

Aug. 18, 1942.

H. F. FREASE

2,293,431

SEPARABLE STRUCTURE

Filed June 30, 1939

5 Sheets-Sheet 1

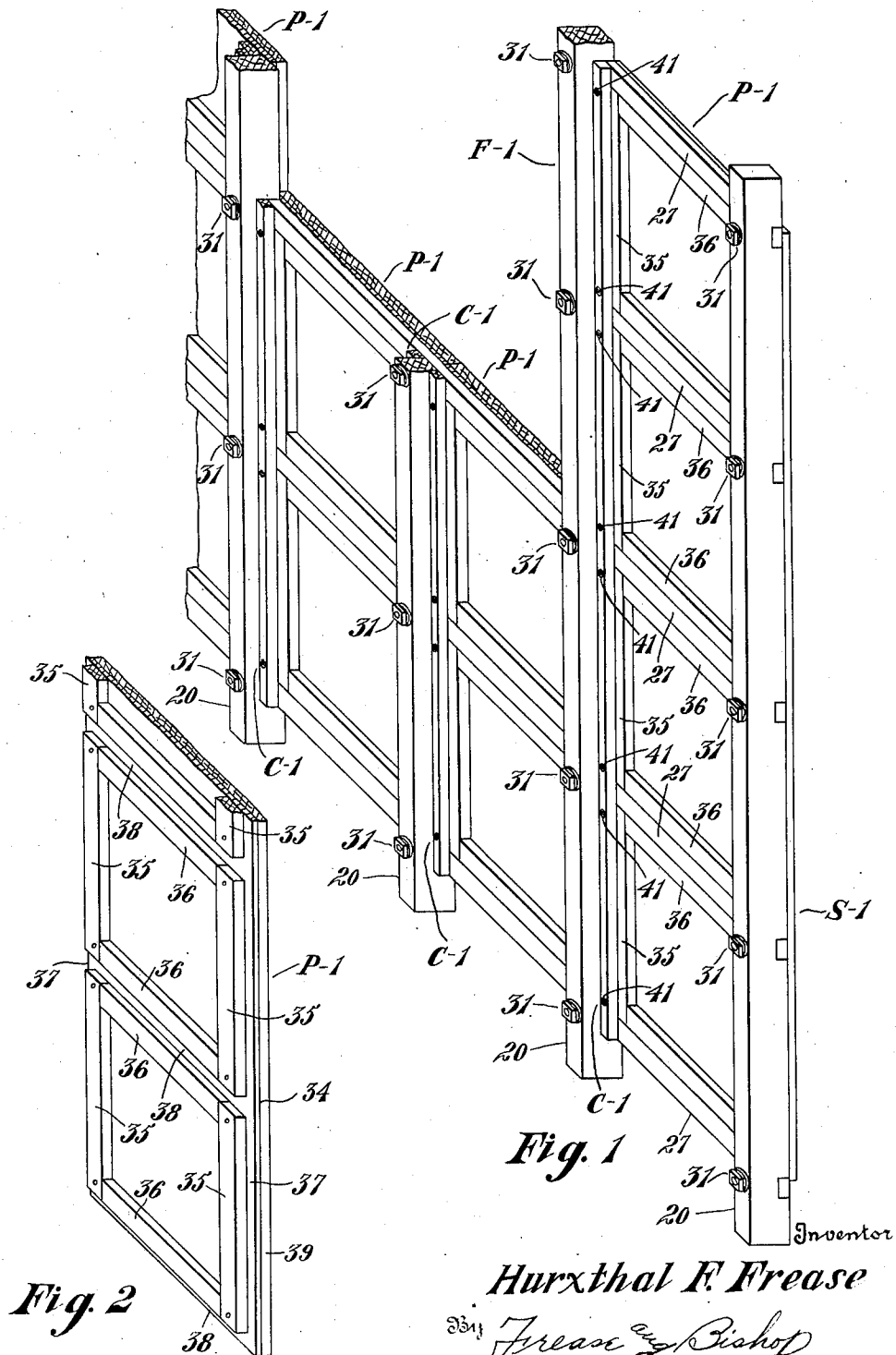


Fig. 1

Fig. 2

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SEPARABLE STRUCTURE

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5 Sheets-Sheet 2

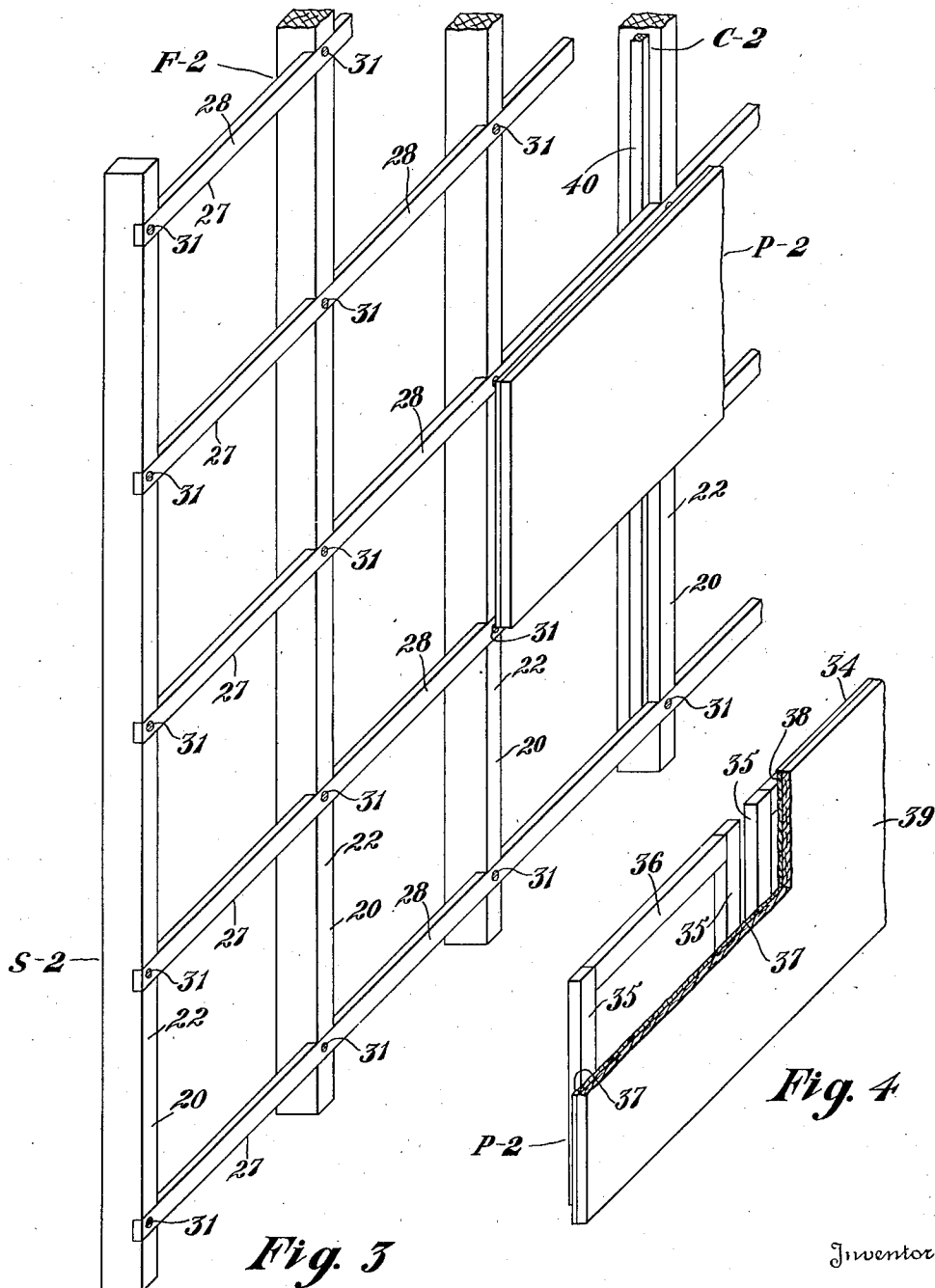


Fig. 3

Fig. 4

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2,293,431

5 Sheets-Sheet 3



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2,293,431

SEPARABLE STRUCTURE

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5 Sheets-Sheet 5

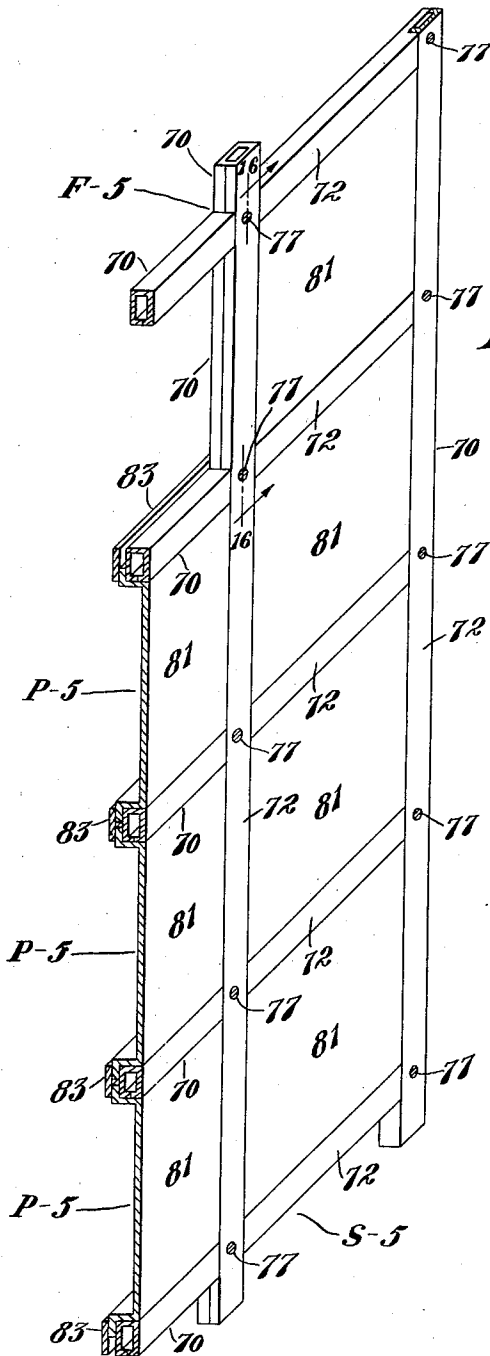


Fig. 14

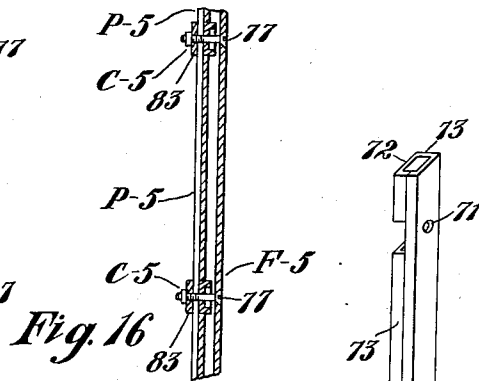
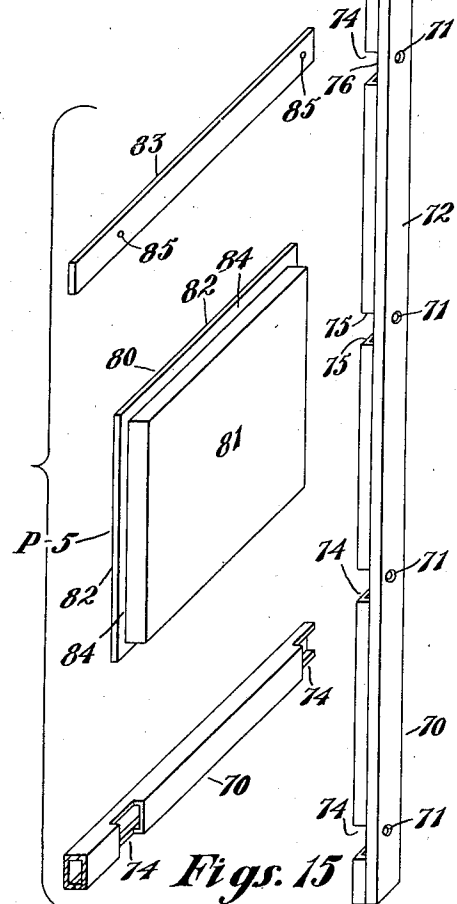


Fig. 16



Figs. 15

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2,293,431

SEPARABLE STRUCTURE

Hurxthal F. Freese, Canton, Ohio

Application June 30, 1939, Serial No. 282,101

6 Claims. (Cl. 20—4)

My invention relates in general to separable structures which may be put together and taken apart primarily by the use of screw drivers and wrenches, and more particularly my invention relates to separable structures adapted for use in providing low cost housing.

Structures in general use up to the present may be termed inseparable.

In every building, each wall, floor, or roof constitutes in itself a component structure of the building as a whole.

In most buildings, the component wall, floor, and roof structures thereof are made from inseparably assembled parts, and the component wall, floor, and roof structures are inseparably assembled together.

In wood construction, the wood frame or dimension members are nailed together, and the sheeting, siding, sub-flooring, flooring, and roofing, are nailed to the wood frame members.

When once nailed in place any subsequent alterations result in the destruction of a substantial portion of the material already in the wood wall, floor, or roof being altered.

Usual brick or tile and other masonry structures may likewise be termed inseparable structures, since for example, after the brick and tile are laid up in the usual manner by means of mortar joints, demolition of the wall, floor or roof made from the same is a very time consuming and an expensive operation, and results in the destruction of a large part of the brick or tile or other masonry units in the structure being demolished.

Usual reinforced concrete structures are likewise inseparable.

In usual steel frame construction, rivets or welding are used to connect the frame members together, and such construction may likewise be termed inseparable.

From another standpoint steel frame construction has been used primarily in industrial and office buildings, wherein the relatively great erection and demolition costs of inseparable construction has not heretofore been considered to be of importance.

The usual inseparable structures whether made of wood, masonry, concrete, or steel, all require almost entirely the use of skilled labor in their erection.

Certain types of separable structures are already in use, in which relatively large wall, floor, and roof panels are inseparably preassembled in a factory, and then taken to the place of use

where the panels are connected together frequently by bolts.

Such forms of structures may be termed large panel structures, each panel requiring a group of men or a crane to handle it.

Moreover in large panel structures, there is a restricted choice in the size and finish of the rooms of buildings made with the same.

Usual inseparable residential buildings are all characterized by restricted choice in the matter of size, shape, and finish of the rooms, and alterations thereof after the building is completed may be undertaken only at relatively great and frequently prohibitive costs.

The objects of the present invention are in general to provide improved separable structures which may be assembled and disassembled by the use of screw drivers and wrenches, reducing the amount of skilled labor required to erect low cost houses in particular, enabling an owner-builder himself to do a major portion of the construction of the building, and enabling economical disassembly whenever desirable for alterations, repairs, or additions.

Further objects of the present invention include the provision of improved separable structures, the parts of which may be made of a variety of different materials.

Further objects of the present invention include the provision of improved separable frame structures adapted for permitting independent expansion or contraction of the frame thereof and the frame covering parts.

The foregoing objects of the present invention are the same as certain of the objects of my prior application for U. S. Letters Patent for Separable frame and connected block structures, filed June 16, 1939, Serial No. 279,501, but in the present invention these objects are attained in a more advantageous manner for many purposes.

Further particular objects of the present invention include the provision of an improved separable structure in which all the frame members or parts and frame covering members or parts may be made of wood and which may be separably connected with each other by screw means, such as screws, and bolts and nuts.

Further particular objects of the present invention include the provision of an improved separable structure in which all the parts may be made of metal, and which are separably assembled by the use of screw means.

Further particular objects of the present invention include the provision of an improved separable structure including frame members

and interfitting frame covering members separably connected with each other by screw means, and coacting with each other to resist displacement of the members or parts of the structure in any direction with respect to each other.

Further particular objects of the present invention include the provision of an improved separable structure, each part of which one man can handle, and which one man may when necessary put together or take apart.

Further particular objects of the present invention include the provision of an improved separable structure having a separable frame and separable panel units, and in which errors in assembly are minimized by the form and arrangement of the parts.

The foregoing and other objects are attained by the structures, members, units, parts, combinations, and sub-combinations, which comprise the present invention, the nature of which is set forth in the following general statement, and preferred embodiments of which together with their mode of use are set forth by way of example in the following description, and which are particularly and distinctly pointed out and set forth in the appended claims forming part hereof.

The nature of the present invention may be stated in general terms as including a first set of preferably equally spaced frame members extending in one direction, a second set of preferably equally spaced frame members extending crosswise of the first set of frame members, the two sets of frame members constituting a criss-cross frame forming a plurality of rectangular preferably square openings between the members thereof and having rectangular seating and sealing faces on the members about the openings, a plurality of frame covering members preferably panel units each including a panel having preferably at one side thereof insert members fitting into one or more of the criss-cross frame openings and resisting angular displacement of the frame members with respect to each other, the panel units having peripheral rectangular seating and sealing flanges and faces about the insert members, preferably screw means for connecting the frame members together, and preferably clamping bar means screw associated with the panel units and the frame members and clamping the panel units on the frame members with the rectangular seating and sealing faces of the panel units screw clamped against the rectangular seating and sealing faces of the frame members.

By way of example, embodiments of the improved separable structures, and the members, parts, and units thereof are illustrated in the accompanying drawings forming part hereof, in which

Figure 1 is a fragmentary oblique view of the rear or inside of a first embodiment of the improved separable structures hereof, in the form of a wall in which the frame members are made of wood, and are bolt connected with each other, and in which the frame covering members are in the form of vertically extending side by side panel units made of wood and include wood insert members fitting in the frame openings, and in which the clamping bars are made of wood and are screw connected with the panel insert members and extend across one set of the frame

members in clamping opposition to the sealing flanges and faces of the panel units;

Fig. 2, a fragmentary rear side oblique view of one of the improved panel units of the structure of Fig. 1;

Fig. 3, a fragmentary oblique view of a second embodiment of the improved structures hereof, which is a wall structure generally similar to the structure of Fig. 1, but including horizontally arranged improved panel units;

Fig. 4, a fragmentary oblique view of one of the horizontal panel units of the structure of Fig. 3 before being assembled therein;

Fig. 5, a fragmentary oblique view of a third embodiment of the improved structures hereof in the form of a floor or roof deck, and including frame members and clamping bars which are identical with the frame members of the structures of Figs. 1 and 3, and panel units which are slight modifications of the panel units of the structures of Figs. 1 and 3;

Fig. 6, an oblique view of one of the panel units of the structure of Fig. 5 before being connected therewith, the panel unit being turned upside down for clearly illustrating the insert members thereof;

Fig. 7, a fragmentary top plan view of a frame member of one of the sets for the frames of the structures of Figs. 1, 3, and 5;

Fig. 8, a fragmentary side elevation thereof;

Fig. 9, a fragmentary top plan view of a frame member of the other set for the frames of the structures of Figs. 1, 3, and 5;

Fig. 10, a fragmentary side elevation view thereof;

Fig. 11, a fragmentary oblique view of a fourth embodiment of the improved separable structures hereof in the form of a double finish surface partition wall, particularly adapted for interior partitions, and in which the frame members, the panel units, and the clamping bars are made of wood and wood products;

Fig. 12, disassembled oblique perspective views of some of the parts of the structure of Fig. 11;

Fig. 13, a fragmentary transverse sectional view thereof as on line 13—13, Fig. 11;

Fig. 14, a fragmentary oblique view of a fifth embodiment of the improved separable structures hereof in the form of a single finish surface wall structure, all the parts of which are made of metal, preferably steel;

Fig. 15, disassembled fragmentary oblique perspective views of some of the parts of the structure of Fig. 14; and

Fig. 16, a vertical transverse fragmentary sectional view as on line 16—16, Fig. 14.

Similar numerals refer to similar parts throughout the several views.

The first embodiment of the improved separable structures hereof illustrated in Fig. 1 is indicated generally by S—1; the second embodiment of the improved separable structures hereof illustrated in Fig. 3 is indicated generally by S—2; and the third embodiment of the improved separable structures hereof illustrated in Fig. 5 is indicated generally by S—3.

The structures S—1, S—2, and S—3 include respectively improved separable criss-cross frames indicated generally by F—1, F—2, and F—3.

A plurality of improved panel units each indicated generally by P—1 are connected with the frame F—1 preferably by improved screw clamp means each indicated generally by C—1; an improved panel unit indicated generally by P—2 is

connected with the frame F—2 preferably by improved screw clamp means each indicated generally by C—2; and a plurality of improved panel units each indicated generally by P—3 are connected with the frame F—3 preferably by improved screw clamp means each indicated generally by C—3.

The structures S—1 and S—2 as shown are each a vertical wall, which may be an exterior wall of a building not requiring flat finish interior surfaces, such as a camp or farm cottage; and the structure S—3 as shown is a horizontal wall, which may be a floor or a roof deck for a similar building.

The frames F—1, F—2, and F—3 are structurally identical, excepting for the over-all areas thereof, and for the fact that the frames F—1 and F—2 are for vertical walls, and the frame F—3 is for a horizontal wall, as aforesaid.

Each improved criss-cross frame F—1, F—2, and F—3, includes a plurality of longitudinally extending members or pieces 20 preferably uniformly spaced and preferably parallel with each other, and which as shown are made of wood, and which may be made from standard dimension or rectangular frame lumber of any usual nominal cross sectional dimension such as 2" x 4".

In Figs. 7 and 8, one of the pieces 20 is shown in plan and elevation respectively before being assembled into any of the improved separable frames F—1 or F—2 or F—3.

Each rectangular frame member or piece 20 has a plurality of longitudinally spaced holes preferably circular bores 21 of equal diameters extending therethrough preferably at right angles to the narrower longitudinal faces 22 thereof and with the longitudinal axes or centers of the bores 21 in the center plane between and parallel with the broader longitudinal faces 23 of the rectangular piece 20.

In one of the narrower faces 22 of each piece 20 there are formed a plurality of longitudinally spaced transverse rectangular notches 24, each notch 24 extending preferably at right angles with the faces 23, and each notch 24 having its opposite side faces 25 preferably equally spaced on opposite sides of the center of one of the bores 21, and the width of each rectangular notch 24 between its opposite side faces 25 being preferably equal to the width of the narrower longitudinal faces 22 of the piece 20.

The bottom faces 26 of the notches 24 are offset from the face 22 of the piece 20 into which the notches are cut, and one end of each bore 21 terminates in the bottom face 26 of one of the notches.

The longitudinal spacing of the centers of the bores 21 of each piece 20 is preferably equal, and a spacing of 24" on centers for the bores 21 is preferable for certain purposes of the present invention.

The improved criss-cross frames F—1, F—2, and F—3, each furthermore includes a plurality of members or pieces 27 preferably uniformly spaced and preferably parallel with each other, and which as shown are made of wood, and which may be made from standard rectangular wood boards having a nominal cross sectional dimension of 1" x 2" for attaining certain purposes of the invention when the pieces 20 are made of dimension lumber having a nominal 2" x 4" cross section.

In Figs. 9 and 10, one of the pieces 27 is shown in plan and elevation respectively before being

assembled into any of the improved separable structures F—1, F—2, or F—3.

More generally, the broader faces 23 of the pieces 27 are preferably equal in width to the faces 22 of the pieces 20, and the depth of the notches 24 is preferably equal to the width of the narrower faces 29 of the pieces 27.

Each piece 27 has a plurality of longitudinally spaced holes preferably circular bores 30 of equal diameters extending therethrough preferably at right angles to the broader longitudinal faces 28 thereof and with the centers of the bores 30 in the center plane between and parallel with the narrower longitudinal faces 29 of the rectangular piece 27.

The longitudinal spacing of the bores 30 of each piece 27 is preferably equal, and also is preferably equal to the spacing of the bores 21 of the pieces 20.

The pieces 20 and 27 as above described are preferably pre-fabricated in a wood working shop, and the required number of each are delivered to each place of use ready for immediate assembly.

In each frame F—1, F—2, and F—3, the pieces 27 extend across the notched faces 22 of the pieces 20, and the pieces 27 fit in the notches 24 of the pieces 20, with the bores 30 of the pieces 27 registering with the bores 21 of the pieces 20.

Screw means connect the criss-cross frame pieces or members 20 and 27 together, as shown the connecting screw means being bolts 31 with washered nuts, the shank of each bolt passing through one of the sets of registering bores 30 and 21.

The connected criss-cross frame members 20 and 27 thus form therebetween in each frame F—1, F—2, and F—3, a plurality of rectangular openings, which preferably are square. The notched faces 22 of the frame members 20 and the outer faces 28 of the frame members 27 on one side of each frame F—1, F—2, and F—3 are flush seating and sealing faces and are in a substantially flat plane.

The heads of the connecting bolts 31 are preferably countersunk in the outer faces 28 of the pieces 27, the shanks of the bolts extending beyond the unnotched faces 22 of the pieces 20, where the washered nuts are screwed on the threaded bolt shanks, clamping the frame members 20 and 27 tightly together.

The improved panel units P—1, P—2, and P—3, each includes a rectangular covering sheet 34, which as shown and preferably for the wood structures S—1, S—2, and S—3, is made of plywood and of an area preferably to extend over a plurality of the square openings in the criss-cross frames F—1, F—2, or F—3.

For the structures S—1, and S—2, each sheet 34 as shown may be 24" x 3' for extending over four of the square frame openings, and for the structure S—3, as shown each sheet 34 may be 24" x 4', for extending over two of the square frame openings.

On one side of each sheet 34 there are provided a set of rectangular insert members 35 which are parallel with each other and have their sides and ends located to fit in the square openings of either of the criss-cross frames F—1, F—2, and F—3, preferably so that the edges of the sheet 34 align with the centers of the frame members.

In the panel units P—1 and P—2, another set of parallel insert members 35 extend between the insert members 35 and form therewith square insert frames on the panel sheets 34, which are adapted to fit in the criss-cross frame openings.

The peripheral and transverse portions of each sheet 34 adjacent and between the insert members, constitute seating and sealing faces 37 and 38 at right angles with each other, and the peripheral portions of each sheet 34 constitute border seating and sealing flanges for the panel unit P-1, P-2, or P-3, of which it is a part.

Each rectangular covering sheet 34 of each panel unit P-1, P-2, and P-3 as shown has secured on its side opposite to that having the insert members secured thereto, a panel lamina 39, illustrated diagrammatically, and which may be of any desired material, such as siding or flooring, and which may or may not have a fabric covering.

The panel units P-1, P-2, and P-3, respectively are applied to their frames F-1, F-2, and F-3 by inserting the square insert frames formed by the insert members 35 and 36 of the panel units P-1 and P-2, and the insert members 35 of the panel units P-3, into the square openings of the respective criss-cross frames.

The rectangular border seating and sealing flanges of each panel unit P-1, P-2 and P-3, each seats and seals against the flush seating and sealing faces of the criss-cross frame members 20 and 27 in each frame F-1, F-2, and F-3.

The screw clamp means C-1, C-2, and C-3, respectively each includes as shown, for each row of insert members 35, a square clamp bar 40 which extends across the frame members 27 on the under or inside thereof and which is screw connected by screws 41 to a row of the insert members 35, screw clamping the seating and sealing faces of the panel units P-1, P-2, and P-3 upon the seating and sealing faces of the criss-cross frames F-1, F-2, and F-3, respectively.

In the structure S-1, the panel units P-1 are arranged with their longer sides extending vertically. In the structure S-2, the longer sides of the panel unit P-2 shown assembled extends horizontally.

By the use of the rectangular panel units P-1, P-2, and P-3 whose over-all dimensions are substantially multiples of the squares defined by the center lines of the criss-cross frame members, and whose insert members define the sides of equally spaced squares corresponding to the equally spaced square openings of the criss-cross frames F-1, F-2, and F-3, the panel units may be assembled on the frames with their longer sides extending parallel with either set of the criss-cross frame members 20 and 27, as may be desired for purposes of attaining greatest strength, or for design purposes, or otherwise.

The panels P-1, P-2, and P-3 are preferably prefabricated at a wood working shop, and delivered to the place of use where they may be very rapidly assembled with the criss-cross frames to make the separable structures hereof.

The fourth embodiment of the improved separable structures hereof illustrated in Figs. 11 and 13 is indicated generally by S-4, and includes an improved separable criss-cross frame indicated generally by F-4, and a plurality of improved square panel units P-4A and P-4B connected in an improved manner on the frame by screw clamp means indicated generally at C-4.

Some of the separated parts and units of the structure S-4 are illustrated in Fig. 12.

The structure S-4 is a double finish surface partition wall for example particularly adapted for low cost buildings.

The frame F-4 includes a plurality of longi-

tudinally extending members or pieces 50, which as shown are made of wood, and which may be made from standard rectangular boards of any usual nominal cross-sectional dimension such as 1" x 3".

Each rectangular frame member or piece 50 has a plurality of longitudinally spaced holes preferably circular bores 51 of equal diameters extending therethrough preferably at right angles to the broader longitudinal faces 52 thereof and with the longitudinal axes or centers of the bores 51 in the center plane between and parallel with the narrower longitudinal faces 53 of the rectangular piece 50.

In one of the broader faces 52 of each piece 50 there are formed a plurality of longitudinally spaced transverse rectangular notches 54, each notch 54 extending preferably at right angles with the faces 53, and each notch 54 having its opposite side faces 55 of the loci thereof preferably equally spaced on opposite sides of the center of one of the bores 51, and the width of each rectangular notch 54 between its opposite side faces 55 being preferably equal to the width of the broader faces 52 of the piece 50.

The bottom face 56 of each notch 54 is offset from the face 52 into which the notches are cut, and one end of each bore 51 terminates in the bottom face 56 of one of the notches.

The longitudinal spacing of the centers of the bores 51 of each piece 50 is preferably equal, and a spacing of 24" on centers for the bores 51 is preferable for certain purposes of the present invention.

The depth of the notches 54 is preferably equal to one-half the width of the narrower faces 53 of the pieces 50.

The pieces 50 as above described are preferably prefabricated in a wood working shop, and the required number of pieces 50 are delivered to each place of use ready for immediate and rapid assembly.

In the frame F-4, one set of the pieces 50 extend in one direction and are equally spaced from each other a distance equal to the spacing of the bores 51. Another set of the pieces 50, with their notches 54 facing the notches 54 of the first set, extend across the first set, the bores 51 of the criss-cross pieces 50 registering with each other and the notched portions overlapping each other.

The criss-cross pieces 50 form in the frame F-4 a plurality of rectangular openings, which preferably are square as shown. The notched and unnotched faces 52 of the assembled frame F-4 as shown are flush on both sides, providing at either side of the frame F-4, rectangular preferably square seating and sealing faces which are in substantially parallel flat planes.

Screw means connect the criss-cross frame pieces or members 50 together, and as shown include screws 57, the shank of each of which extends through one of the sets of registering bores 51. The heads of the screws 57 are preferably countersunk in the unnotched side of one set of the criss-cross pieces 50.

The improved panel units P-4A each includes a seating and sealing rectangular frame 60, which may be made of standard wood boards of the nominal 1" thickness, and which corresponds to the sheet 34 in the panel units P-1, P-2, and P-3. On one side of the frame 60, a plurality of side by side insert board members 61A are secured as by nailing, the total area of the side by side boards 61A being less than

the area of the frame 60, and being square for fitting and filling any of the square openings of the criss-cross frame F—4.

As shown the width of each frame 60 of the panel units P—4A is equal to the distance between centers of the vertical criss-cross frame members 50, while the height of each frame 60 is less than the distance between centers of the horizontal criss-cross frame members 50, so that in the assembled structure S—4, the shanks of the screws 57 may extend between the spaced horizontal end faces 62 of the frames 60.

In the structure S—4, horizontal clamping bars 63 extend across the horizontal peripheral flange portions 64 of the frames 60 on the side of the frames opposite to that on which the insert boards 61 are secured.

As shown, the clamp bars 63 are made of wood and the screws 57 screw into the clamp bars 63, screw clamping each frame 60 with its rectangular border portions 65 and 66 about the insert board members 61A seated and sealed against the adjacent flush faces 52 of the criss-cross frame members 50, and with the insert board members fitting and filling one of the square openings of the criss-cross frame F—4.

For providing a double finish surface for the structure S—4, each panel unit P—4A as shown has horizontal cross-pieces 67 made of wood and secured as by nailing to the side of the frame 60 against which the clamp bars 63 abut, each cross-pieces 67 preferably being so located so as to be adjacent one side edge of one of the two clamp bars 63 clamping each panel unit P—4A.

A square covering sheet 68 preferably of plywood is secured as by nailing on the sides of the cross-pieces 67 opposite the sides abutting the frame 60 in each panel unit P—4A.

The area of each covering sheet 68 is preferably equal to the area between centers of the criss-cross frame members 50.

The panel units P—4B are substantially identical in shape and use as the panel units P—4A, but in each panel unit P—4B a one-piece insert board member 61B is used instead of the side by side insert board member 61A. Each one-piece insert board member 61B is square and fits and fills one of the square openings of the criss-cross frame F—4, and may be made of fibrous material such as wood fiber board.

The panel units P—4A and P—4B are preferably prefabricated in a wood working shop, and delivered as required to the place of use, where they are rapidly assembled on the frame F—4, as above described.

The fifth embodiment of the improved separable structures hereof illustrated in Figs. 14 and 15 is indicated generally by S—5, and is an all metal structure preferably made of steel, and includes an improved separable criss-cross frame indicated generally by F—5, and a plurality of improved square panel units P—5 connected in an improved manner on the frame by screw clamp means indicated generally by C—5.

Some of the separated parts and units of the structure S—5 are illustrated in Fig. 16.

The structure S—5 is a single finish surface wall adapted for use for example as an exterior wall of a metal building not requiring an interior finish surface on the same wall, such as a tool house, a garage, and the like.

The structure S—5 is structurally in all metal counterpart of the structure S—4 without the metal equivalents of the cross-pieces 67 and the covering sheets 68.

The frame F—5 includes a plurality of longitudinally extending metal members 70 preferably tubes having a rectangular cross section, each having a plurality of longitudinally spaced preferably circular holes or apertures 71 of equal diameters formed in one rectangular tube wall 72, with the centers of the apertures 71 being on the longitudinal center line of the tube wall 72.

In the opposite parallel tube wall 72 and in the other opposite tube walls 73 of each tube 70 there are formed a plurality of notches 74, each notch extending at right angles with the tube walls 73, and each notch 74 having its opposite side faces 75 or the loci thereof preferably spaced on opposite sides of the center axis of one of the circular apertures 71 which is perpendicular to the planes of the opposite walls 72, and the width of each rectangular notch 74 between its opposite side faces 75 being preferably equal to the width of the walls 72 of the tube 70.

The longitudinal spacing of the centers of the apertures 71 of each tube 70 is preferably equal, and a spacing of 24" on centers for the apertures 71 is preferable for certain purposes of the invention.

The bottom edges 55 of each notch are in the tube walls 73, and the depth of each notch 54 is preferably equal to one-half the width of the walls 73 of the tubes 70.

The metal tubes 70 as above described are preferably prefabricated in a sheet metal working shop, and the required number of notched and apertured tubes or members 70 are delivered to each place of use ready for immediate and rapid assembly.

In the frame F—5, one set of the tubes 70 extend in one direction and are equally spaced from each other a distance equal to the spacing of the apertures 71. Another set of the tubes 70, with their notches 74 facing the notches 74 of the first set, extend across the first set, the apertures 71 of the criss-cross tubes 70 registering with each other and the notched portions overlapping each other.

The criss-cross tubes 70 form in the frame F—5 a plurality of rectangular preferably square openings. The notched and unnotched walls 72 of the criss-cross tubes 70 in the assembled frame F—5 as shown have flush outer faces on both sides, providing at either side of the frame F—5, rectangular preferably square seating and sealing faces which are in substantially parallel flat planes.

Screw means connect the criss-cross frame members or tubes 70 together, and as shown include threaded bolts or machine screws 77 with nuts, the shank of each screw extending through one of the sets of registering apertures 71. The heads of the screws 77 are preferably countersunk in the apertured wall 72 of one set of the criss-cross tubes 70.

Each improved panel unit P—5 is preferably a one-piece metal preferably steel stamping including a rectangular preferably square flange frame 80 from which protrudes a rectangular preferably square insert pan 81 on the front side of the panel unit.

As shown the area of each flange frame 80 is slightly less than the equal areas between centers of the criss-cross frame members 70, so that the shanks of the screws 77 may extend between the edges 82 of the frames 80.

In the structure S—5, horizontal clamping bars 83 extend across the rear sides of the horizontal

flanges 84 of the flange frames 80 of the panel units P—5.

As shown, the clamp bars 83 are made of metal preferably steel and have formed therein on their center lines a plurality of apertures 85 equally spaced the same distance apart as the apertures 71 in the tubes 70.

The shanks of the screws 77 extend through the apertures 85 of the clamp bars 83 and nuts are screwed on the threaded ends of the screw shanks, screw clamping each panel unit flange frame 80 with the front seating and sealing faces of its rectangular flanges 84 seated and sealed against the adjacent flush faces 72 of the criss-cross frame members 70, and with the insert pan 81 fitting and filling one of the square openings of the criss-cross frame F—5.

The embodiments of the present invention illustrated and described herein are by way of example, and the scope of the present invention is not limited to the same or to the particular details thereof, but is commensurate with any and all novel subject matter contained herein which may at any time properly under the United States patent laws be set forth in the claims hereof or originating herein, and the elements of any of such claims being intended to include their functional or structural equivalents.

I claim:

1. In a separable structure, two sets of spaced longitudinally extending frame members separably connected with and crossing each other and forming a criss-cross frame having a plurality of equal area openings, the frame members having on one side thereof seating faces about the openings, a plurality of panel units, each panel unit including flange portions with seating faces abutting the seating faces of the criss-cross frame members about one of the openings, insert members on each panel unit fitting in one or more of the openings, and screw clamp means operative between the panel units and the criss-cross frame and separably clamping the panel units on the frame, the screw clamp means including clamp bars on the other side of the frame and screws connecting the clamp bars with the panel units and clamping the clamp bars and the panel units against opposite sides of the frame.

2. In a separable structure, a criss-cross frame including spaced and angled members forming a plurality of openings, the frame members having on one side thereof seating faces about the openings, a plurality of panel units, each panel unit including flange portions with seating faces abutting the seating faces of the criss-cross frame members about one or more of the openings, insert members on each panel unit fitting in one or more of the openings, and screw clamp means operative between the panel units and the criss-cross frame and separably clamping the panel units on the frame, the screw clamp means including clamp bars on the other side of the frame and screws connecting the clamp bars with the panel units and clamping the clamp bars and the panel units against opposite sides of the frame.

3. In a separable structure, a criss-cross frame including spaced and angled members forming a plurality of square openings, the frame members having on one side thereof seating faces about the openings, a plurality of rectangular panel units, each panel unit including flange portions

with seating faces abutting the seating faces of the criss-cross frame members about one or more of the openings, insert members on each panel unit fitting in one or more of the openings, and screw clamp means operative between the panel units and the criss-cross frame and separably clamping the panel units on the frame, the screw clamp means including clamp bars on the other side of the frame and screws connecting the clamp bars with the panel units and clamping the clamp bars and the panel units against opposite sides of the frame.

4. In a separable structure, a criss-cross frame including spaced and angled members forming a plurality of square openings, the frame members having on one side thereof seating faces about the openings, a rectangular panel unit including flange portions with seating faces abutting the seating faces of the criss-cross frame members about a plurality of the square openings, a plurality of insert members on the panel unit, the insert members having their sides on a plurality of squares equal to and spaced from each other the same as and fitting in the plurality of square openings of the criss-cross frame, and screw clamp means operative between the panel unit and the criss-cross frame and separably clamping the panel unit on the frame, the screw clamp means including clamp bars on the other side of the frame and screws connecting the clamp bars with the panel units and clamping the clamp bars and the panel units against opposite sides of the frame.

5. In a separable structure, a criss-cross frame including one set of spaced longitudinally extending frame members each having a plurality of longitudinally spaced notches formed in one face thereof, a second set of spaced frame members extending longitudinally across the first set, each frame member of the second set being located in a row of the notches of the frame members of the second set, means separably connecting the frame members together at their crossings, a plurality of panel units, each panel unit including flange portions with seating faces abutting the frame members, insert members on each panel unit fitting in one or more of the openings between the frame members, and screw clamp means operative between the panel units and the criss-cross frame and separably clamping the panel units on the frame, the screw clamp means including clamp bars on the other side of the frame and screws connecting the clamp bars with the panel units and clamping the clamp bars and the panel units against opposite sides of the frame.

6. In a separable structure, a criss-cross frame including two sets of spaced longitudinally extending frame members, one set of the spaced members extending across the other set, a plurality of panel units each including flanges seating on one side on some of the frame members, insert members on each panel unit fitting in one or more of the openings between the frame members, clamp bar members abutting the other side of the frame members, and screw means separably connecting the clamp bars with the panel units and clamping the clamp bars and the panel units against opposite sides of the frame members.

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