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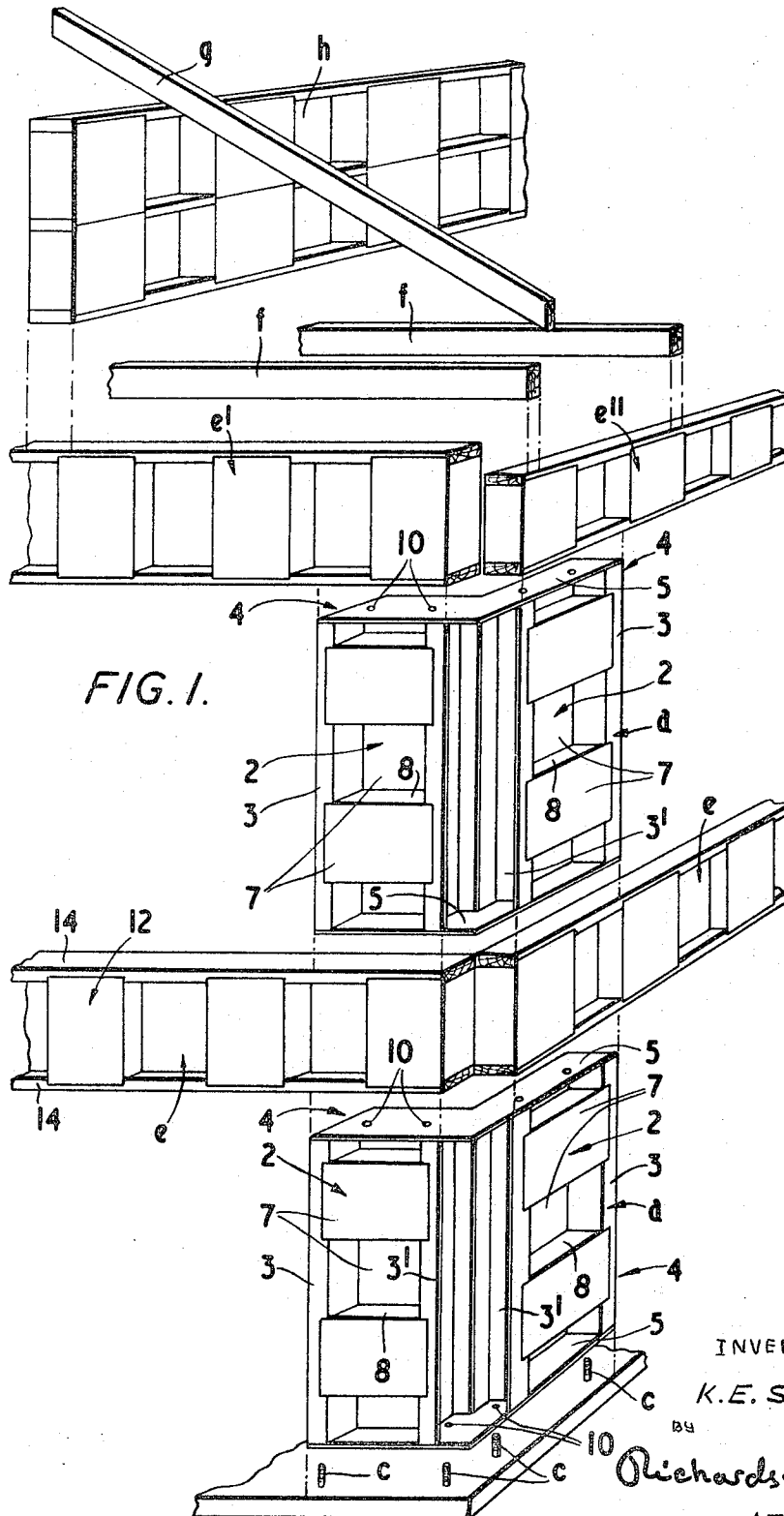
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3,305,989

MULTI-STOREY BUILDING FRAMEWORK

Filed Feb. 18, 1964

2 Sheets-Sheet 1



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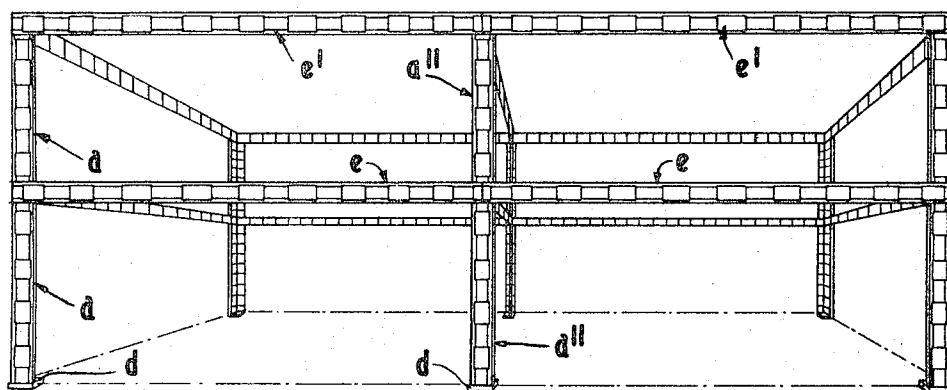


FIG. 2.

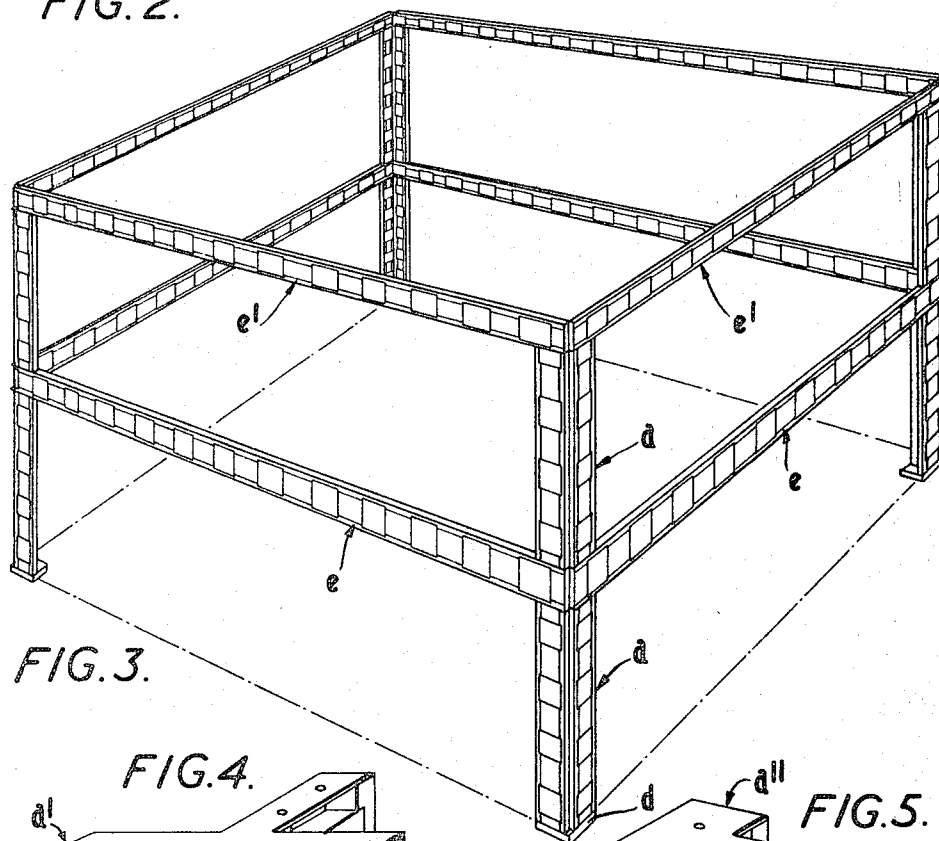


FIG. 3.

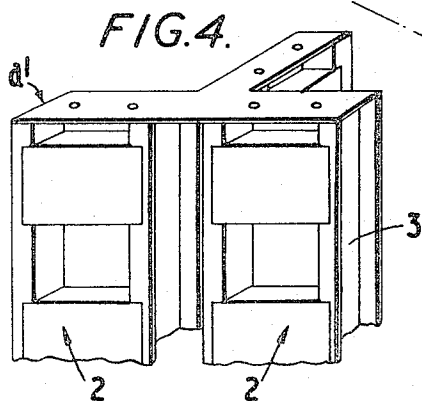


FIG. 4.

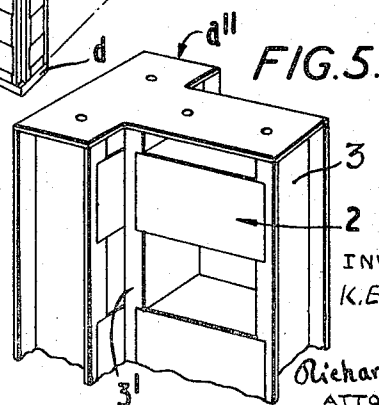


FIG. 5.

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1

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MULTI-STOREY BUILDING FRAMEWORK

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11 Claims. (Cl. 52-295)

This invention is concerned with novel constructions of frameworks for multi-storey buildings and with the fabrication thereof from improved kinds of structural members.

According to the invention in its broadest aspect, in a multi-storey building framework each storey or tier is built-up by vertical pillar or column units disposed around the periphery and horizontal cross-members which extend between adjacent said peripheral pillar or column units and rest upon the top thereof in superimposed relationship, said cross-members of each lower storey or tier supporting in turn the pillar or column units of the next higher storey or tier which are in vertical alignment with the pillar or column units of the lower storey or tier.

In carrying out the invention, preferably a set of aligned pillar or column units are positioned at each corner, and the framework elements are assembled so as together to make up a series of complete rectangles extending throughout the structure in both vertical and horizontal planes.

It has been found that particular advantage may be obtained in fabricating the above forms of framework construction by employing composite structural frame members which comprise a continuous corrugated web part of castellated, turreted or step-like form in longitudinal cross-section, connecting spaced-apart, parallel, longitudinal reinforcing chord members. Examples of such composite structural frame members which may serve for use as the horizontal cross-members in particular are disclosed in the specification of my co-pending patent application No. 226,060 but in addition, particular advantageous novel forms of vertical pillar or column units having this basic construction have also been devised for use in the above-defined building frameworks and these constitute a further aspect of the invention.

Thus, the preferred pillar or column units for use in fabrication of the building frameworks in accordance with the invention broadly comprise at least two interconnected limbs extending in divergent vertical planes, each limb comprising a continuous web part connecting a pair of spaced-apart vertical chord members, the web part being corrugated along its length so as to have a castellated or turreted form in longitudinal cross-section with longitudinal side wall portions disposed alternately in parallel spaced-apart vertical planes and connected by intermediate transverse wall portions.

By way of example of the manner in which the invention may be carried out, various views of the fabrication of a framework for a two-storey house, and structural members therefore, are illustrated in the accompanying drawings.

In said drawings,

FIGURE 1 is an exploded perspective view showing one corner of the structure;

FIGURE 2 is a perspective view showing the complete basic framework unit suitable for a pair of semi-detached two-storey houses;

FIGURE 3 is a perspective view showing the complete basic framework unit suitable for a single detached two storey house; and

FIGURES 4 and 5 are perspective fragmentary views showing alternative forms of peripheral pillar or column

2

units for use intermediate the corners where intermediate walls are required.

Referring firstly to FIGURE 1, it is seen that the build-up of the building framework is effected by a plurality of pillar or column units *a* at the corners which provide the elevation and which, in this instance, are composed of two continuous corrugated metal web parts *2, 2*, connecting pairs of spaced-apart vertical metal chord members *3, 3'*, forming two limbs *4, 4*, extending in mutually perpendicular vertical planes and arranged with the chord members *3'* in an edge-to-edge, welded-together relationship to give a generally L-shaped cross-sectional form. In addition, horizontal flat L-shaped bearer plates *5* are welded across top and bottom ends of each pillar or column unit *a*.

The web parts *2, 2*, of the units *a* are corrugated transversely so as to provide, in longitudinal cross-section, a castellated or turreted form with longitudinal side wall portions *7* disposed alternately in parallel spaced-apart vertical planes and connected by perpendicular intermediate transverse wall portions *8*, and preferably, as shown, the width of each web part, defined by the distance between successive side wall portions *7*, is less than the distance between the pairs of interconnected chord members *3, 3'*, and is also less than the length of each corrugation, defined by the distance between each pair of successive transverse wall portions *8*.

Furthermore, in the preferred construction illustrated, the transverse wall portions *8* of the web parts *2, 2*, are recessed or cut-away along their free edges to provide notches within which are fitted the vertical chord members *3, 3'* so that the latter, which are conveniently in the form of metal channel-section elements welded to the web parts, are embraced by marginal parts of the side wall portions *7*.

In the assembled structure, each pillar or column unit of the lowermost storey is secured at its lower end by up-standing hold-down bolts *c* embedded in a concrete floor or footing *d* as shown, these bolts *c* being engaged in apertures *10* of the adjacent bearer plate *5*.

Superimposed on the upper end of the lowermost pillar or column unit *a*, so as to rest thereon, are the ends of two horizontal perimeter cross-members *e, e*, which form the mid-floor support beams. Each cross-member *e* again has a sheet-metal continuous corrugated web part *12* of castellated or turreted form in longitudinal cross-section, similar to the web parts *2* of the pillar or column units *a*, and longitudinal chord members *14, 14*, along upper and lower edges of the web part *12* are accommodated in cutaway portions or notches formed in the intermediate transverse wall portions of the web so as to fit between the side wall portions of the latter. In this case, it is preferred that the chord members *14, 14* should be composed of wood, as indicated, and these may be secured to the web side faces by nails or the like. The use of wood chord members provides a useful versatility in enabling other parts of the building structure to be attached as readily as in the case of a wooden framework.

The second storey is built up with further pillar or column corner units *a* which are supported, as indicated, upon the adjacent ends of the lower horizontal cross-members such as *e, e*, in vertical alignment with the correspond pillar or column units of the lower storey. At the top, the second storey pillar or column corner units support horizontal perimeter cross-members *e', e'*, which are again similar to the cross-members *e, e*. The cross-member *e''*, however, is advantageously of less depth than the cross-member *e'* when it is intended, as shown in FIGURE 1, to support wooden ceiling joists *f* which conveniently lie flush on their top surfaces with the top surface of the cross-member *e'*.

In assembling the framework, each of the horizontal cross-members is conveniently affixed to the adjacent ends of the pillar or column units by bolts which pass through the chord members and through the apertures 10 shown in the bearer plates 5.

For the roof, a conventional rafter roof construction may be used but as shown the rafters *g* are advantageously supported by a particular form of rafter support purlin *h*, which rests on the cross-members *e'*.

As will be seen from the drawing, in the construction of the rafter support purlin *h*, two sheet-metal web parts of castellated form with gapped or notched intermediate transverse walls are arranged of superimposed one above the other are connected by a common wood longitudinal reinforcing chord member having a depth equal to double the depth of the gaps or notches in the intermediate transverse walls. In this construction, clearly the web parts may be arranged either as shown, with the side wall faces and recesses of one being aligned with the side wall faces and recesses of the other, or alternatively, they could be arranged in an offset or staggered relationship with the side wall faces of the one above the recesses of the other. This latter arrangement may, in some cases, possibly give a better bracing effect. Also, more than two superimposed web parts can clearly be built up in the same manner, if desired, to give larger composite structural members.

The ends of the horizontal cross-members of the basic framework preferably do not lap at the corners which facilitates the use of a smaller range of standard sizes and allows cantilever supports (for the roof structure, for example) readily to be incorporated if desired.

Where intermediate walls are required to be incorporated in the framework, as in a semi-detached house for example, pillar or column units *a'* or *a''*, of T-section may be used, as shown in FIGURES 4 and 5, these being built-up in the same manner as the L-section corner units *a*. In the case of the unit *a''* shown in FIGURE 5, however, the inner chord member 3' of the central limb is welded directly to the one-piece web part forming the cross-head of the T.

Completed basic frameworks, in accordance with the invention, for a semi-detached two-storey house and for a single detached two-storey house, respectively, are illustrated diagrammatically in FIGURES 2 and 3, and it will be clear that the structures are such that the assembled framework elements together make up a series of complete rectangles extending throughout the structure in both vertical and horizontal planes.

Building frameworks fabricated as described can have a very high inherent strength and rigidity and also, they are capable of being readily erected very quickly so that the roof structure can be completed at an early stage and highly efficient methods of building construction can be employed.

The invention may be applied, of course, not only to frameworks for multi-storey dwelling houses but also to other kinds of multi-storey buildings.

Use of structural frame members of the particular kind disclosed gives particular advantages in respect of the high strength to weight ratio originating from the web design which, in contrast for example to a non-corrugated or simple sinuous corrugated form giving only a limited stiffening effect, may be described as being "box-braced." A further advantage is the ease with which the structural members can be assembled and connected together, and the choice between materials such as sheet metal, wood, or other non-metallic material, for the longitudinal reinforcing members greatly increases the versatility.

Also, it may be pointed out that the strength of individual structural members can readily be altered by utilizing different thicknesses or gauges of sheet material for the web part, without altering the overall dimensions of the member. Design of structural frameworks can there-

fore very conveniently be based on the use of standard sizes of structural members fabricated to possess the required strength.

Although sheet metal will often be a preferred material for at least the web part, the use of other materials may be advantageous in some cases and it may be possible, for example, to utilise satisfactorily a plastics material.

Numerous modifications may, of course, be made within the scope of the appended claims. Particular mention may be made, however, of the fact that in the pillar or column units illustrated, in the accompanying drawings, the web parts terminate in corrugation steps which are of smaller size than the remaining corrugation steps (defined by the distance between successive intermediate transverse walls), but to achieve maximum strength in some cases, it is preferred that all the corrugation steps, including the terminal steps, should be of equal size so that the web parts have an integral number of equally-dimensioned side face portions extending from one end of the other.

I claim:

1. A multi-storey building framework composed of a plurality of vertical pillar units and horizontal cross-members assembled to form a series of rectangles extending throughout the structure in both vertical and horizontal planes, a pillar unit at each corner defining the height of each storey and the horizontal cross-members extending between adjacent pillar units and resting on the top thereof, said cross-members of each lower storey supporting in turn the corner pillar units of the next higher storey which are in vertical alignment with the corresponding corner pillar units of said lower storey, each horizontal cross-member comprising a pair of spaced-apart upper and lower wood chord members and an intermediate continuous corrugated web part having a turfed form in longitudinal cross-section defining longitudinal side face portions and intermediate transverse wall portions, and said web part having notches in upper and lower edges of the intermediate transverse wall portions in which fit the upper and lower chord members.

2. A multi-storey building framework composed of a plurality of vertical pillar units and horizontal cross-members assembled to form a series of rectangles extending throughout the structure in both vertical and horizontal planes, a pillar unit at each corner defining the height of each storey and the horizontal cross-members extending between adjacent pillar units in superimposed relationship, said cross-members of each lower storey supporting in turn the corner pillar units of the next higher storey in vertical alignment with the corresponding corner pillar units of said lower storey, each pillar unit comprising at least two interconnected limbs extending in divergent vertical planes which are perpendicular to one another, each limb comprising a continuous web part and a pair of vertical spaced-apart chord members connected by said web part which is of wandering form, comprising longitudinal side wall portions disposed alternately in two parallel spaced-apart vertical planes and intermediate transverse wall portions which extend between said side wall portions and also brace opposite facing surfaces of chord members.

3. A multi-storey building framework according to claim 2 wherein notches are provided in the free edges of said intermediate transverse wall portions of said web parts of the pillar units, and the vertical chord members are engaged within said notches.

4. A multi-storey building framework according to claim 2 in which the vertical chord members of the pillar units comprise metal channel-section elements secured to said web parts by welding.

5. A multi-storey building framework, according to claim 2 in which the corrugation of the web part in each limb of the pillar units are equally spaced, and the intermediate transverse wall portions of said web part are

5

perpendicular to the planes of the side wall portions, and the distance between the two parallel planes containing the side wall portions is less than the distance between the spaced-apart vertical chord members and also is less than the length of each corrugation which is defined by the distance between each pair of successive intermediate transverse wall portions.

6. A multi-storey building framework according to claim 2, in which the pillar units further comprise horizontal bearer plates secured at upper and lower ends.

7. A multi-storey building framework according to claim 2, further comprising a plurality of concrete foundation elements and fastening means embedded in said foundation elements, which fastening means anchor the lower ends of the pillar units of the lowermost storey.

8. A pillar unit for a multi-storey building framework, comprising a pair of interconnected limbs extending in divergent mutually-perpendicular vertical planes, each limb comprising a continuous corrugated web with a castellated form in longitudinal cross-section defining side wall portions disposed alternately in two parallel spaced-apart vertical planes and intermediate transverse wall portions connecting said side wall portions, and a pair of vertical spaced-apart chord members connected by said web part.

9. A pillar unit according to claim 8, further comprising horizontal bearer plates secured at upper and lower ends and wherein the vertical chord members of each limb comprise metal channel-section elements secured to said connecting web part.

6

10. A pillar unit according to claim 8 in which the vertical chord members of each limb are fitted within notches in the free edges of said intermediate transverse wall portions of the connecting web part.

11. A pillar unit according to claim 8 in which the corrugations of the web part of each limb are equally spaced, and the intermediate transverse wall portions of said web part are perpendicular to the planes of the side wall portions, and the distance between the two parallel planes containing the side wall portions is less than the distance between the spaced-apart vertical chord members and also is less than the length of each corrugation which is defined by the distance between each pair of successive intermediate transverse wall portions.

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