Sept. 10, 1946. E. R. CLOSS 2,407,252

PREFABRICATED BUILDING

Filed Oct. 22, 1943 3 Sheets-Sheet 1

Fig.1.

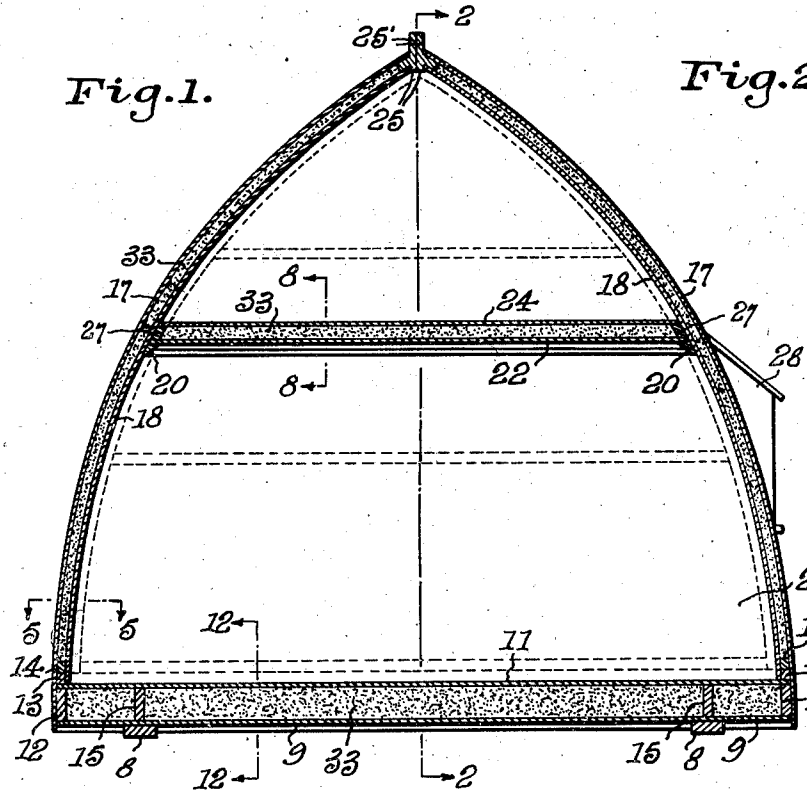


Fig.2.

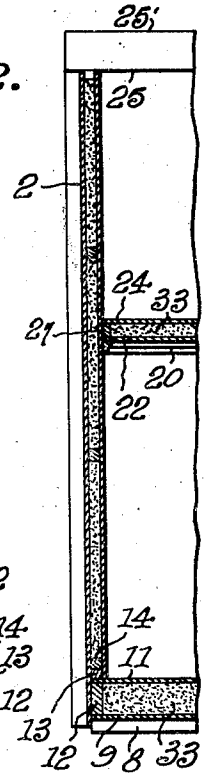


Fig.3.

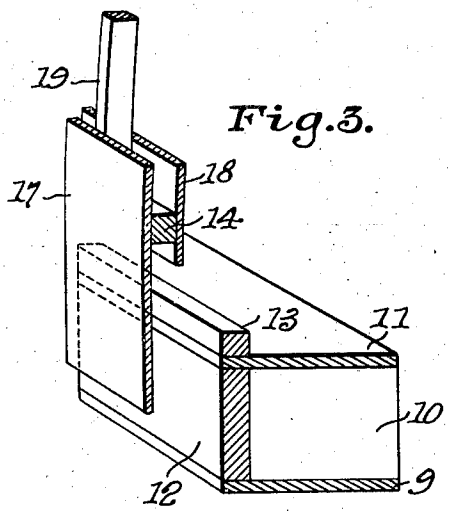
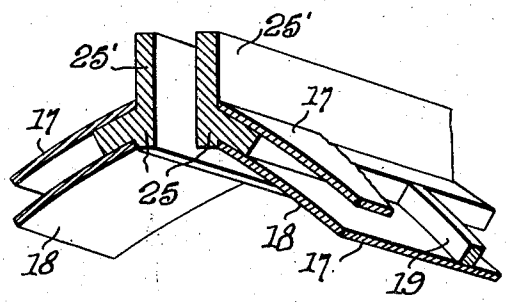


Fig.4.



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Sept. 10, 1946. E. R. CLOSS 2,407,252

PREFABRICATED BUILDING

Filed Oct. 22, 1943 3 Sheets-Sheet 2

Fig.5.

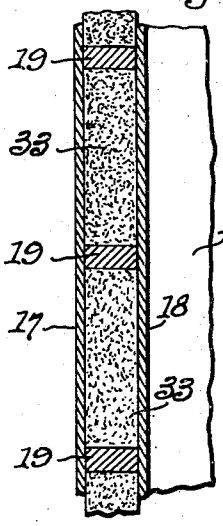


Fig.6.

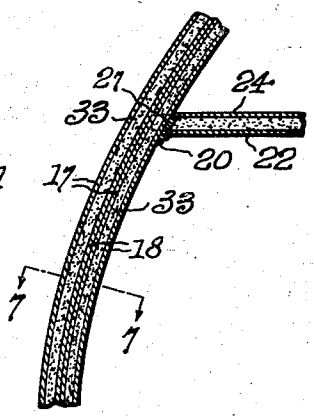


Fig.7.

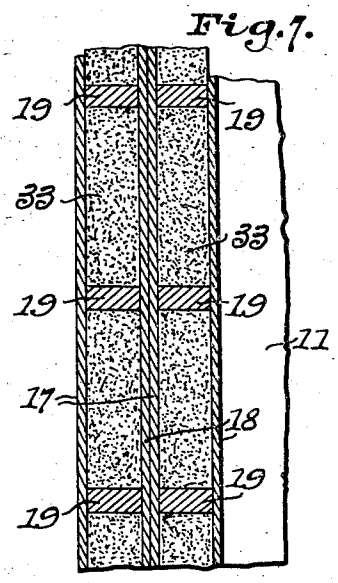
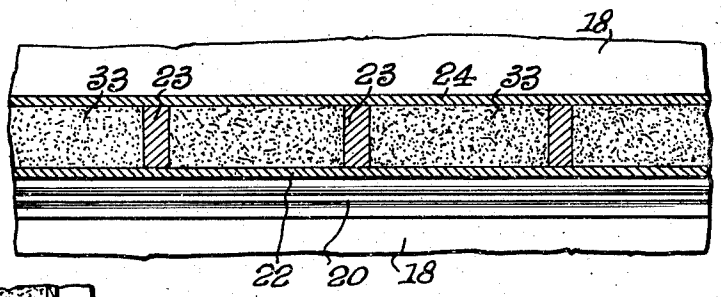


Fig.8.



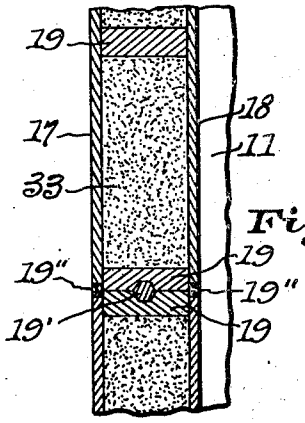


Fig.9.

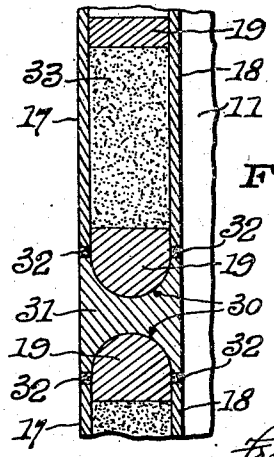


Fig.10.

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Sept. 10, 1946. E. R. CLOSS 2,407,252

PREFABRICATED BUILDING

Filed Oct. 22, 1943 3 Sheets-Sheet 3

Fig. 11.

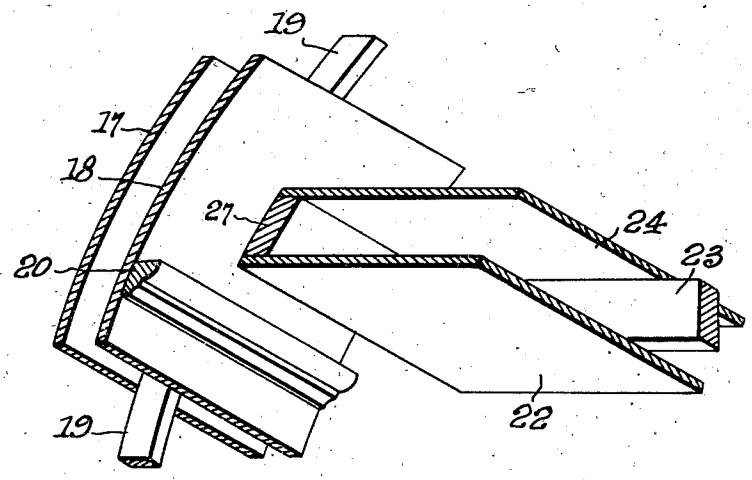


Fig. 12.

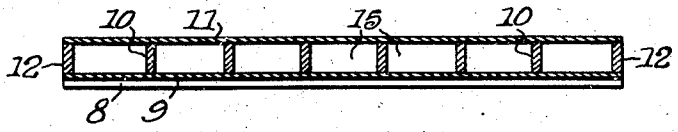
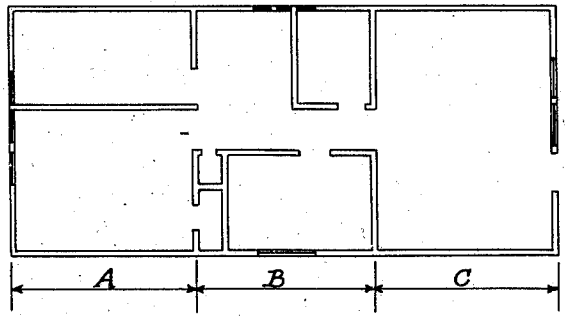


Fig. 13.



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2,407,252

UNITED STATES PATENT OFFICE

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PREFABRICATED BUILDING

Edwin R. Closs, United States Army,
Camp Swift, Tex.

Application October 22, 1943, Serial No. 507,252

6 Claims. (Cl. 20—2)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

1

The invention described herein may be manufactured and used by or for the Government for governmental purposes, without payment to me of any royalty thereon.

This invention relates to the construction of what are termed prefabricated buildings. It involves new and improved structural units, adapted for ready assembly to produce a finished structure that in itself, because of the character of its components, and the way they are put together, possesses advantages over known constructions in many respects.

The invention, including its several parts or aspects, was conceived in an endeavor to solve some of the problems arising out of the present war emergency, as for example, (1) scarcity of many metals and other materials, as well as fitments, attachments and hardware, ordinarily used in the building of houses and other structures, but now on what is known as the critical list; (2) the pressing need for construction methods that will make possible the use of comparatively unskilled labor, and the doing of a given job in the minimum number of "on the job erection hours;" (3) the need for a system involving the minimum number of major structural members, of such nature and so assembled that they may in themselves provide the interior as well as the exterior surface finish of the building; (4) the importance of lightness in the component members without sacrifice of strength necessary to care for normal stresses or loads in the finished building; (5) the need for a structure that may be effectively insulated against heat or cold to any degree (within limits, of course); (6) the desirability of using so far as possible interchangeable units, with provision for expansion of a finished building when desired, with almost the facility that characterizes the familiar so-called "sectional book-case;" and (7) the utilization for the most part, of a material extraordinarily strong, easily made and shaped, and yet relatively certain as to supply, i. e., ply-wood.

Having in mind the objects thus indicated, among others, the invention includes the elements, combinations, arrangements and relations of parts and procedural methods hereinafter set forth with reference to the drawings forming part of this specification.

In the drawings,

Fig. 1 is a vertical sectional view of a single building unit embodying my invention, and showing the wall-and-roof elements, the interior ceiling-and-cross-brace element, and the floor element of such a unit;

2

Fig. 2 is a fragmentary vertical sectional view taken on line 2—2 of Fig. 1 and showing an end wall of the building unit;

Fig. 3 is a view partly in section and partly in perspective, showing a wall-and-roof element as it is about to be assembled with a corresponding floor element;

Fig. 4 is a view partly in section and partly in perspective, with parts broken away, showing two matching wall-and-roof elements about to be joined at the ridge line of the structure;

Fig. 5 is a sectional view, with parts broken away, taken on line 5—5 of Fig. 1;

Fig. 6 is an end view with parts broken away; showing how two wall-and-roof elements may be assembled in two-ply face-to-face relation, for increased strength and/or insulating effect;

Fig. 7 is a sectional view, with parts broken away, taken on line 7—7 of Fig. 6;

Fig. 8 is a sectional view, with parts broken away, taken on line 8—8 of Fig. 1;

Fig. 9 is a sectional view, with parts broken away, showing a form of edge joint between adjacent wall-and-roof elements, where a plurality of such elements are combined as in Fig. 13;

Fig. 10 is a view similar to Fig. 9, illustrating another form of edge joint between wall-and-roof elements;

Fig. 11 is a perspective view partly in section and with parts broken away, showing the ceiling-and-cross brace element as one end of it is about to be assembled with a wall-and-roof element;

Fig. 12 is a section taken on the line 12—12 of Fig.1, looking in the direction of the arrows; and

Fig. 13 is a typical architect's plan of a building made up of three such units as are indicated at A, B, and C in Fig. 1, joined together and indicating interior partitioning arrangements, and windows.

Referring now to the numerals on the drawings, there are shown in Fig. 1 two wall-and-roof elements or panels, each comprising an outer shell 17, preferably of ply-wood, and an inner shell 18 of the same material and parallel to and matching shell 17 in width and length, these shells being spaced apart by a series of rib members 19, preferably more than three in number, extending from the lower edges of the shells to their upper edges respectively, and arranged at regular intervals and parallel to each other along the widths of the shells; there being preferably a rib 19 at each extremity of the widths of the shells, as indicated in Figs. 9 and 10. Ribs 19 are firmly united to the confronting surfaces of the shells as by means of a strong and preferably water-proof

glue or adhesive, so that the effect is that of an extraordinarily strong solid piece or panel, but compartmented to provide dead air spaces when assembly is complete (Figs. 9 and 10). Within these spaces mineral wool or other insulating material may be packed, as indicated at **33** in Figs. 5, 7, 9 and 10. Further strength is imparted by reason of the fact that the composite shell, i. e., the inner and outer shell and the ribs **19** are formed on parallel curves, so that when two units are brought into the Fig. 1 relation there is constituted a Gothic arch. Each wall-and-roof unit, it will be understood, is of length so that the desired altitude, measured from the apex of the arch (which will be the ridge of the building) to the floor of the building, will be achieved; and its width will be such as to give the desired depth of building or building section.

The pre-fabrication of the curved wall-and-roof elements by means of jigs and applied pressure and adhesive and/or other securing means, may be done in known ways.

The floor element construction will be clear from a comparison of Figs. 1, 3 and 12. It rests on conventional sills **8**, and is made up of one or more parallel smaller than normal floor beams **10**, parallel sill members **12** at right angles to beams **10**, cats **15**, and a horizontal floor **11** and sub-floor **9** preferably of ply-wood enclosing and spaced apart by and adhesively united to the parts **10**, **12** and **15**, whereby is formed a very strong though light floor structure, compartmented as shown by reason of the relations between the various parts. In the several compartments may be placed suitable insulating material, particularly in the spaces between sills **12** and cats **15**. Sills **12** are of length equal to the width of the wall-and-roof section just described; they are in effect end closures and supports between floor **11** and sub-floor **9**, and immediately over them and adhesively united to end edge portions of floor **11** are raised building shoes **13** of length equal to that of sills **12**. This box type floor panel may be readily pre-fabricated in any wood-working shop by setting the various parts up in jigs and applying a water-proof adhesive to all joints and bearing surfaces, followed by pressing of the entire panel in a jig, resulting in a large, light floor unit of exceptional strength and insulating qualities. By reason of the fact that the floor panel extends well beyond the supporting plate **8** on each side, the relative foundation and excavation size and costs are reduced, thereby diminishing the foundation perimeter and the number of square feet of cellar area, as compared with the floor area of the super-incumbent building.

As an example of means for quick and effective assembly of the wall-and-roof elements with the floor panel, I have shown (as to each wall-and-roof element) the inner shell **18** of length so that its lower edge rests on floor **11**, while the lower edge of shell **17** extends down to and even below the level of sub-floor **9**. Within the space between the shells **17** and **18**, slightly above the lower edge of shell **18** (Fig. 3) is a secondary plate or sill member **14**, firmly adhesively united to both shells and to the lower ends of ribs **19** (Fig. 1), as part of the fabrication of the wall-and-roof element. With the described construction it is evident that the slotted lower edge of the wall-and-roof element may be set down over the primary shoe **13**, with the lower end surface of shell **17** in face-to-face engagement with the outer face of sill **12**. Since all joints and meeting surfaces are to be in strong adhesive union, and pressed together in any preferred way while the adhesive is drying, it is evident that the floor and the wall-and-roof sections are readily fitted and effectively held together.

Union of the upper ends of the two matching wall-and-roof elements is accomplished as follows (Figs. 1 and 4). For each of these elements there is a ridge member comprising an upstanding extension **25'** having a curved tongue or part **25** which extends outwardly and downwardly adjacent to the lower end of the extension **25'**. The tongues **25** of the ridge members extend in opposed relation to each other and fit between and are adhesively united to the inner faces of shells **17** and **18** at their upper ends, with the upper ends of the shells **17** and **18** abutting against the outer faces of the upstanding extensions, whose confronting faces of the extensions are parallel when brought together and adhesively and/or otherwise held in that relation, as hereinafter described.

In Figs. 1 and 11 I have indicated a ceiling-and-cross-brace element, comprising a box-like structure with a top wall **24**, a bottom wall **22**, end walls **27**, and beams or ribs **23** (Figs. 1 and 8), between and adhesively united to each of said walls, thus providing a compartmented structure, whose cells or compartments may be packed with insulating material if desired. This ceiling panel may be readily prefabricated from ply-wood, and it will be dimensioned so that its length will correspond to the distance between roof-and-wall sections at a chosen height above the floor while its width matches that of the wall section. It is set in place as indicated in Figs. 1 and 11, moldings **20** being adhesively or otherwise secured to the shells **18** at the proper height, and the ceiling panel being put in place so that it rests upon moldings **20**, with its ends **27** in contact with the respective shells **18**. All surfaces that are to be in contact are covered with adhesive before they are brought together; and in order that effective pressure may be applied I prefer that the curve of the wall-and-roof element shall be somewhat less in radius than is required for the finished building. It follows that when opposite wall-and-roof elements are erected and pressed against the ends of the ceiling panel, there will be an opening between the confronting faces of the ridge parts **25'**. These faces are covered with water-proof adhesive and then brought together with suitable clamps, so that the wall-and-roof elements are firmly united at the ridge, and so that the ceiling panel which by reason of its length and the relation of the various parts is already held in compression between shells **18**, is put under still further compression, thereby compressing the applied adhesive and joining the ceiling panel and the wall-and-roof elements to form a rigid whole.

When a building is to have a depth greater than the width of one of the roof-and-wall elements, it becomes necessary to employ two or more of said elements for each side of the building, in edge-joined relation. In Fig. 9 I have shown one way of accomplishing such joint. In that case the ribs **19** at the ends of adjacent roof-and-wall elements are provided with recesses in which are accommodated a spline **19'**. The confronting faces of the ribs **19**, the surfaces of the recesses in the ribs, and the surfaces of the spline, are all covered with suitable water-proof adhesive, and the parts are brought together in the Fig. 9 relation, and held until the adhesive sets. Any spaces

between the confronting edges of the respective shells 17 and 18 may be filled with mastic 19'' or the like, and if desired may be covered with battens.

Another form of each connection is shown in Fig. 10, where the ribs 19 project well beyond the edges of the respective shells 17 and 18 and are formed to enter correspondingly shaped recesses 30 in a connecting piece 31. Here again any spaces between the edges of shells 17 and 18 and the opposed edges of the connecting piece may be filled with mastic or the like 32, and if desired covered with battens. Of course, where the building is to be thus sectionalized, with wall-and-roof elements in edge-joined relation, there will be corresponding multiplication of the matching floor panels, edge-joined by adhesive to each other and to the wall-and-roof elements. And similarly with respect to ceiling units, if these are used.

As indicated in Fig. 6, there may be cases where it is desired to have greater insulating effect in the building, and in such cases a plurality of wall-and-roof elements may be employed, in ply relation as shown in Fig. 6, the contacting faces of the elements being preferably adhesively united. In the same way, other structural elements herein described, as, for example, the floor panel and the ceiling-and-cross-brace element, may be pluralized and in multi-ply relation, whether for the sake of strength or insulating effect, or both.

It will be understood that the ends of the building will be closed by means of generally flat closure members 2 (Fig. 2) whose perimeter will be adapted to fit the end spaces defined by the curved wall-and-roof elements and the floor panel on which they rest. Furthermore, the wall-and-roof elements and the end closure elements 2 may be provided with suitable openings for light and ventilation as indicated in Fig. 13, and one or more of these elements may be a prefabricated unit of ply-wood to fit between adjacent ribs 19, it being understood that window openings are perhaps most conveniently located between such adjacent ribs. One of these window units is indicated at 28 in Fig. 1.

It will be understood, and it is repeated here, that all major units forming a part of my building will be made so far as possible of some such material as ply-wood, and that all joints and contacting surfaces of various units and the parts thereof will be formed and united with waterproof adhesive. It will be appreciated that with a building whose side walls and roof are continuous and curved as indicated, there is no need for flashings, gutters or leaders, and rafters, girders, tie rods, studs, scantlings and the like elements, which are separately applied in conventional building practice, are eliminated as separate elements, either because they are not necessary or because equivalents of them are prefabricated in the various units or their absence compensated for by the conformations and other characteristics of the complete building and/or its components.

The cellular or compartmented construction, with interior bracing, is considered to be of importance from the standpoint of strength and insulating effect, and is therefore preferred for each of the major units, i. e., wall-and-roof element, floor panel, ceiling-and-cross-brace, and end closures, and all of these are to be made of wood so far as possible, preferably ply-wood.

And it is clear that the units of each different

class (e. g., wall-and-roof element, floor panel, etc.) may be made in quantity, of some standard size and interfitting and adhesively joinable with corresponding units of the same or different class.

It will thus be seen that there is herein provided a novel and efficient form of prefabricated building which is well adapted for the purpose intended. Even though there has been herein shown certain features of construction and assembly of parts, it is nevertheless to be understood that various changes may be made therein, if the changes do not depart from the spirit or scope of the claims.

Having described my invention, what I claim as new and wish to secure by Letters Patent is:

1. A building structure including a floor, dual wall and roof panel units, each of said units comprising inner and outer shells formed on similar curves and extending upwardly from said floor, a ridge member uniting the upper ends of the units together and including complemental portions mounted on the upper ends of said units, said portions having upstanding extensions and curved tongues extending outwardly and downwardly adjacent to the lower ends of the extensions, said tongues fitted between the upper ends of said shells and adhesively united to the inner faces thereof and said extensions having parallel confronting faces adhesively united.

2. A building structure including a floor, dual compartmented interiorly braced wall and roof panel units, each of said units comprising inner and outer shells formed on similar curves and extending up from said floor, a ridge member uniting the upper ends of the units together and including complemental portions mounted on the upper ends of said units, said portions having upstanding extensions and curved tongues extending outwardly and downwardly in opposed relation to each other adjacent to the lower ends of the extensions, said tongues fitted between the upper ends of said shells and adhesively united to the inner faces thereof and said upstanding extensions having parallel confronting faces adhesively united.

3. A building structure including a floor panel of ply wood, adhesively edge-joined dual wall and roof panel units, each of said units comprising inner and outer shells formed on parallel curves and extending up from said floor panel, rib members holding said shells of the units in spaced relation and extending from lower ends of said units to upper ends thereof, a ridge member uniting the upper ends of said units together and comprising complemental portions mounted on the upper ends of said units, said portions having upstanding extensions and curved tongues extending outwardly and downwardly in opposed relation to each other adjacent to the lower ends of the extensions, with the tongues fitted between the upper ends of said shells and adhesively united to inner confronting faces thereof and to the upper ends of said rib members and said upstanding extensions having confronting faces adhesively united.

4. A building structure including a floor panel having an upper floor member and a lower subfloor member, raised building shoes mounted on end edge portions of said upper member of said floor panel, dual compartmented interiorly braced wall and roof panel units, each of said units comprising spaced inner and outer shells formed on parallel curves and extending up from said floor panel, said inner shells fitted down over said building shoes and engaging said upper floor member

at their lower edges and said outer shells extending down past the upper floor member to the lower floor member whereby a weather tight closure is provided at the bottom of said structure, a ridge member uniting the upper ends of said units together and comprising complemental portions mounted on the upper ends of said units, said portions having tongues and upstanding extensions with the tongues fitted between the upper ends of the shells and adhesively united to inner confronting faces thereof and said extensions having confronting faces adhesively united.

5. A building structure including a floor, confronting dual wall and roof panel units, each of said units comprising spaced inner and outer shells formed on parallel curves and extending upwardly from said floor, a ridge member uniting the upper ends of said units together and including complemental portions mounted on the upper ends of said units, said portions having outwardly and downwardly curved lower tongues and upstanding extensions with the tongues fitted between the upper ends of said shells and adhesively united to inner confronting faces thereof and said extensions having parallel confronting faces adhesively united and a compartmented interiorly braced ceiling and cross brace member extending between and adhesively united to and in compression between each of said confronting wall and roof panel units.

6. A building structure including a floor panel having an upper floor member and a lower subfloor member, raised building shoes mounted on end edge portions of said upper floor member, dual compartmented interiorly braced wall and roof panel units, each of said units comprising inner and outer shells formed on similar curves and extending up from said floor panel, upwardly extending rib members holding said shells in spaced relation, sill members mounted between and adjacent to the lower ends of said shells, said inner shells fitted down over said building shoes and engaging said upper member of the floor panel at their lower ends and said outer shells extending down past the upper floor member to the lower floor member, said sills engaging said shoes and adhesively united to said shells and to lower ends of said rib members, a ridge member uniting the upper ends of said units together and including compartmented portions mounted on the upper ends of said units, said portions having outwardly extending tongues and upstanding extensions, said tongues fitted between the upper ends of said shells and adhesively united to inner confronting faces thereof, said extensions having parallel confronting faces adhesively united and members closing the ends of said structure.

EDWIN R. CLOSS.