not be pulled outwardly when so applied. The bolts 84a are also provided with nuts 88a and co-

operate with the additional registering bolts 93. The construction described provides for the production of a strong compact wall composed of a plurality of light interchangeable load-bearing wall frames which are arranged side by side in vertical order between the girts 24, 79 and 80. The adjoining sides of the wall frames are inwardly recessed to produce the tongue extensions formed by the members 63, 64, 71 and 72, which are adapted to be firmly united by the lock rails extending substantially the full height of the building.

The lock rails are joined to the girts by the bolts 84, holding the wall frames together, and this action is supplemented by the bolts 84a, which are arranged at intervals between the bolts 84. The construction lends itself readily to convenience in assembly and economy in manufacture. The lower ends of the lock rails contiguous to the girts 24, are provided with downwardly directed straps 103 which at their lower ends are bolted as at 104 to the webs of the girts 24. The exterior facing sheets or panels rest at their lower edges on the upper and outer flanges of the girts 24, and skirt panels 105 are arranged below the exterior facing panels in order to cover and protect the foundation members of which the girts 24 form a part. The skirt panels include layers of heat insulating material, as indicated at 106, and an exterior facing sheet 107. Each of these sheets has its upper end inwardly flanged as at 108 to engage with the top flange of the girts 24 and contacting with the lower edges of the panels 89, a compressible packing 109 being interposed between the adjacent surfaces of the panels 89 and 105. The flange 108 of each skirt panel 105 is provided with hook extensions 110 arranged for engagement with an upstanding flange 111 formed in connection with the bottom rail 76 of the wall frames. It will be observed that by the provision of this wall construction together with the bottom insulation 29, and other features of insulation hereinafter explained, spaces are provided within the building through which gaseous heating or cooling fluids may be circulated for the comfort of the occupants of the building. These spaces also provide for the convenient installation of conduits used for supplying plumbing and electrical facilities. The wall frames in which windows and doors are provided are preferably of double width than the usual wall frame, and at the corners, the wall frames are of angular construction in conformity with the wall planes.

On the inside of the building, room walls are formed by connecting with each of the wall frames a top finish sheet 112 and the bottom interior finish sheet 113. These sheets are stamped from sheet metal and have their inner surfaces suitably finished to produce desired decorative appearances. The top sheet 112 of each wall frame is marginally ribbed as at 114, the said ribs terminating at their outer edges in laterally directed flanges 115. The flanges 115 carry rigid hooks 116, which are receivable within slots 117 formed in the back sections 62 of the plates 61.

When wider wall frames are employed, a pressed steel backing rail is employed, the backing rail extending vertically of the wall frame. Also, the wall frames carry a rigid horizontal backing rail 119 to which is secured at intervals a plurality of resilient clips 120. The spaced resilient arms of these clips, which are of U-shaped form, removably but firmly receive a molding strip 121 preferably of a plastic material, the back of the strip being recessed as at 122 for the reception of the curved outer ends of the resilient arms of the clips 120. The lower flanges or ribs 114 of each of the top sheets 112 rest on the upper arms of the clips 120.

The lower sheets 113 are of substantially the same construction as the top sheets except that they are considerably longer, the width of both sheets being the same. Each of the lower sheets is provided with inwardly extending securing hooks 123 which are removably received within slots 124 provided in vertical members of the wall frames. By this construction, it will be seen that the interior finishing sheets 112 and 113 of the wall frames may be quickly and easily applied to said wall frames without the use of screws, bolts or other similar forms of fastenings. The joints between adjacent sheets are neatly finished so that the erected structure presents a very highly finished appearance. The lower edges of the bottom sheets 113 extend below the base mold 52 and a layer of felt may be inserted between the base mold and the finish surface of the bottom sheet.

The ceiling is formed to comprise a plurality of square shaped sections 125 which have their upper surfaces equipped with resilient clips 126 adapted to be brought into snap engagement with upstanding flanges 127 formed in connection with the girts 79 and pressed steel beams 128 connected with the girts 79. These beams are of substantially the same construction as the beams or joists connected with the lower girts 24 and are used to support the ceiling 125 of the first floor and the floor construction 129 of the second floor, where a multiple story building is provided. The beams 128 are provided at their ends with the angle braces 38 which are receivable within slots 131 provided in connection with the girts 79. The margins of the flooring 129, which, it will be observed, are considerably spaced from the beams 128, are supported, as is the flooring construction of the first floor, by means of wedge braces 132 which have their tapered outer ends positioned in stationary clips 133 connected with the wall frames. This construction may be duplicated to produce a building containing the desired number of stories, the wall frames being placed one upon the other in interfitting relationship and secured to the girts which, in turn, support the floor joists or beams, and the latter supporting the flooring and ceiling constructions. Each wall frame has its exterior provided with the insulating panels and its interior with the top and bottom finish sheets of the type indicated at 112 and 113.

The roof girts 80 rest upon the shouldered or recessed upper edges 78 of the upper rows of wall frames and are secured thereto by the bolts 64. The said roof girts support the second floor ceiling 134, which is a duplicate of the ceiling 125. Also, the roof girts have connected therewith the pressed steel beams or joists 135, which in all essential features of design are duplicates of the lower and second floor beams or joists.

The beams 135 effect the support of a roof 136

composed of a plurality of strips 137 arranged in parallel adjoining order. Each of the strips consists of a body 138 of light weight heat insulating material, such as those described in and forming the members 29 and 89. The bodies 139 are protected along their upper surfaces by metallic sheets 139.

The strips 137 are joined relatively by extending the sheets 139 to include V-shaped extensions 140 which are received within W-shaped metallic strips 141, the latter resting on backing pieces 142 which extend longitudinally of the beams or joists 135. The engagement of the extensions 140 with the strips 141 is maintained by the provision of roof rails 143 which have beveled side walls in conformity with the angularity of the extensions 140. Fastening elements 144 operate to clamp the backing pieces in their secured operative positions, holding the roof strips in their operative positions. The under sides of the roof rail strips 143 may be provided with a compressible packing as indicated at 145. This construction provides readily applied but secure and water-tight means for joining the roof members.

The strips 137 disposed contiguous to the wall frame units have their outer edge portions formed with depending enlargements 146 which rest upon the upper flanges of the girts 89. Also these outer strips 137 have their marginal portions provided with upwardly extending enlargements 147 arranged immediately over the lower enlargements 146, the enlargements 147 serving to somewhat depress the roof surface. Moisture or rainwater is drained from this depressed roof deck by means of outlet conduits 148 which communicate with openings 149 provided in upwardly extending portions of the rails 143. The conduits 148 are arranged at intervals and pass through the adjoining wall frames, the outer ends of said conduits being downwardly bent as at 150 and terminated in registration with the upper ends of down spouts 151, which are located in the channels for the lock rails 81.

Disposed upon the upper portions of the upper row of wall frames is an insulated coping 152. This coping comprises a thick body 153 of thermal insulation which spans and closes the open upper ends of the wall frames. The body 153 is covered and protected by a metallic facing 154 of a non-corrosive metal. This facing is provided with longitudinal marginal flanges 155, formed by bending the material of the facing 154 back upon itself to produce a seat for a packing 156. Securing bolts 157 pass vertically through said packing and have their threaded shanks received within correspondingly threaded openings formed in the enlargements 147 on which the inner longitudinal edges of the coping rests. The bolts 157' at the outer longitudinal edges of the coping have their threaded shanks provided with binding nuts 158 which engage with the under side of one of the wall frame cross members. The coping comprises strips of suitable length, formed as above described, and the abutting ends of these lengths are united by bending the facing material 154 upwardly to produce spaced flanges 159, which are covered by a compressible metallic packing 160, inverted channel-shaped strips 161 cover and protect the packing and at their ends are secured in place by means of the bolts 157 and 157'.

The exterior walls of the wall frames may be provided with a cornice of the type indicated at 162, or any other equivalent type of overhang

projection, whether intended for decorative effects or utilitarian purposes. Thus the overhanging projection may take the form of a porch roof or an awning box or a second story deck porch. As shown, however, the cornice 162 comprises a hollow body of insulation 163 protected by a metallic covering 164 and having its inner end seated within an opening 165 formed in the exterior finish sheets of the wall units or frames. The openings 165 are preferably provided with a packing as indicated at 166. The cornice further includes inwardly extending metallic braces 167 which have their inner ends bolted or otherwise secured as at 168 to the internal bracing of the wall units or frames.

In view of the foregoing, it will be seen that the present invention provides a complete residential building composed primarily of standardized prefabricated steel units by which improved strong light-weight vertical and horizontal walls may be conveniently and securely united in desired assembled relationship at the site of building erection. These units are so disposed and constructed as to effectively withstand the loads and stresses applied thereto and to last indefinitely in the performance of their intended functions. All exposed surfaces of these vertical and horizontal members entering into the construction of the building are readily susceptible of being decoratively finished to produce pleasing effects. The entire building construction may be rendered fireproof and free from the destructive action of insects. The vertical outer walls of the building and the first floor and roof construction are composed of heat insulating materials so that the interior of the building may be readily and economically heated or cooled by standard heating and air conditioning devices now commercially available for residential use. Within the confines of these heat insulating walls, intercommunicating spaces are provided to permit of the free circulation of the gaseous heating or cooling fluids and the room panels or sheets, connected with the inner sides of the wall frames, may be provided with suitably arranged openings or grilles providing for the admission and exit of the atmosphere tempering fluids which are distributed to the different rooms of the building. Also the open spaces provided by the wall frames provide for convenience in the matter of installing and concealing of service conduits, such as those used in the plumbing and electrical wiring of the house. The wall units are firmly and positively held in aligned adjoining order by the provision of the channel-shaped lock rails which serve to tie the wall units together and also to unite the same with the frame girts, producing a firmly joined structure of high mechanical strength.

What is claimed is:

1. In prefabricated building construction, a plurality of substantially hollow rectangular load-sustaining wall units, abutting extensions projecting from the vertical sides of said wall units, said extensions possessing a width less than that of the thickness of said wall units, a channel rail engaging the extensions of adjoining wall units throughout the length of the extensions, headed bolts removably carried by the inner sides of a pair of adjoining extensions, said bolts having the shanks thereof arranged to project through and beyond openings formed in said channel rail, securing nuts removably carried by the outer ends of said bolts and operative to maintain said channel rail in clamping engage-

ment with said extensions, removable outer panels of thermal insulation connected with said wall units, and securing means engageable with said nuts for retaining said insulating panels in connection with said wall units.

2. In prefabricated building construction, a plurality of substantially rectangular, load-sustaining wall units, abutting extensions projecting from the vertical sides of said wall units, said extensions possessing a width less than that of the thickness of said wall units and being provided with tapered surfaces, a channel rail engaging with the tapered surfaces of adjoining extensions throughout the entire length thereof, threaded means for retaining said channel rail in frictional clamping relationship with the tapered surfaces of said extensions, panels of heat insulating material removably connected with the front of each of said wall units, and securing means for said panels cooperative with said threaded means.

3. In a prefabricated building construction, a plurality of hollow substantially rectangular load-sustaining wall units of predetermined dimensions, abutting extensions projecting from the vertical sides of said wall units, said extensions possessing a width less than that of the thickness of said wall units and being provided with tapered surfaces, a channel rail engaging with the tapered surfaces of adjoining extensions throughout the entire length thereof, bolts carried by said extensions and projecting through openings provided in said channel rails, clamping nuts threadably carried by said bolts for maintaining said rail in clamping engagement with said extensions, a panel of heat insulating material removably positioned on the front of each of said wall units, studs projecting outwardly from said nuts, and a securing strip for uniting the adjoining vertical edges of adjacent panels, said securing means being connectible with said studs.

4. In a building wall, a foundation girt, a pair of wall frame units disposed in upright side by side abutting order on said girt, said frame units comprising open rectangular members having spaced vertical side stiles and horizontal connecting bars, said side stiles being formed of inner and outer metallic strips joined to provide tubular portions, the outer strips being narrower than the inner strips to provide longitudinally extending recesses at the sides of said units, flange means formed with said strips and providing lock-rail and insulation-receiving seats, a channel-shaped lock-rail engaging the first of said flanges of said abutting units, means engaging said lock-rail and holding the same in unit-joining position, an insulation strip positioned in engagement with the second set of

flanges, said strip covering said lock-rail, finish panels positioned on the outer sides of said frame units, the edges of said panels overlapping said insulation strip, and securing means for holding said finish panels in applied position, said securing means being engaged with said lock-rail holding means.

5. The structure set forth in claim 4 in combination with means for covering said panel securing means, said covering means being retained by said latter securing means.

6. In a building wall, a foundation girt, a pair of wall frame units disposed in upright side by side abutting order on said girt, said frame units comprising open rectangular members having spaced vertical side stiles and horizontal connecting bars, said side stiles being formed of inner and outer metallic strips joined to provide tubular portions, the outer strips being narrower than the inner strips to provide longitudinally extending recesses at the sides of said units, flange means formed with said strips and providing lock rail and insulation-receiving seats, a channel-shaped lock rail engaging the first of said flanges of said abutting units, means engaging said lock rail and holding the same in unit joining position, an insulation strip positioned in engagement with the second set of flanges, said strip covering said lock rail, exterior finish panels positioned on the outer sides of said frame units, the edges of said panels overlapping said insulation strip, securing means for holding said finish panels in applied positions, said securing means being engaged with said lock rail holding means, and interior finish panel means detachably secured to the inner sides of said frame units.

7. In a building, a wall comprising a plurality of rectangular open frame units arranged side by side in vertical order, longitudinally extending ribs provided on the abutting edges of said units, lock rail members positioned in engagement with a rib of each of adjoining units, means for securing said lock rails in position to prevent separation of said units, a finish panel section disposed on the exterior side of each unit, the side edges of each panel having a longitudinally extending groove, attaching strip means positioned between adjoining panel sections, flange means on said attaching strips, said flanges being disposed in the grooves in said panels, and means connected with said lock rail securing means for retaining said attaching strips in applied positions whereby said finish panels will be held in assembled order with said units.

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