

April 5, 1966

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3,243,929

HOUSE CONSTRUCTION OF HOLLOW PANELS WITH DOUBLE
CHANNEL PERIPHERAL EDGE CLOSURE MEMBERS

Filed July 26, 1962

6 Sheets-Sheet 1

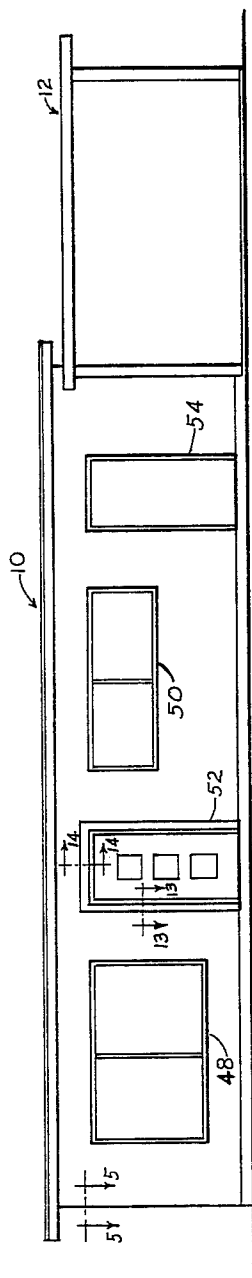


Fig. 1

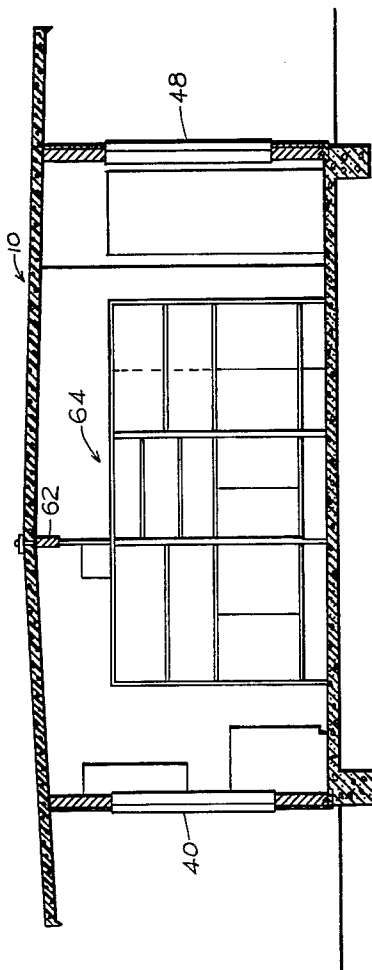


Fig. 3

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6 Sheets-Sheet 2

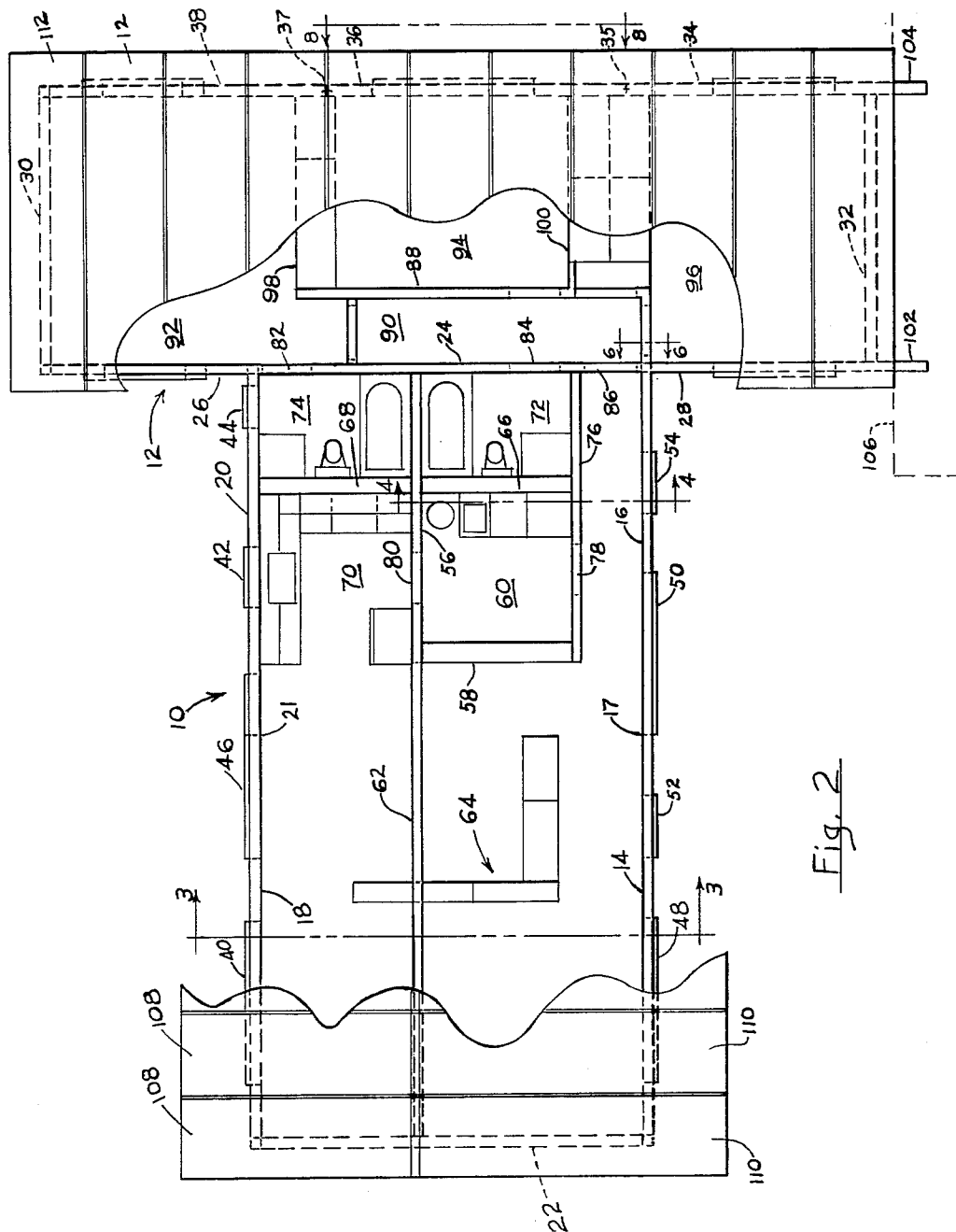


Fig. 2

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6 Sheets-Sheet 3

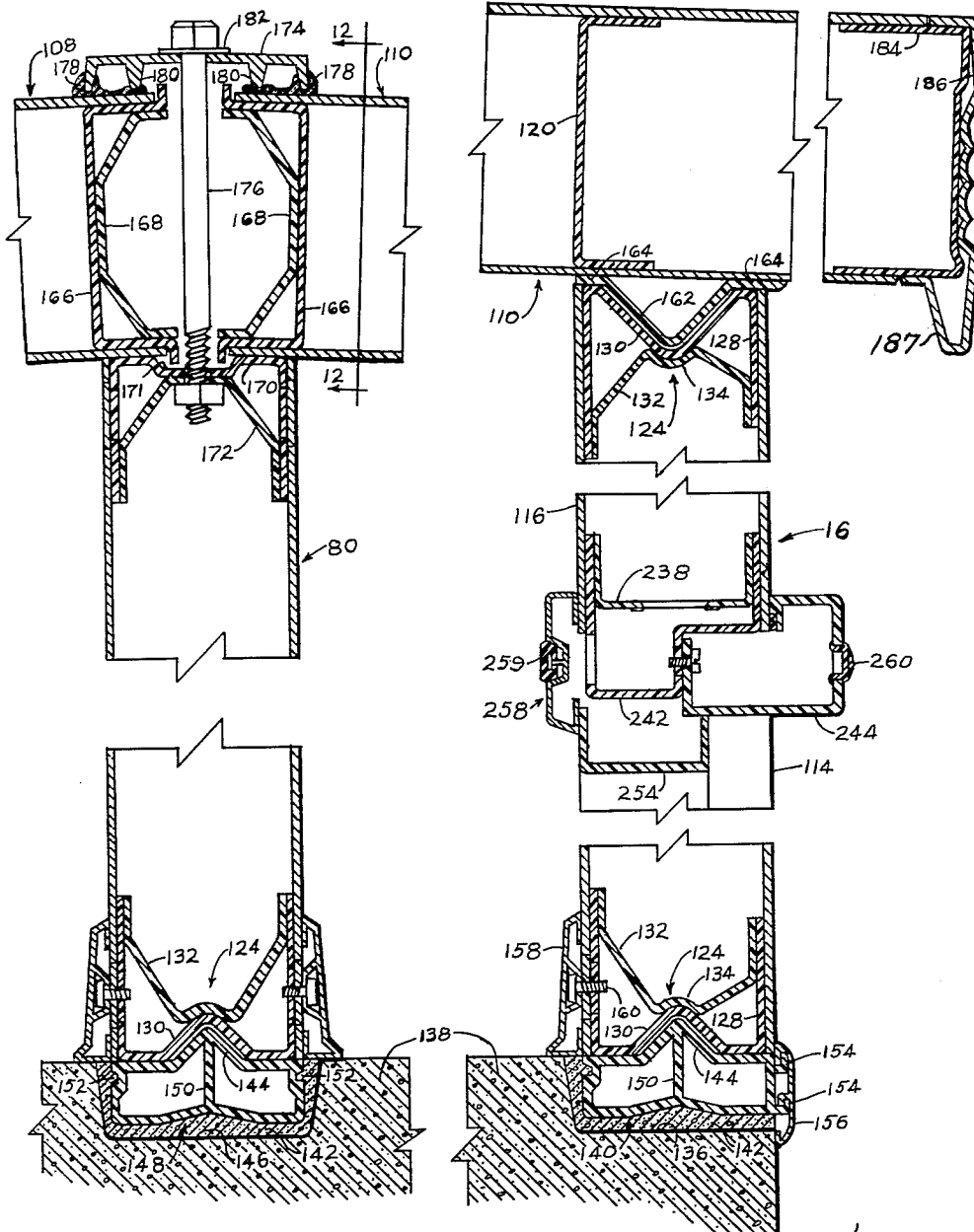


Fig. 4

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6 Sheets-Sheet 4

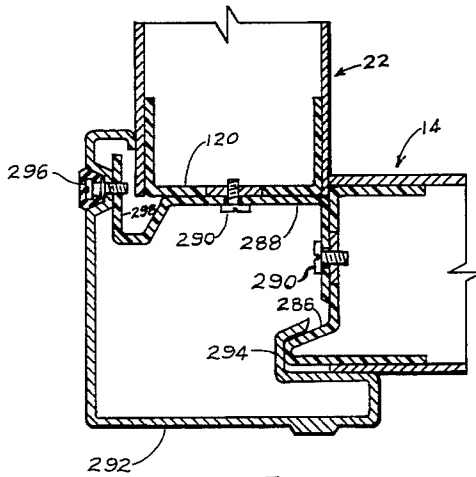


Fig. 5

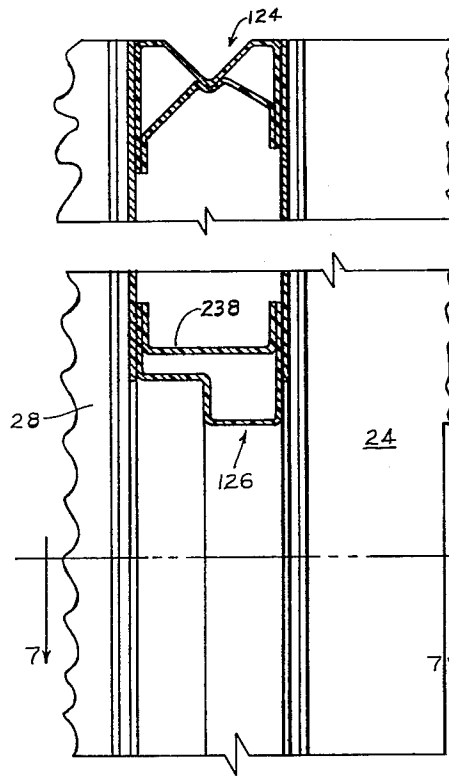


Fig. 6

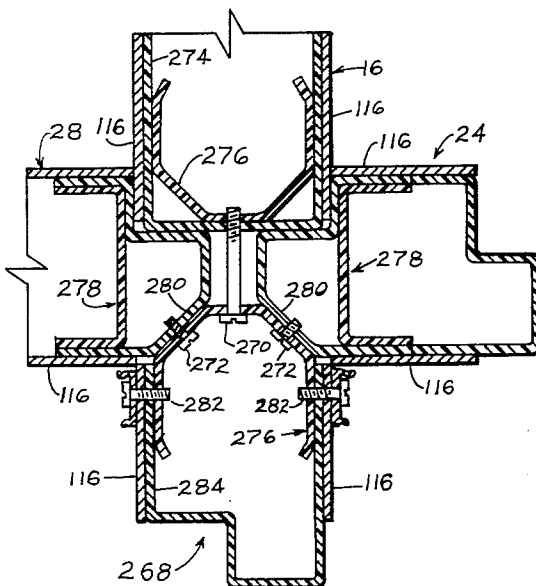


Fig. 7

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6 Sheets-Sheet 5

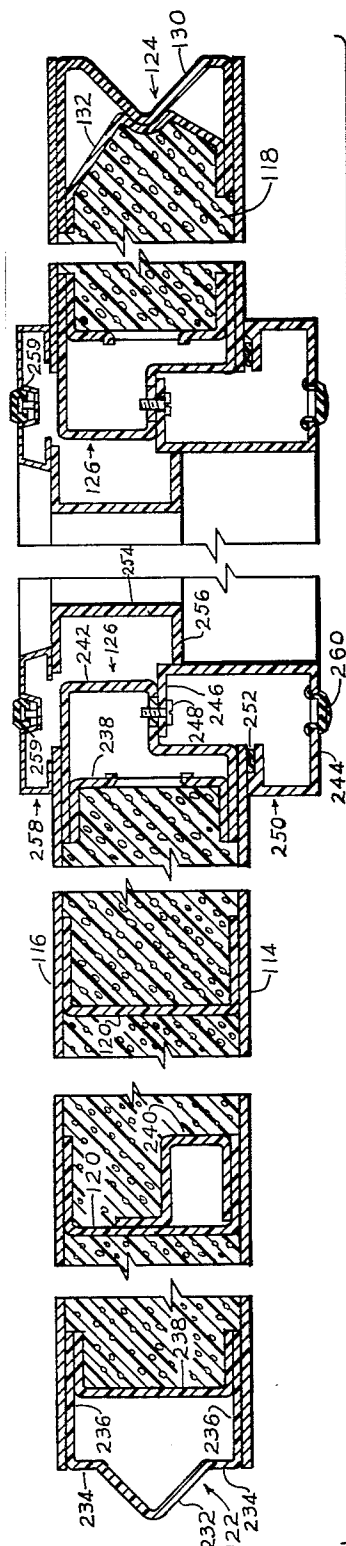


Fig. 9

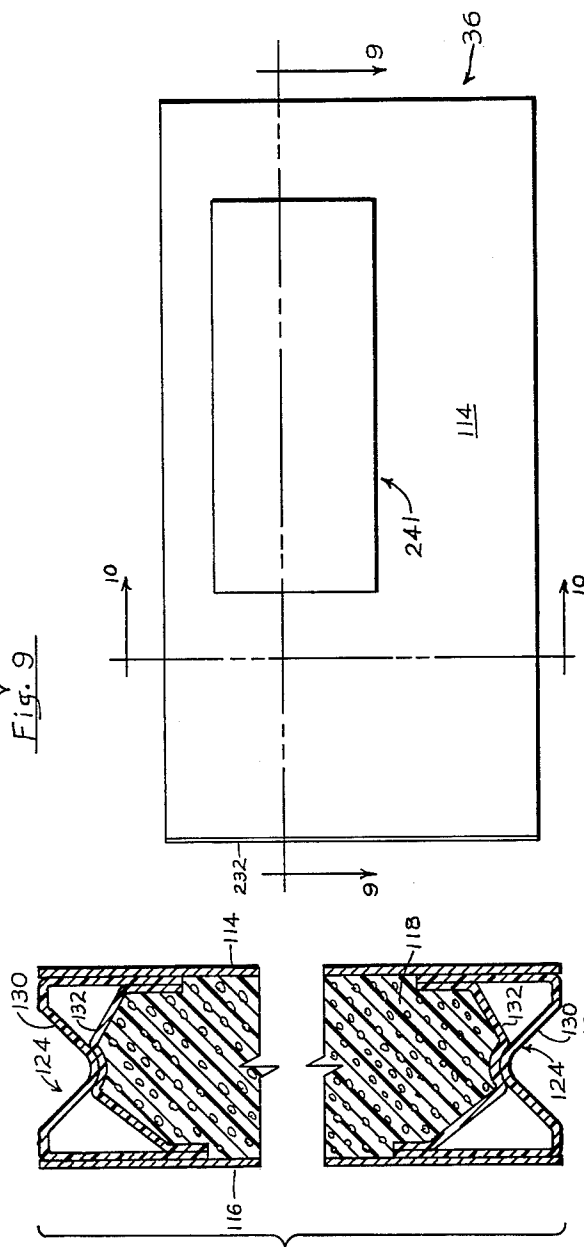


Fig. 8

Fig. 10

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6 Sheets-Sheet 6

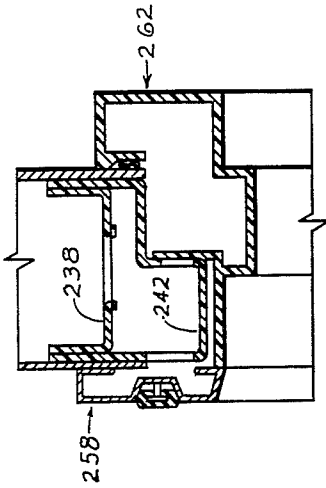


Fig. 14

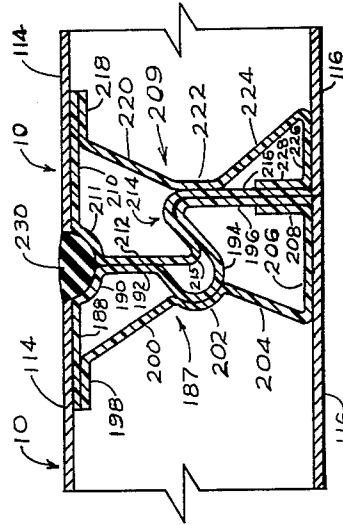


Fig. 12

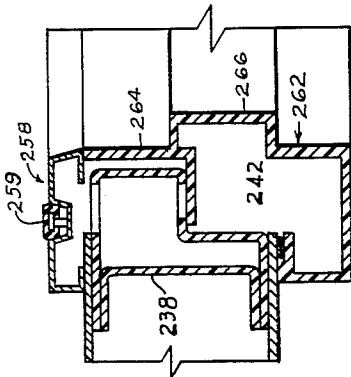


Fig. 13

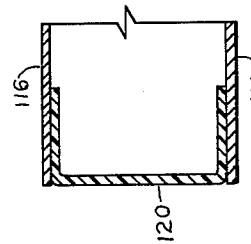


Fig. 11

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HOUSE CONSTRUCTION OF HOLLOW PANELS WITH DOUBLE CHANNEL PERIPHERAL EDGE CLOSURE MEMBERS

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7 Claims. (Cl. 52—234)

This invention relates to prefabricated building structures, and in particular to dwellings. In recent times this has been a field involving a great measure of activity, and a correspondingly large number of proposed approaches toward solution of the problems involved. As in all modern technology, the basic end sought is economy of time, material, labor and cost.

In spite of the importance of mass production, the innumerable proposals have had relatively little noticeable impact in the technology of fabricating structures and, beyond a current trend toward the use of prefabricated roof trusses and, to a lesser extent, the use of sections of pre-assembled wall studding, the construction work still remains largely an on-site project of step-wise erection, with mass production depending, for the most part on progressive construction by teams of specialists, working in succession.

According to the present invention, all of the essential elements of the building, including exterior roof and siding, and interior wall surfaces, are capable of prefabrication at the factory, with simple assembly at the building site, through interlocking features and easy bonding. No ordinary fasteners, such as nails, are required, and no cutting and fittings is involved. Under the system herein described, entire exterior walls, as well as partitions, are merely set in place on a slab, in interconnecting relationship, and the roof laid in place. This is made possible by the general scheme of construction of the prefabricated units, to be hereinafter described in detail, and which involve, generally, a "sandwich" type of wall section, having one-piece panels on the two sides, enclosing an inner filler, with inner rib reinforcements of channel section, located at door and window openings as well as at spaced points along the wall section, and with edge inserts on the four sides, closing the ends of the panels, and shaped exteriorly for cooperative mating engagement with edge members of adjacent units of the building structure. As will be seen, the mating edges comprise various shapes corresponding to the different situations involved in various parts of the structure, and generally speaking these shapes will be different on the four sides of any given section or unit of the structure. However, consistent with the necessary or desirable variation, the number of distinct parts represents a satisfactory minimum.

It is, therefore, a general object of the invention to provide prefabricated units for a building, which may be constructed in their entirety, and in final form at the factory, so that building erection involves only assembly of the units. More particularly, it is an object to provide entire wall sections, and like units, in prefabricated form. Another object is to provide for erection of buildings with prefabricated units, without the use of ordinary fastening means. A further object is to provide prefabricated building units having built-in studding. A still further object is to provide a spaced-wall building unit with edge closures having interlocking features. A related object is to provide prefabricated roof units having characteristics as aforesaid, and which is assembled by simple laying of the units in place. A further and more particular object is to provide prefabricated building units of plastic

material, which are locked in place at assembly by cementing, or a like process.

Additionally, it is an object to provide prefabricated wall units in which the reinforcing elements, including the edge closure members, are generally of channel-form section, as contrasted with pieces of solid section, whereby, not only is high strength maintained, with lowered weight, but a great variety of dove-tailing forms is easily attained.

Yet another object is to provide framing for door and window openings which is related to the edge closure pieces referred to above.

These and other ends, which will be readily apparent, are attained in satisfactory measure by the present invention, as more fully described in the specification to follow, and as illustrated in the drawings, in which:

FIGURE 1 is a front elevational view of a house constructed of prefabricated wall sections according to the invention;

FIGURE 2 is a top plan view of the house of FIGURE 1, with portions of the roofs removed to show interior structure and arrangement;

FIGURE 3 is a sectional view taken on the line 3—3 of FIGURE 2;

FIGURE 4 is an enlarged sectional view taken on the line 4—4 of FIGURE 2, and foreshortened in both horizontal and vertical directions;

FIGURE 5 is a sectional view, enlarged, of a typical, outside corner joint, taken on the line 5—5 of FIGURE 1;

FIGURE 6 is an elevational view, enlarged in scale, and foreshortened, of a typical inside corner, taken on the line 6—6 of FIGURE 2;

FIGURE 7 is a sectional view through the four-way corner joint, taken on the line 7—7 of FIGURE 6;

FIGURE 8 is a view of an outer wall panel, enlarged, taken on the line 8—8 of FIGURE 2, and illustrating male and female, vertical edge closures;

FIGURE 9 is a horizontal sectional view, on further enlarged scale, and foreshortened, taken on the line 9—9 of FIGURE 8;

FIGURE 10 is a vertical sectional view, also to enlarged scale, and foreshortened, taken on the line 10—10 of FIGURE 8;

FIGURE 11 is a view similar to the left end portion of FIGURE 9, and showing a different form of edge closure;

FIGURE 12 is a sectional view taken on the line 12—12 of FIGURE 4;

FIGURE 13 is an enlarged, sectional view, taken on the line 13—13 of FIGURE 1; and

FIGURE 14 is an enlarged, sectional view, taken on the line 14—14 of FIGURE 1.

Referring to the drawings by characters of reference, there is shown, in FIGURES 1 to 3, an assembled house, of generally L-form, comprising a living area rectangle 10, constituting the leg of the T, and a transverse, bedroom area rectangle 12, constituting the cross member of the T. Due to the small size of the scale, only general outlines of the structure are indicated in FIGURE 2.

The living wing 10 is made up of a total of six wall panels, with a pair of panels 14, 16 on the front side, joined at the line 17, a pair of panels 18, 20, on the rear side, joined at the line 21, an end, exterior panel 22, and an end, interior panel 24.

The bedroom wing is made up of panels comprising two panels 26, 28, extending from the living wing, a pair of end panels, 30, 32, and, on the long, outer side, a set of three panels 34, 36, 38, with meeting lines 35, 37.

On the rear side, wing 10 has a large window 40, and two smaller windows 42, 44, and a wide doorway 46, which may be provided with sliding glass doors, leading to a patio. On the front side, wing 10 has two picture

windows, 48, 50, and two doorways 52, 54. An inner partition 56, extending lengthwise of wing 10, from inner, end wall 24 to the end wall 58 of a utility room 60, is a bearing wall for roof support, and is supplemented by a lintel 62, which has support on end wall 22, and on an immediately located room divider 64, of L-form. A pair of aligned partitions 66, 68, on opposite sides of wall 56, separate the room 60 and the kitchen 70, respectively, from a pair of bathrooms 72, 74. A partition 76 confines bathroom 72 and room 60, and has a doorway 78 leading into the latter. A second doorway 80, in wall 56, leads from the kitchen to room 60. Wall 24 has doorways 82, 84, leading to the respective bathrooms, and a third door 86 leading into the hall outside of the utility room 60.

In the bedroom wing, a partition 88 defines a hallway 90, communicating with three bedrooms 92, 94 and 96, and closet structures 98, 100, constitutes partitions between the bedrooms. Panels 28 and 34 extend beyond end wall 32 in projections 102, 104, adapted to receive storage shelves or cabinets, and to provide support for a carport roof 106, indicated in dash lines.

The roofs each comprise a series of panels laid in side-by-side relation along the long dimensions of the wings. Thus, wing 10 has a series of identical panels 108, extending from the line of the lintel 62, and overhanging the wall panels 18 and 20, and a series of somewhat longer panels 110 on the opposite side of the lintel, and overhanging walls 14 and 16. The lintel could also be located midway of the wing, in which case the roof panels 108 and 110 would be of equal length. The width of wing 12 is such that only one set of roof panels 112 is required.

A typical wall unit is shown in FIGURES 8-10, in which middle panel 36 of the bedroom wing has been selected for illustration. The complete, prefabricated panel is of the sandwich type, with surface boards 114, 116, which may be of any conventional composition, such as pressed fiber, plaster board, or the like, and which are held in spaced relation by edge closure members, and internal, stud-like elements, presently to be described in detail, the remaining space in the interior being filled by a porous, filler material 118, which is preferably a foamed, polyurethane plastic. For simplicity, and for the sake of clarity as to other details, this filler has been shown only in FIGURES 9 and 10, being omitted from other figures.

In the fabrication of the wall unit at the factory, the surface boards, such as 114 and 116, are cut to size and provided with suitable openings for windows, doors and the like. The spacing and reinforcing members which may be metal but are preferably formed of strong plastic material, such as the studding 120, and edge closures 122 and 124 of FIGURES 9 and 10, are then cemented or glued in place, in the required layout, on one of the surface boards. If window or door openings are involved, edge closures, such as 126 of FIGURE 9, are also laid at the boundaries of the opening. Thereafter, the filler material 118 is flowed into the available spaces between the structural members, by suitable means, after which the other surface board is laid on the unit, and heat and pressure applied. During this curing stage the filler 118 becomes firmly adhered to both surface board, rendering the entire wall section a unitary element, endowed with stability, strength and permanence. It is, furthermore, of exact size, as predetermined for the building scheme, and needs only to be stood up in its proper location, and secured by adhesives. This construction is typical, and basic to all wall units, the only distinction among the several units being the type of edge closures employed, which appear in some variety, depending on the nature of the several joints, and typical examples of such joints will be described hereinafter.

FIGURE 4 shows typical, vertical sections through both inner and outer walls as well as the roof panels. The outer wall panel 16 is seen as comprising the female edge closure strip 124 at both top and bottom edges. These

strips are composite, comprising two sheet-like, generally channel form components, permanently secured together and spaced to provide a tubular, honeycomb structure. Thus, each strip comprises an outer channel 128, with an inwardly dished, V-form bottom 130, and an inner channel 132, secured by cementing in nested relation within the channel 128, and also having an inwardly dished portion 134 in which the vertex of the V-section 130 is received, and secured by cementing. Thus constructed, the unit has great rigidity and strength, with minimum weight, and presents especial reinforcement against damage to the V-section, female joint member.

Anchorage for the wall is provided in a rabbet corner 136 of the building slab 138, which receives a special strip 140, of hollow construction, secured in place by a mass of mastic or cement 142, and having a projecting, V-form ridge 144 which mates with V-trough 130 on the bottom edge of the wall panel. With the panel thus in place, and the male and female parts secured as by cement, the wall is securely anchored in place, especially against lateral movement, which is positively prevented by the keying interlock.

The inside, bearing wall, 80, is also anchored in the slab 138, the latter being provided with a channel 146, in which a strip 148, generally similar to the strip 140 is secured by cement 142. This strip also has a V-ridge 144, mating with lower edge closures the same as in the outer wall. Each strip has a reinforcing, inner septum 150, under the V, and strip 148, which is symmetrical about the septum, has side channels 152, for greater holding power. Only one of these appears in strip 140, on the inner side, and the outer side is provided with a pair of hooks 154, adapted to receive cooperating hooks on an outside, trim strip 156. On the inside, a trim strip or baseboard 158, of hollow construction, is secured to the wall unit, by any convenient means, such as a bolt 160, or a snap-on device, and one of these strips may be placed on each side of the inside wall 80.

The support for the roof panels is evident in FIGURE 4, wherein a panel 110 is shown as having an inner end sharing the top edge of wall 80 with its companion panel 108, and supported on and overhanging the outside wall 16. For the outer support, the panel 110 has secured to its under side, a channel with a V-body 162 similar to V 130 of channel 128, and having flanges 164 contacting the roof panel. As seen, this V nests in the V-trough at the top of wall 16, and is cemented thereto. At the wall 80, the inner edges of the roof panels are each provided with a closure member comprising a generally rectangular channel 166, in which is nested a boattail channel member 168, both being concave outwardly. The top edge of wall 80 has a generally similar closure member, with a channel 170 having a central trough 171 and a nested channel 172, but in this case, both are concave inwardly. The opening between the inner edges of panels 108 and 110, is covered by a cap strip 174, secured by bolts 176, passing through suitable bores in the cap and in the channels 170, 172, and a suitable sealant material 178 is provided under the edges of the cap. For additional protection, the cap may have additional inner ribs 180, suitably sealed, and a sealant may also be provided under the outer washer 182.

The roof panels have inner, channel studs 120, at suitable intervals, and their outer ends are closed by inwardly open channels 184, over the collective, outer ends of which is placed a fascia strip 186, having a depending, extending, lower, looped edge 187.

FIGURE 12 shows the longitudinal, or side joint between the roof panels. This is a stepped joint, with a generally S-form interlock. Considering the female member, to the left in FIGURE 12, the closure strip 187 comprises an outer member having a flange 188 attached to the inner side of upper surface board 114, an arcuately dished corner 190, a perpendicularly disposed section 192, an intermediate, diagonally directed loop portion

194, and a terminal, perpendicularly directed flange 196. Partially mated with this element, to form the honey-combed closure strip, is a second member having a flange 198 secured to a portion of flange 188, in face contact, a diagonal section 200, an intermediate trough 202, receiving the bight of loop 194, a second diagonal section 204, an outwardly directed section 206, secured to inner board 116, in face contact, and a perpendicular, terminal section 208, secured to the inside of the other terminal flange 196, in face contact. Due to the generally stepped configuration of the edge closure element, side edges of the two surface boards 114, 116, are staggered.

The male edge closure 209, which is stepped re-entrantwise, forming a claw in complementary relation to closure 187, has a top flange 210, secured to the underside of board 114, in face contact, an arcuately dished corner 211, in mirror-image relation to a corner 190, a perpendicular, depending section 212, an intermediate section 214, of S curvature, one loop 215 of which extends partly into loop 194, to lock the parts against side-wise relative movement, and a second, and terminal, perpendicular section 216. Inwardly of the component just described, the reinforcing component has an upper flange 218, an inwardly open, channel form part spanning the thickness of the panel, and having an upper, diagonal section 220, a medial, perpendicular section 222, a lower, diagonal section 224, an outwardly directed, lower section 226, secured to the inside of the lower board 116 in face contact, and a terminal, inwardly directed flange 228, secured to the inner side of section 216, in face contact. It will be understood that the two types of closure members, 187 and 209, will be provided, respectively, on opposite side edges of each roof panel, except in the end panels, which will have a closure and trim such as shown in the longitudinal end of the panel in FIGURE 4. A suitable sealant material 230 is placed in the trough formed by arcuate corners 190 and 211, and in the event of leak for any reason, the space between loop 215 and loop 194 serves as a drain channel. In this connection, it should be noted that the roof will have a slight slope, as shown in FIGURE 4, in any degree deemed necessary or desirable.

FIGURES 8-10 show a wall section which is used for attachment of other wall sections to its respective ends, and therefore comprises the male and female end closure members, 122, 124, respectively, of which the female section has already been described. The male section 122 comprising spaced, inner and outer sheets, has an outwardly extending V-ridge 232 with marginal portions 234, the two being similar to parts 162, 164 shown in FIGURE 4. In this case, however, for attachment within the wall panel, the member has a pair of flanges 236, secured to the inner sides of boards 114, 116, in face contact, and secured within this channel member, and also open inwardly, is an inner sheet in the form of a reinforcing channel piece 238, spaced inwardly of the outer channel member. At convenient locations, the channel studs 120 may be provided with hook-form elements 240, for handling elements of the electrical wiring system.

The edge closures at the window opening 241 (shown in FIGURE 9, but omitted in FIGURE 8) are roughly similar to closure 122, and differ therefrom in the outer component 242, which has a stepped form rather than a V-ridge. The frame 244 of the window is preferably of metal and is generally L-form, with an inner flange 246, secured as by a screw 248 to the shoulder of the piece 242, and with an inwardly directed hook section 250, engaging the face of outer board 114, and sealed by a suitable strip 252. The element 244 further carries a channel member 254, providing a step 256 for accommodating the window proper, and the crack between this member and inside surface board 116 is covered by a flanged, channel-form trim strip 258, secured in any convenient manner, such as snap-fastener strip 259. Access

to screws, such as 248 is had through suitable openings in the member 244, which openings are closed by snap plugs 260. A similar arrangement, at the top of a window is shown in FIGURE 4.

In the case of vertical wall edges which are not to be joined to another wall edge, one of the channel studs 120 may be used for the edge closure, as shown in FIGURE 11.

As shown in FIGURE 13, the door jamb is generally similar to the window hardware, except that the element 262 has a strip 264 extending through the door opening, and has an intermediate channel portion 266 forming a door stop with an inner and an outer shoulder. A like element is employed at the top of the door, as shown in FIGURE 14. An inside door lintel is shown in FIGURE 6, wherein the same unit 126, which mounts the window hardware in FIGURE 9, is employed.

In the four-way joint shown in FIGURE 7, special pieces are employed. Herein, the hallway door jamb 268 is secured to wall 16 by screws 270, and to wall panels 24 and 28 by screws 272. The end closure of panel 16 comprises a channel 274, in which is secured a nested, claw-form channel 276. The end closures 278 in panels 24, 28, are generally similar to closure 126 of FIGURE 6, except that they have bevelled corners 280, which receive, in nested relationship, the tapered outer end of one of the claw-form strips 276, which is secured by screws 282 in a shouldered, channel member 284, which constitutes a door stop.

An outside corner joint is shown in FIGURE 5. Here, one panel, 22, is provided with a channel end closure 120, and the panel 14 has a generally similar channel closure, modified by provision of an extending lip or ridge, 286 on its outer side. The two panels are joined by a strip 288 of L-form section, secured by screws 290. A corner trim strip 292, also of generally L-form, has a hooked end 294 interengaging lip 286, and is secured by screws 296 to a hooked portion 298 of the connecting member 288.

From the foregoing description, it will be apparent that the objects enumerated at the outset are attainable in ample measure by the features of construction embodied in the present invention. Off-site construction of entire walls, to final dimensions, and with doorways and window openings framed, makes possible a rapid erection at the building site, without need for fitting, cutting, trimming, or requirement for skilled labor. In addition, the use of interlocking or interfitting edge closures, together with the adaptability of plastic structural members for attachment by adhesion, further expedite the job of erection.

Generally speaking, whereas a certain preferred, general embodiment, and preferred variants among the sub-combinations of structural elements have been shown and described, various other modifications will become apparent, in the light of this disclosure, and the invention should not therefore, be deemed as limited, except insofar as shall appear from the spirit and scope of the appended claims.

We claim:

1. In a building assembled from prefabricated wall and roof units including outer wall panels, roof panels, and inner partition panels, a plurality of structural units, each unit comprising a pair of spaced, parallel, surface boards having edge closure members throughout the periphery of the unit, plastic structural members of channel form, located in parallel spaced relation within the unit, having their channel flanges adhesively secured to the inner faces of said boards and a solid, foamed, plastic material contained in the spaces within said unit, said edge closure members each comprising a plurality of plastic members of substantially uniform thickness and of generally channel shape, the webs thereof being at least partly spaced apart, the flanges of at least one of said channels being adhesively secured to the inner edge faces

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of said boards and the flanges of each of said channels being secured adhesively to each other interiorly of said boards, the outwardly facing portions of exposed channel webs of mating panel units being formed for inter-fitting relationship.

2. The structure according to claim 1 wherein, of the plurality of edge closure channels there is one having its flanges directly secured to the inner edge faces of the boards and another having the outer faces of its flanges secured to the inner faces of the one channel, the webs of the two channels being secured together at their mid-points but diverging thence toward the junctures of the flanges and webs, whereby the web of the one channel is braced by the web of the other.

3. The structure according to claim 1 wherein the edge closure channels face inwardly of units which they close.

4. The structure according to claim 3 wherein, of the plurality of edge closure channels there is one having its flanges directly secured to the inner edge faces of the boards and another having the outer faces of its flanges secured to the inner faces of the one channel, the webs of the two channels being secured together at their mid-points but diverging thence toward the junctures of the flanges and webs, whereby the web of the one channel is braced by the web of the other.

5. The structure according to claim 3 wherein, of the plurality of edge closure channels, the exposed one has its flanges directly secured to the inner faces of the boards, the web thereof having a stepped, L-shape, there being a second, interior channel having the external faces of its flange secured to the internal faces of the exposed channel.

6. The structure according to claim 3 wherein, of the plurality of edge closure channels, the exposed one has its flanges directly secured to the inner faces of the boards, the web thereof having a stepped reentrant shape forming a claw, there being a second interior channel having the external faces of its flanges secured to the interior faces of the exposed channel and a portion of it web secured to the web of the exposed channel.

7. The structure according to claim 3 wherein, of the

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plurality of edge closure channels, the exposed one has its flanges directly secured to the inner faces of the boards, the web thereof having a first portion, adjacent one board, perpendicular to its adjacent flange, a second adjacent portion at right angles to the first portion and extending away from the body of the unit and a third adjacent portion extending back toward the body of the unit and joined to the second flange of the channel, there being a second interior channel having the external faces of its flanges secured to the interior faces of the exposed channel and a portion of its web secured to the web of the exposed channel.

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