

April 20, 1948.

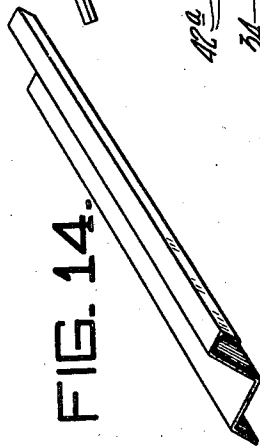
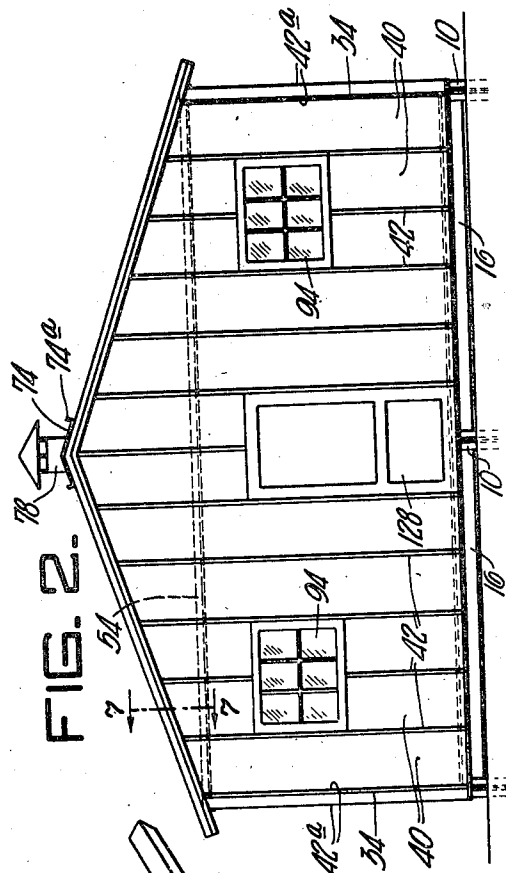
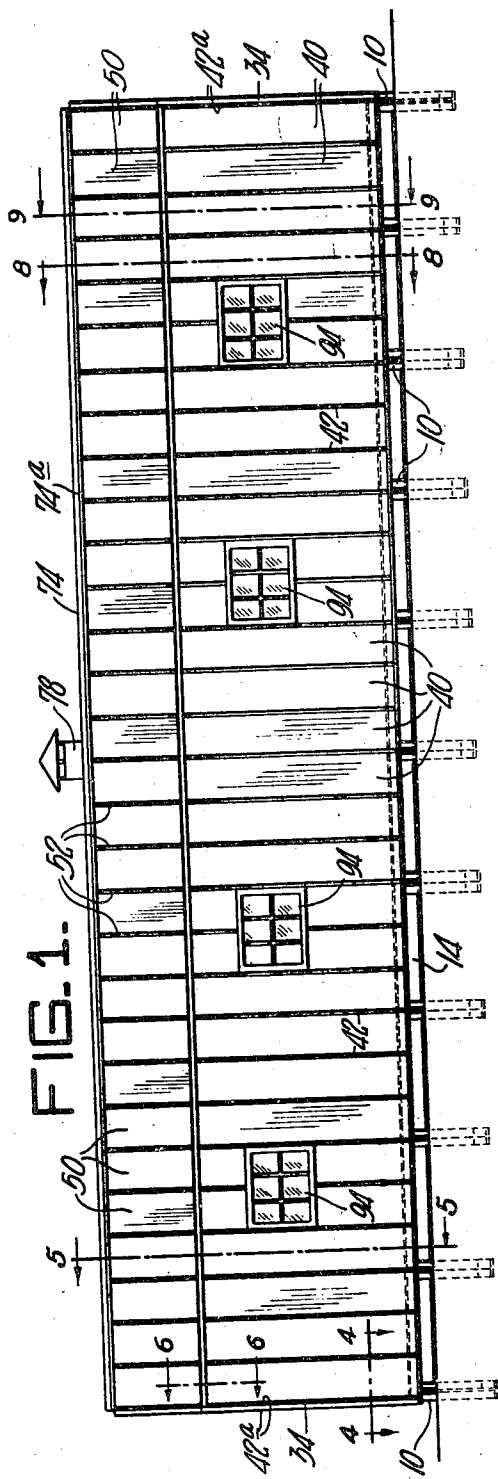
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2,439,960

PREFABRICATED METAL HOUSE CONSTRUCTION

Filed May 3, 1943

5 Sheets-Sheet 1



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April 20, 1948.

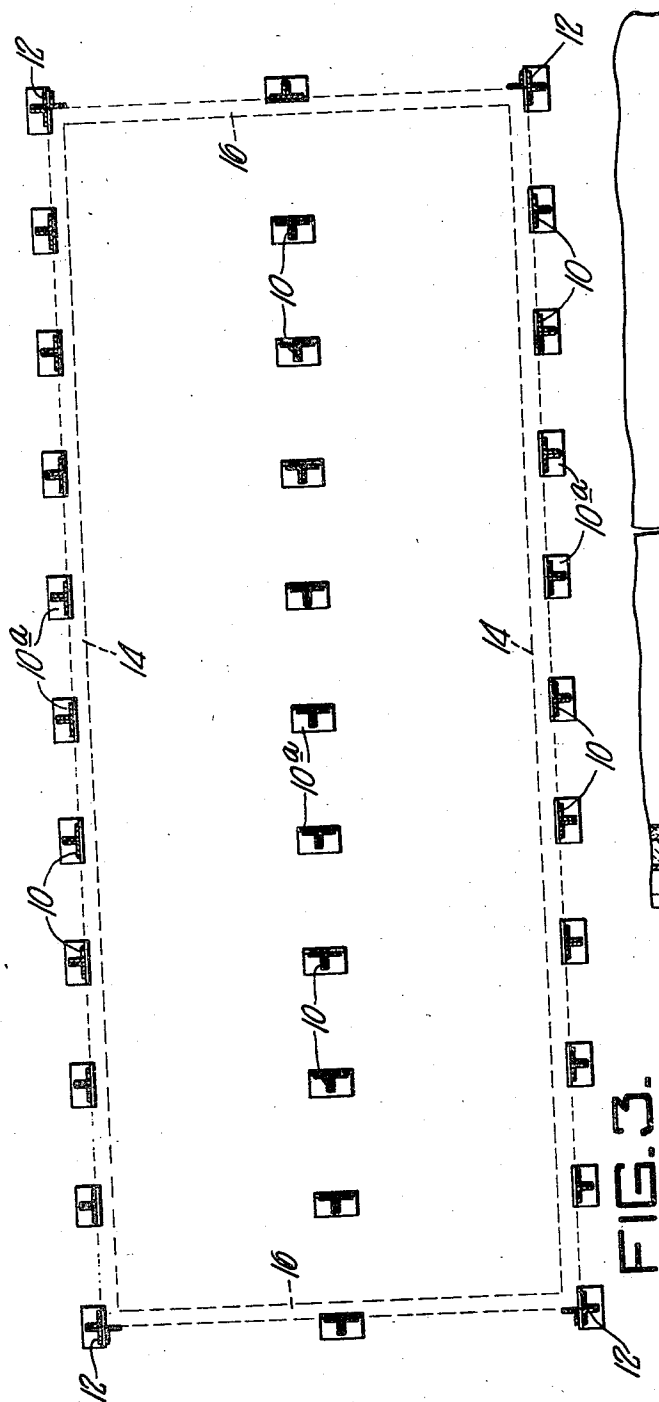
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PREFABRICATED METAL HOUSE CONSTRUCTION

Filed May 3, 1943

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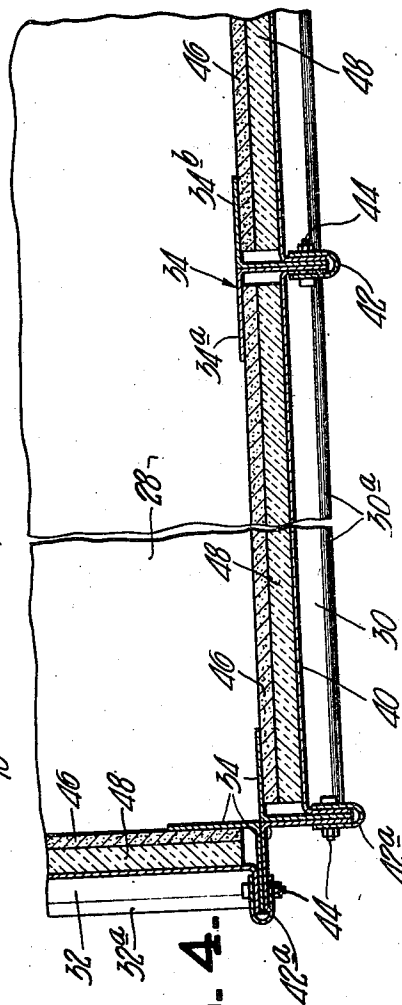


Fig. 4.

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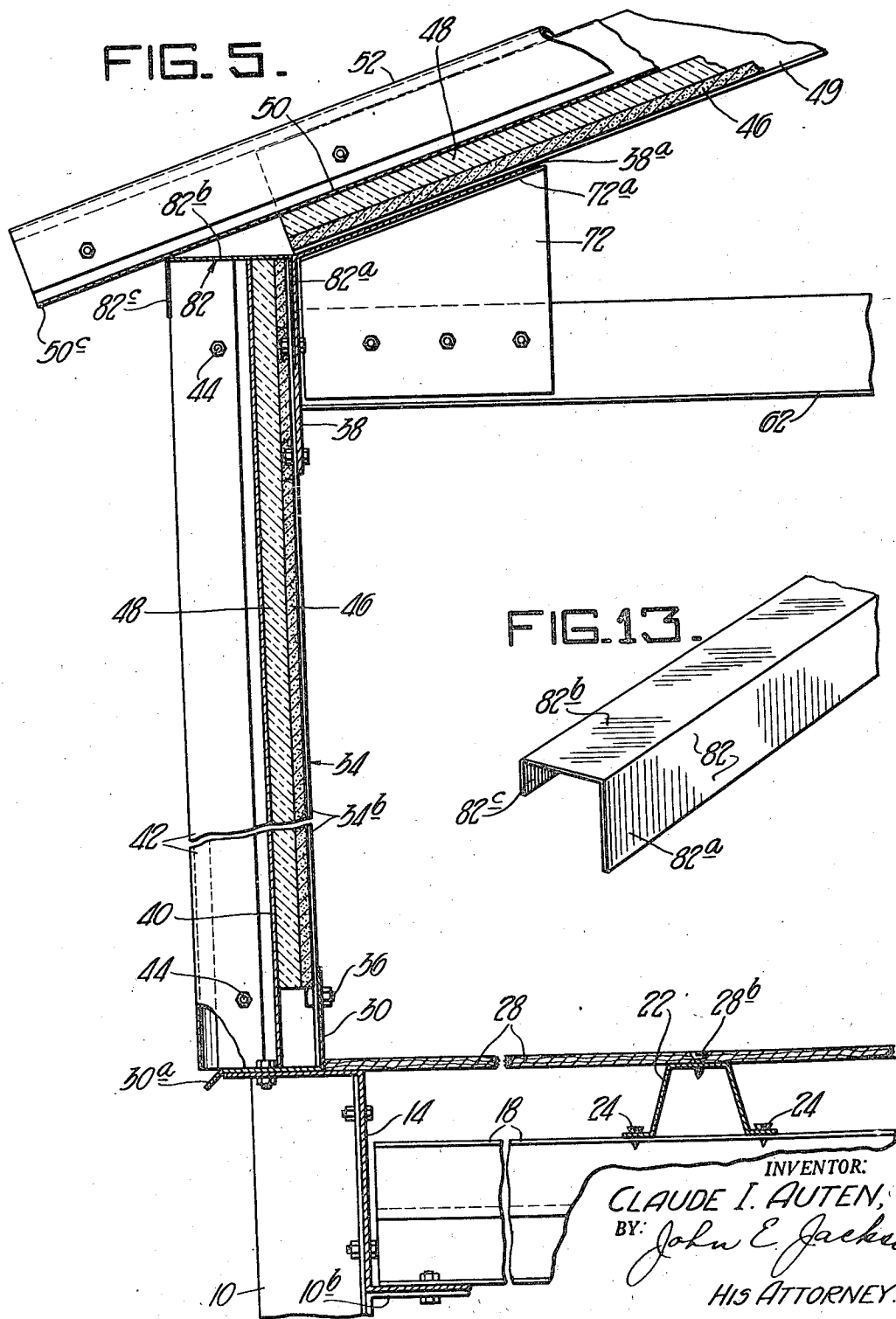
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PREFABRICATED METAL HOUSE CONSTRUCTION

Filed May 3, 1943

5 Sheets-Sheet 3



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PREFABRICATED METAL HOUSE CONSTRUCTION

Filed May 3, 1943

5 Sheets-Sheet 4

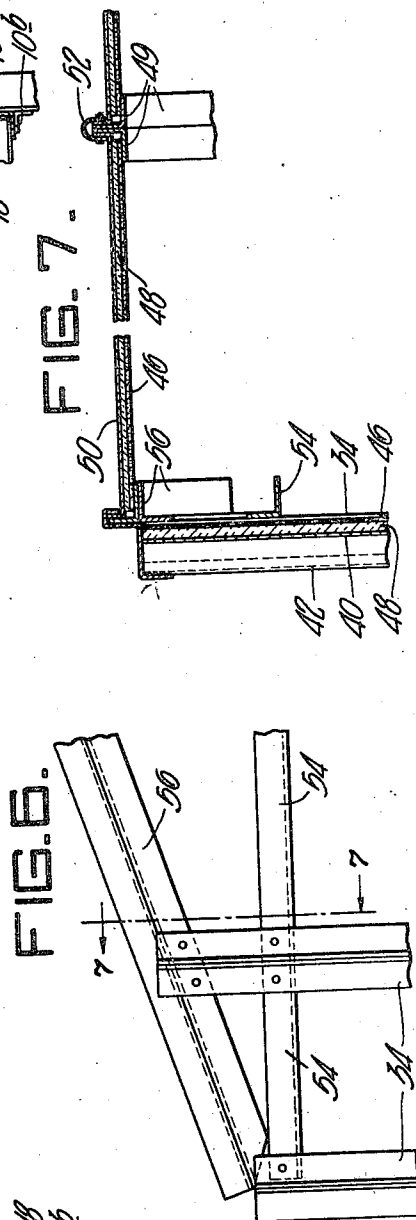
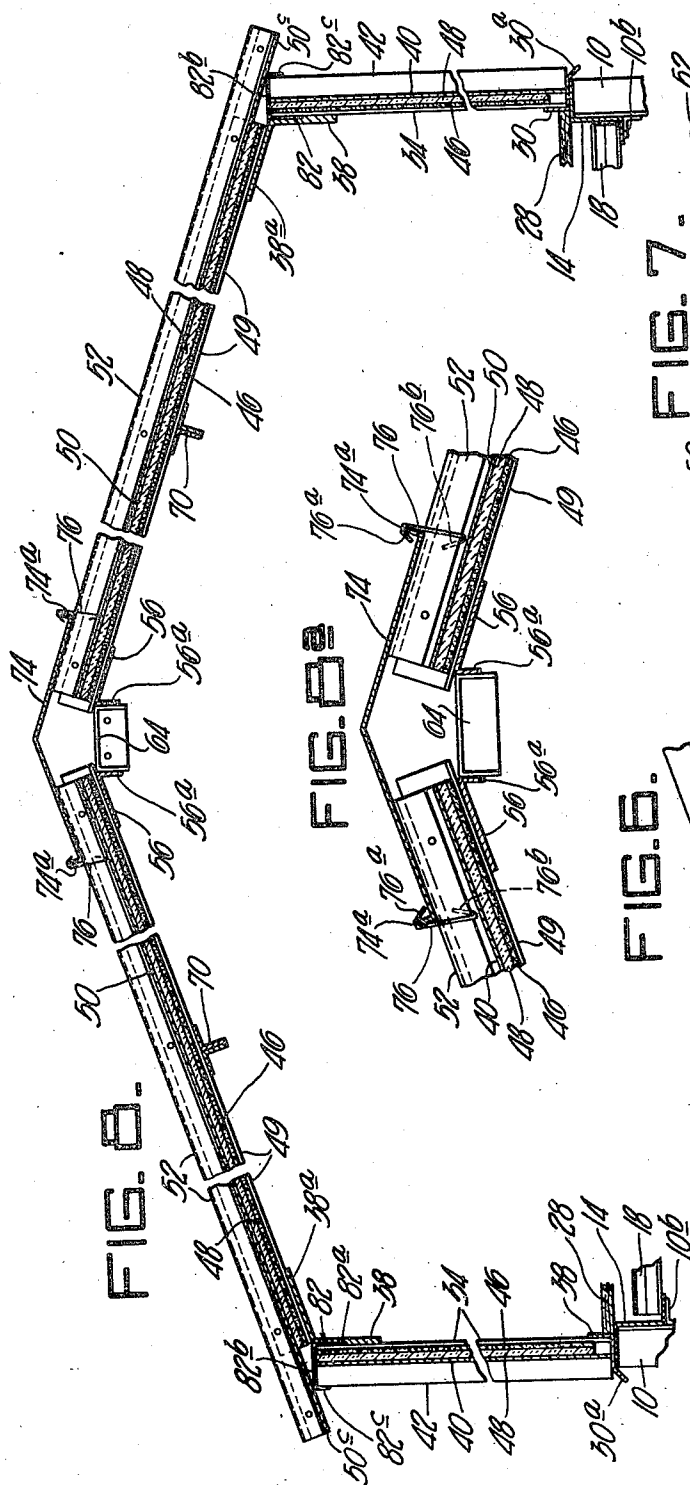
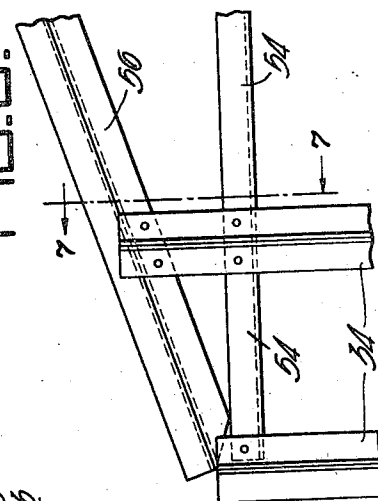


FIG. 6.



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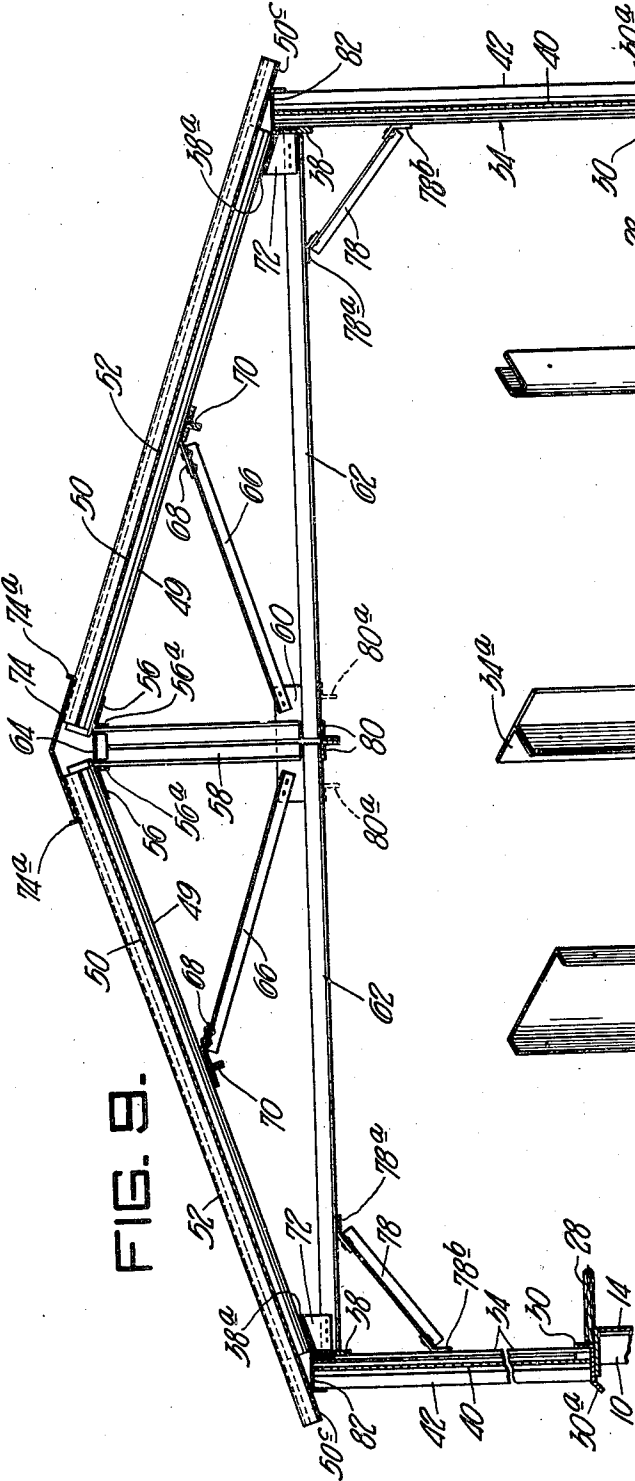


FIG. 9.

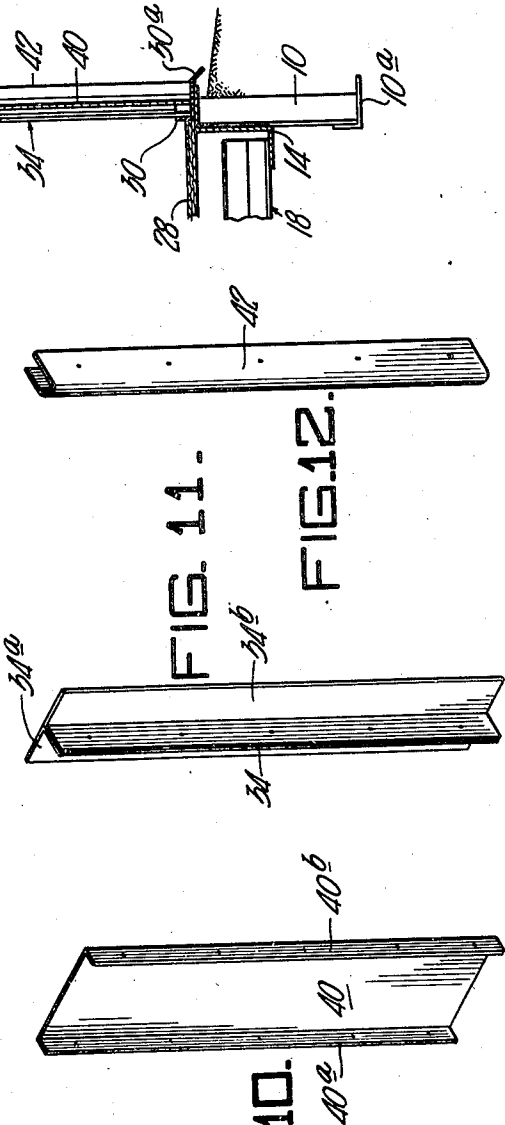


FIG. 10.

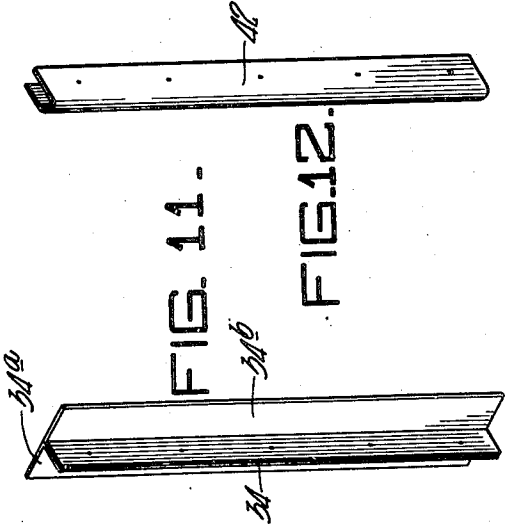


FIG. 11.

FIG. 12.

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UNITED STATES PATENT OFFICE

2,439,960

PREFABRICATED METAL HOUSE CONSTRUCTION

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Application May 3, 1943, Serial No. 485,486

2 Claims. (Cl. 189-1)

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The present invention relates to the substructure and superstructure of a building of non-combustible construction, and more particularly to a metal building construction, the units of which can be completely fabricated at the factory and which are adaptable for ready and permanent assembly into a building and/or buildings of variable dimensions.

Primarily the invention contemplates non-combustible metal building units that are easily manufactured from commercially available metal mill products by normally equipped sheet metal shops and more particularly metal building units that are especially adaptable to transport in a small cubic space without distortion and damage.

A further object of the invention is to provide metal building units of a small number of types that, when assembled, will complete a non-combustible metal building and that the metal units of each pattern be interchangeable with all other units of the same pattern, to lessen the cost of production and to facilitate the field assembly of the metal building units into complete buildings by either experienced or inexperienced workmen.

Another object of the invention is to provide metal building units of such a pattern that the units of the same type and also units of different types will nest together tightly with a minimum of space between them and of such pattern and length that when bundled and/or crated packages will in turn be minimum sized packages when compared with the weight of their contents and also the square feet of surface area of the building that the parts will provide in order that the total cubic space occupied by the packages for a complete building when transported in a truck, a freight car, a ship, or an aeroplane, shall be compact and small.

Another object of the invention is to provide for the joining together of the metal building units by simple devices when the units are being assembled into a non-combustible metal building to form firm, strong and permanent connections that will resist stresses balanced with the strength of the metal building units and to join the units together in such a manner that the joined units in part or in whole will act together as a combined unit to resist stress and the completed metal building in toto is sufficiently strong to resist and sustain the design loads required of it and that may be imposed thereon by the loads to which it may be exposed during erection and also the loads of snow and wind pressures.

Another object of the invention is to provide metal building units which, when completely prefabricated, transported and joined together, present a metal building that is satisfactory in appearance for the purposes required of it and that

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will be sufficiently resistant to the penetration of the elements such as wind, rain and snow, and the simple connections between units in the completed building be such that the metal building units can be easily and readily taken apart, packed again for transport, and reassembled at another location without damage to the metal units and the connecting mediums.

Another object of the invention is to provide metal units of a pattern that when the units are being assembled into a building and also after the building is completely assembled, insulating material of standard commercial thickness, shape and known conductivity factors may be readily and easily placed in or on the metal building units to provide against the penetration of the temperatures in the air surrounding the building into the space enclosed by the walls and roof of the non-combustible metal building, also to provide against the loss of heat units of the air enclosed by the walls and roof of the non-combustible building through the said walls and roof.

Another object of the invention is that holes, slots, and the like for field connections will be punched to a uniform location and pattern in the metal building units in order that the shop labor and consequent cost of fabricating the metal building units and their connections be reduced to a minimum number of man-hours and consequent cost per building.

Another object of the invention is to provide metal building units and their simple field connections of such patterns and sizes that standard commercial windows, doors, and other building accessories may be inserted in the spaces normally occupied by the metal building units without sizing the doors, windows and other building accessories to a special size and pattern when the metal building units and the normal accessories are being assembled into metal buildings.

A further object of the invention is a metal building superstructure that has the required resistance to specified strains and stresses when supported upon a foundation and/or floor of many conventional types of constructions by means provided in the framing of the superstructure that does not require a change of the details of the superstructure.

A further object is to provide building units of such pattern that all the load supporting members and enclosing wall and roof elements are producible from stock gauges of sheet metal adapted to be cold formed by simple die bending operations, or by progressive die rolling.

Another object of the invention is to construct and arrange the parts so that they can be readily dismantled and re-erected without damage to the parts or without providing new or additional parts.

A further object is to so construct and arrange

the various component parts herein shown and described that they singly and jointly cooperate to perform the individual and combined functions hereinafter more fully set forth.

With these and other objects in view which will more readily appear as the details of the invention are more fully disclosed, the same consists in the novel construction of a metal building comprising the combination and arrangement of metal building elements and accessories hereinafter more fully described, illustrated and claimed.

A preferred practical embodiment of the invention is illustrated in the accompanying drawings, in which:

Figure 1 is a side elevation of a building embodying the herein claimed invention;

Figure 2 is an end elevation thereof;

Figure 3 is a plan of suitable foundation posts for supporting the building;

Figure 4 is an enlarged typical horizontal section on line 4—4 of Figure 1;

Figure 5 is a vertical enlarged section 5—5 of Figure 1;

Figure 6 is a detail view of gable end framing-section 6—6 of Figure 1;

Figure 7 is a detail view of gable end framing and end flashing-section 7—7 of Figures 2 and 6;

Figure 8 is a typical transverse roof section on line 8—8 of Figure 1;

Figure 8^a is an enlarged detail of part of Figure 8, showing the fastener;

Figure 9 is a transverse section on line 9—9 of Figure 1, showing the roof truss;

Figure 10 is a detail perspective view of a roof and wall panel;

Figure 11 is a detail perspective view of a typical wall panel supporting member; this view also illustrating a typical roof supporting member or rafter;

Figure 12 is a detail perspective view of a U-shaped batten;

Figure 13 is a detail perspective view of an eaves flashing of Figure 5;

Figure 14 is a detail perspective view of a gable end flashing of Figure 7.

While not limited thereto, the prefabricated house construction embodying the present invention is peculiarly well suited for erection and use by Army and Navy personnel, and chief components of the structure are shop formed of light-gauge sheet steel and are of a size, pattern and weight to simplify and speed up erection, yet permit dismantling for transfer to another site. All the necessary parts for a one-story building of the design and construction shown measuring 20 feet wide by 50 feet long and having a height of 12 feet at the peak of the roof, can be packed for shipment by rail, auto truck, or water craft in a space whose outside measurements are 10 feet long, 6 feet wide and 4 feet high. Thus it is apparent that the improved house construction will save valuable cargo space as compared with prior structures when shipped overseas for use as a "task force" housing, a use for which the described structure is exceedingly well suited.

Before describing the construction in detail, it will be noted that the house illustrated comprises a metal substructure mounted on posts or other suitable foundations, the substructure supporting a flooring of suitable material such as plywood panels. The components of the superstructure including side and end walls and roof and roof truss are all made of patterned metal preformed parts and the walls and roof

are lined with suitable wallboard or heat insulating material. The walls and roof are enclosed by panels of sheet metal having flanges at their edges which are fitted between upright wall supporting members and inclined roof rafters. The wall and roof panels are preferably of uniform pattern as are also the supporting members therefor. The uniformity or identity of cross sectional contour of these parts is apparent by reference to Figures 1, 2, 3, 5, 7, 10, 11 and 12.

Referring particularly to the drawings, the building may be supported on any suitable foundation. By way of example I have illustrated a multiplicity of steel foundation posts, formed of angles arranged back to back and having feet 10^a secured to their lower extremities (see Figure 3). In the corners of the building, reinforced corner posts 12 are provided which are made by connecting together a plurality of angles to form a cross as viewed in plan. The several angles constituting the corner posts are secured to one another by suitable bolts penetrating the angle flanges. Extending longitudinally at each side of the building there is a Z-shaped sill 14, the horizontal top flange of which overlaps the adjacent outer row of the posts (see Figures 5 and 8). Similar transverse Z-shaped sill members 16 are provided at each end of the building, and the top flanges thereof also overlap the end posts in a similar manner (see Figure 2).

A series of transversely extending floor joists 18 are supported on the lower horizontal flanges of the Z-sills 14 as shown in Figure 5. At the points where the joists take their bearing on the Z-flanges, the posts are provided with bearing brackets such as shown at 10^b in Figure 5. The floor joists are not shown in greater detail for the reason that they form the subject of my Patent No. 2,387,229, which issued October 23, 1943, and is a division of the present patent.

Secured to the webs of the transverse Z-sills 16 are transverse angle members, not shown, to form supports for the extremities of longitudinally extending floor supporting purlins 22. The intermediate portions of these purlins 22 take their bearing on the several transversely extending floor joists 18. The purlins are of substantially channel shape in cross section, as best shown in Figure 5, and are provided with outwardly turned flanges at their lower extremities. Penetrating these flanges are drive screws 24 which secure the purlins to the floor joists 18. These drive screws pass through suitable holes in the flanges of the purlins and enter the space between the Z-member and the floor joist. Thus the screws can be quickly driven into place by a hammer blow, and quickly removed by a screw driver for dismantling. The substructure constituting a suitable foundation and the described side and end sills together with the floor joists and purlins form a floor supporting substructure which can be readily and easily assembled. Any suitable form of flooring may be supported on this substructure. However, the structure shown and described is peculiarly well suited for supporting a flooring made up of a series of plywood panels such as indicated at 28. The end panels of the series may overlap the Z-sills at the ends and may be secured thereto by drive screws. Similarly, the side series of panels may overlap the top flanges of the Z-sills 14 and be secured thereto by drive screws. At intermediate points the floor panels rest on the purlins 22 and are secured thereto by drive screws 28^b (Figure 5); thus the flooring is quickly and easily assembled

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with its supporting substructure, and as easily dismantled for reerection when desired.

Longitudinally extending side sill angles 30 are secured to the top flanges of side sills 14 (Figures 4 and 5). Similar transverse end sill angles 32 are secured to the top flanges of transverse ends sills 16. At their outer extremities the sill angles 30 and 32 are bent downwardly as indicated at 30^a and 32^a to form a water shed overlapping the horizontal flanges of the Z-members to which the angles are secured, thus preventing the inward seepage of water. The sill angles are secured to the top flanges of the Z-sill members by vertically disposed bolts as shown, and are also secured to the uprights by suitable bolts as shown.

As best shown in Figures 4 and 5, the wall structure includes a series of wall supporting uprights 34, each formed of a pair of angles 34^a and 34^b arranged back to back. Since the construction of the side walls and end walls are the same, a description of one will suffice for all. As shown in Figure 5, at their lower ends the angular upright wall supporting members are secured to the upstanding flange of the sill angle by means of bolts 36. At the upper extremity of the upright wall supporting member 34 at each side of the building there is a longitudinally extending eaves member 38 secured to the uprights by suitable bolts as shown. The upright wall enclosure is formed of a plurality of panel members 40, each of which, as shown in Figure 10, is in the form of a flat metal sheet with outwardly bent flanges 40^a and 40^b which are adapted to make face-to-face contact with the outwardly extending flanges of the angle member 34. At the joints between adjacent wall panel sections the wall structure is tied together by means of U-shaped batten strips 42, one of which is shown in detail in Figure 12. The overlapping or nesting arrangement of batten strips is such that a weather-tight joint is secured when the bolts 44 which penetrate the flanges of the wall panels and the upright angles 34 and the battens are drawn up tight. As illustrated in Figure 4, there are three upright angle members 34 with their flanges so disposed that they jointly form a reinforced cross-shaped corner post. At the corners the end wall panels are secured by batten strips 42^a in much the same manner that the other panels are secured. The parts when secured together as described above, provide a compound section to properly resist design stresses.

Interposed between each wall panel 40 and the parallel pair of adjacent wall supporting members 34 there is a sheet of wall board 46, the outer face of which may carry a layer of heat insulating material 48. Or, if desired, the wall board may itself constitute the heat insulation. The wall board may take the form of various types of fiber board, gypsum board, and insulating materials of various suitable types may be alternatively employed. In the erection of the upright walls several of the panel sections and upright supporting members described may be assembled with the angle members 30 and the eave member 38 while the latter are supported in horizontal position on the ground or on suitable work-horses.

After the uprights carrying the eaves member 38 have been erected and after the similar end walls have been placed, the roof sections may then be put in place. The roof is made up of a plurality of rafter angles 49 which are arranged in pairs back to back. The lower ends of these

rafters rest on the upper obliquely inclined flange 38^a of eaves member 38 and are secured thereto by suitable bolts as shown. Interposed between adjacent rafter angles 49 there are placed roof panels 50 which are of the same pattern or cross sectional contour as the wall panels, these roof panels being provided with flanges which make face-to-face contact with the side flanges of the rafter angles 49. The side flanges of the roof panels and the flanges of the rafter angles 49 are overlapped by roof batten strips 52, as clearly shown in Figure 7, in much the same manner as the wall panels are secured to their upright members.

At each gable end of the building there is a top cross member 54 which is bolted to the end upright wall supporting members 34 and at the gable ends in addition to the rafters there are provided inclined angle members 56 to afford a means for connection with the upper ends of the end wall panels (Figure 6).

The upper extremities of the rafter angles 49 rest on central ridge members 58 which are symmetrically arranged on opposite sides of the center line of the building so that a space is provided between them for the passage of a suitable smoke pipe or vent pipe (Figures 8, 8^a and 9). Each central ridge member is provided with a downwardly extended flange 56^a and said flanges are secured to parallel upright struts 58 whose lower extremities are fastened to gusset plates 60 carried by cross members 62 forming part of a roof truss. Separators 64 are interposed between the flanges 56^a of the ridge member so as to reinforce the central region of the roof. Diagonal members 66 connect the gusset plates 60 with connecting plates 68 secured to longitudinal member 70 bolted to the rafters 49. The roof truss structure such as shown in Figure 9 will be placed on 5-foot centers or other equal module dimensions along the length of the building. Suitable longitudinal truss bracing of conventional form not shown will also usually be employed.

The horizontal cross member 62 of the truss carries at each extremity a gusset bracket 72 having laterally extended horizontal flange 72^a adapted to be secured to the under face of the flange 38^a of the eaves member. This arrangement provides for ease of erection because as erection work progresses from one end of the building toward the other, the gusset bracket will afford means for progressively connecting the parts end to end.

Interposed between the flanges of the rafter angles 49 and roof panels 50, I preferably provide wall board with insulation substantially the same as that interposed between the similar members of the upright walls as clearly shown in Figure 7.

Extending longitudinally along the peak of the roof is a peaked ridge plate 74 which closes the space between the parallel central ridge members 56. The ridge plate is formed with upstanding flanges 74^a with spaced holes at the bottom of the upstanding flanges (to permit water run-off) and the plate is secured in place by means of hook-like fastening devices 76 having hooked ends 76^a which engage over the flanges 74^a, these fittings also being provided with lower hook extremities 76^b which are adapted to be hooked under the flanges of the roof batten members 52. Where a smoke pipe or vent pipe is to be installed, a suitable hole will be cut in the ridge plate so as to permit its passage there-

through. Such a vent pipe is suggested at 78 in Figure 2. This pipe may be assumed to pass between the flanges 56^a of the central ridge members above referred to.

To keep the upright wall members and the cross members 62 of the roof truss square and true during erection, suitable knee braces 78 may be fastened by brackets 78^a and 78^b to said cross member and said uprights as shown in Figure 9. If desired, these knee braces may be removed after the building has been completely erected. Longitudinally extending truss tie members 80 in the form of angles arranged back to back may be centrally located as shown in Figure 9 or these angles may be secured in spaced relation as indicated in 80^a and dotted lines in the figure so as to provide for the passage of a smoke or vent pipe.

An eave flashing channel 82 of the pattern shown in Figure 13 is secured to the upper extremities of the wall supporting uprights 34 and the vertical leg of the eaves member 38. The top portion 82^b of the eave flashing covers the tops of the uprights, the wall panels, the wall board, and the battens which secure the panels to the uprights. A downwardly extended flange 82^c overlaps the upper ends of the battens and provides for the drainage of water so as to prevent the same from entering the joint between the battens and the parts which they overlap. As indicated in Figure 5, the roof panels 50 are of such a length that their lower ends 50^c project a considerable distance beyond the eave flashing so as to thus carry off rainwater or the like to a point remote from the flashing.

In the wall construction shown it will be apparent that the outer surface of the heat insulation 48 is held in snug contact with the inner face of the adjacent sheet steel panel and that the inner face of the wall board 46 is engaged snugly by the flanges 34^a and 34^b of the uprights 34. The contrast of the color of the flanges and the color of the wall board presents an attractive appearance.

The roof insulation is similarly held in place as shown. At the top of the wall the flashing 82 excludes the access of water to the fibrous or other wall board. At the bottom the wall board is held a slight distance above the level of the base flange of the sill angle 36 since it rests on the heads of bolts 36 as shown. Thus an air space is provided above the sill to prevent moisture from reaching the wall board and insulation by capillary attraction.

The wall construction illustrated is so arranged that stock size windows and doors can be readily installed merely by omitting one of the angular uprights so as to provide sufficient width for either a window 94 or a door 128 at a desired location.

An important feature inherent in the roof and side wall constructions herein described is that no holes are made either in the field or shop in the weather exposed surfaces of the panels. The only holes in the roof and wall panels are made in the flanges at right angles to the weather exposed surfaces thereof and the holes in such flanges are amply protected by the overlapping portions of the battens described.

The window and door features above described are claimed in my respective copending applications, Serial No. 486,571, filed May 11, 1943, now Patent No. 2,363,475, and Serial No. 486,572, filed May 11, 1943, now Patent No. 2,356,730.

Although I have shown and described specific details of prefabricated steel house design and construction which an actual reduction to practice on a commercial mass production basis has demonstrated is highly desirable, it is not to be construed that I am limited thereto since various modifications and substitutions of equivalents may be made by those skilled in the art without departure from the spirit and scope of the invention as defined in the appended claims.

I claim:

1. Prefabricated metal house construction comprising a series of upright wall supporting members consisting of sheet metal angles arranged back to back along each side and at each end of said house, a respective metal eaves member bent to an obtuse angle secured to each series of upright side members, a respective top horizontal gable end cross member consisting of a metal angle secured to each series of upright end members, the outer-most end and side upright members being secured to each other to form integrated reinforced corner posts, rafter members each consisting of sheet metal angles of the same cross-sectional size and shape as said upright wall supporting members and arranged back to back and having their lower ends resting on and secured to said eaves member, a pair of spaced parallel central longitudinally extending ridge members of sheet metal each bent to an acute angle and forming supports for the upper ends of said rafter members, the spacing between said central ridge members being adapted to accommodate a smoke pipe, cross members carrying 35 gusset brackets at their ends having lateral flanges for attachment to said eaves members, upright struts whose tops and bottoms are respectively connected with said ridge members and said cross members, metal roof panels filling the spaces between the several rafter members and having flanges contacting the sides of said rafters, U-shaped sheet metal battens embracing and secured to said flanges of the panels and rafter members, and a central ridge plate spanning the 45 space above said spaced ridge members.

2. The combination of claim 1 further characterized in that said ridge plate is bent to inverted V-shape to form a central peak with upstanding end flanges, and securing members having hooked portions engaging under said battens and over said upstanding flanges so as to hold said ridge plate in place.

CLAUDE I. AUTEN.

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