April 25, 1933. R. C. GRAEF 1,905,167

BUILDING WALL STRUCTURE

Filed May 6, 1932 2 Sheets-Sheet 1

Fig. 1

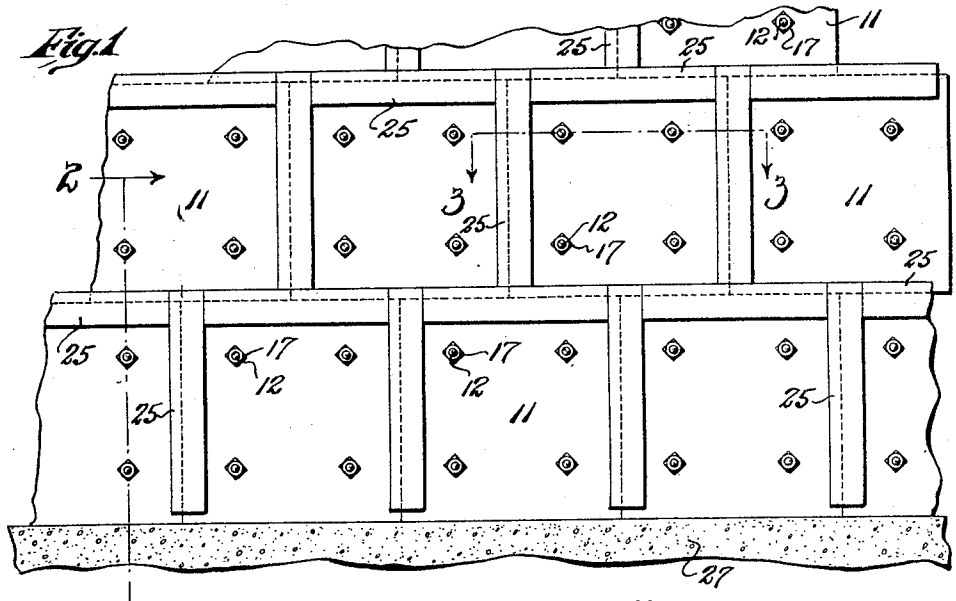


Fig. 2

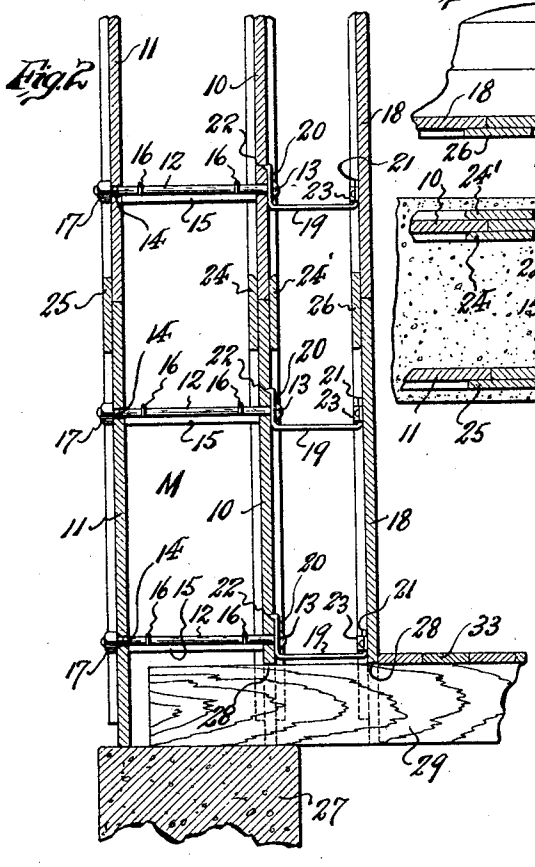


Fig. 3

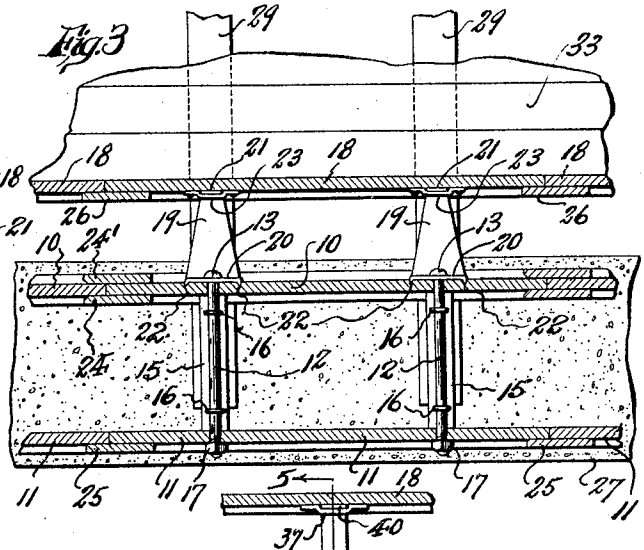
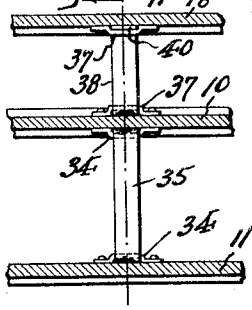


Fig. 4



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Fig. 5

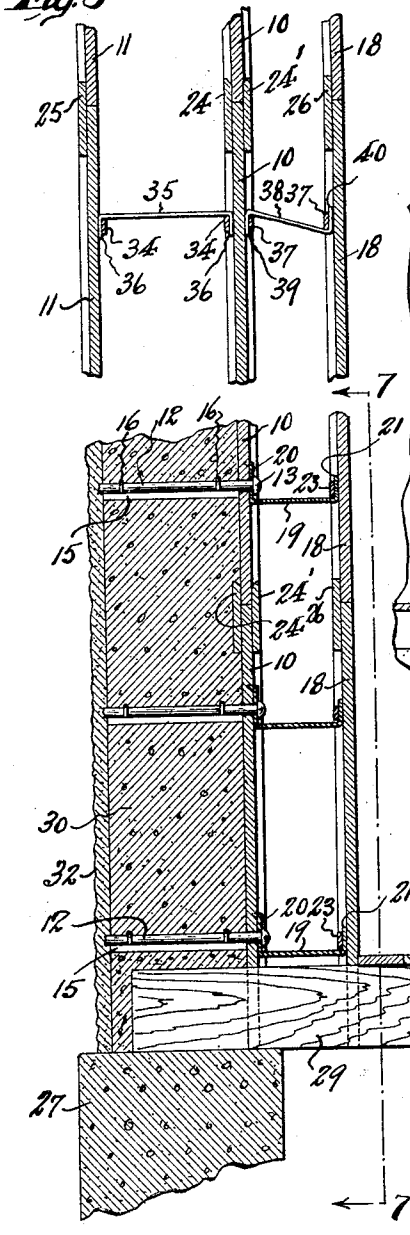


Fig. 7

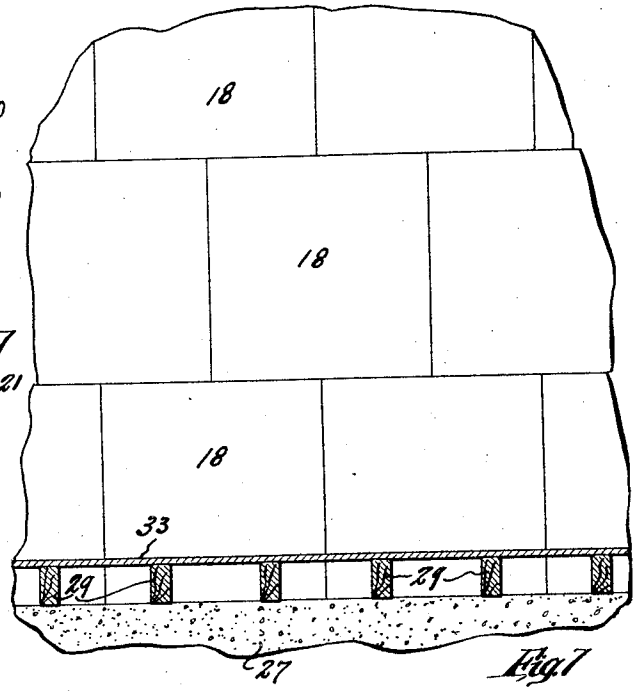


Fig. 6

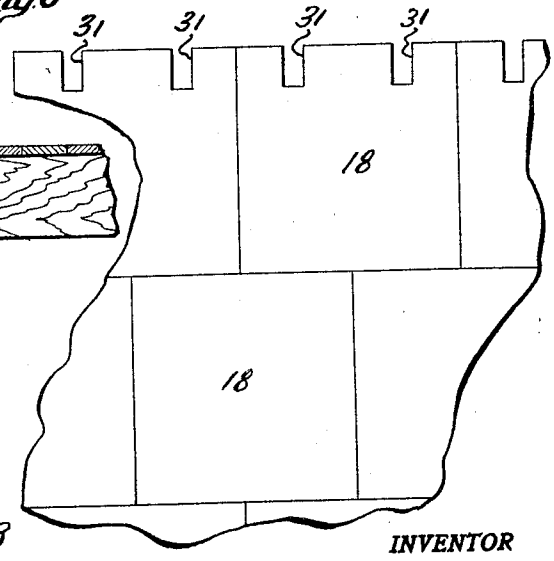


Fig. 8

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UNITED STATES PATENT OFFICE

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BUILDING WALL STRUCTURE

Application filed May 6, 1932. Serial No. 609,675.

This invention relates to improvements in building wall structure and method of producing the same, and the same has reference, more particularly, to an improved assembly of materials for use in the erection of building walls.

This invention has for its principal object to provide a novel means for producing cast concrete wall structures, comprising fabricated wall form units capable of being quickly assembled together so as to furnish a form to receive and shape cast concrete into a wall core; parts of said form units being removable from the exterior side of the wall core, and other parts thereof remaining as a permanent part of the finished wall structure; said latter parts having arranged in assembled and supported connection therewith an inside wall finish so disposed as to be spaced from the cast concrete wall core to provide intermediate insulating air space therebetween.

This invention has for a further object to provide novel wall form units capable of being assembled together one with another in interlocking, self-sustaining relation; each unit comprising outer and inner panels, spaced apart by interconnecting and spacing means so as to provide an intermediate wall mold to receive cast concrete for the formation of an integral wall core; each unit being provided at its inner side with projecting carrier elements to receive and attach, in off-set or spaced relation to said inner side, corresponding interior finishing panels, which become a permanent part of the completed wall structure.

Other objects of this invention, not at this time more particularly enumerated, will be understood from the following detailed description of the same.

Illustrative embodiments of this invention are shown in the accompanying drawings, in which:—

Fig. 1 is an exterior elevation of assembled wall form units as erected and arranged preparatory to casting a concrete wall core in connection therewith; Fig. 2 is a fragmentary transverse vertical section on line 2—2 in Fig. 1, drawn on an enlarged scale; Fig. 3 is a fragmentary horizontal section on line 3—3 in Fig. 1, drawn on an enlarged scale; Fig. 4 is a fragmentary view similar to that of Fig. 3, but showing a modified arrangement of interlying elements between the panels of the units, and Fig. 5 is a vertical section, taken on line 5—5 in Fig. 4.

Fig. 6 is a fragmentary transverse vertical section, showing the finished wall structure according to this invention, and Fig. 7 is an interior elevation of the finished wall structure, taken on line 7—7 in Fig. 6.

Fig. 8 is a fragmentary interior elevation of the wall structure with parts arranged to receive upper floor beams, preparatory to continuing the erection of the wall structure for the upper stories of a building.

Similar characters of reference are employed in the above described views, to indicate corresponding parts.

Preparatory to the building of a wall structure according to this invention, wall form building units are fabricated to be taken to the job for erection. Each such unit comprises a pair of wall form panels 10 and 11, preferably made of pressed wood board, fibre board, or other suitable material. These panels may be of any suitable thickness sufficient to assure requisite rigidity. I have found it feasible to use panels having dimensions of approximately three by four feet, although sizes of greater or less dimensions may be employed. The panels 10—11 are arranged side by side in spaced apart relation, according to the thickness of the cast concrete wall core desired to be formed in connection with the use thereof. Said panels 10—11 are secured together in such spaced apart relation by combined tying and spacing means. Preferably the tying and spacing means comprise transverse bolt rods 12, having at one end a head portion 13 and an externally screw threaded portion 14 at the opposite end. The panels 10—11 are perforated with matched openings at suitable spaced intervals to permit the passage, through and between the same, of a plurality of said bolt rods 12. Preferably the bolt rods 12 are passed through the inner panel 10 to and through the outer

panel 11, with the heads 13 coacting with said inner panel 10, and the threaded portion 14 projecting exteriorly from the outer panel 11. Spacer stays 15 are associated with each bolt rod 12, the same preferably comprising a length of wood strip corresponding to the width of spacing desired, said strip being provided with staples 16 through which the bolt rods extend, whereby the spacer stays 15 are supported by the respective bolt rods in parallel relation thereto, and so as to extend from and between the inner faces of the opposed panels to thereby space the same one from the other. Fastening nuts 17, of any suitable form, are applied to the exteriorly projecting threaded ends 14 of the bolt rods, to hold the parts assembled together as above described.

Arranged to project laterally from the outer side of each inner panel 10 are combined suspension and spacing struts for attachment to the wall structure of interior finishing or facing panels 18; which panels are of dimensions corresponding to those of the panels 10—11, and which may be made of any suitable interior finishing material, such as pressed wood, plaster board or other forms of interior wall board material, or in fact any panel material suitable for the purpose. Said combined suspension and spacing struts preferably comprise sheet metal members 19 formed at their inner ends with an angular base flange 20 to abut the outer surface of the inner panel 10, and at their outer ends with an upstanding angular tongue 21 for purposes to be subsequently disclosed. Said base flanges 20 are provided with openings through which said bolt rods 12 may pass, whereby the latter may be utilized to anchor the suspension and spacing struts in operative assembled relation to the wall structure. For example, said base flanges 20 are disposed to lie between the head portions 13 of the bolt rods and the panels 10, so that when the bolt rods are drawn tight the same serve to hold the base flanges 20 anchored to the panels 10. In order to prevent twisting or like displacement of the struts from operative assembled relation to the wall structure, the free corners of said base flanges 20 are preferably formed to provide spurs or prongs 22 which penetrate the material of the panel 10. It will be obvious that any other means of holding connection may be established between the bolt rods 12 and the base flanges 20 of the struts, as e. g. threading the former into the latter, instead of utilizing the keeper head portion 13 above mentioned. The interior finishing or facing panels 18 are provided on their inner sides with metallic or like socket strops 23 to receive the tongues 21 of the struts, whereby the panels 18 are supported and spaced by the latter in operative assembled relation to the panel 10 and ultimately to the finished wall structure. Said interior finishing or facing panels 18 may be assembled with the wall form building units prior to the erection thereof, or during the erection thereof, or after the completion of the whole wall structure, as may be most convenient in any given case.

The wall form building units are provided with means to mutually interlock the same together when a plurality thereof are assembled edge to edge in the process of erecting the same and for forming the complete wall structure. The interlocking means comprises female receiving channels formed along one horizontal and one vertical margin of each panel 10, 11 and 18 of each wall form building unit, so as to receive free marginal portions of adjacent corresponding panels of abutting wall form building units, as such units are successively assembled and built up in adjoined wall forming relation. Preferably these female receiving channels are formed as follows:

Secured to the inner and outer sides respectively of the inner panel 10 are marginal strips 24—24′ to project beyond a horizontal edge, such as the top edge, and beyond a vertical edge, such as the left hand edge, thereof. These strips 24 may be made of the same material as the panel or of any other suitable material, and the strips may be secured to the panel by nailing or by any other suitable fastening method or means. The strips 24—24′ form female receiving channels closed on both sides and contiguous to the panel edges bordered thereby. Secured in like manner to the outer side of panel 11 are marginal strips 25 to project beyond a corresponding horizontal edge and a corresponding vertical edge thereof, thus providing receiving channels closed on the outer side and contiguous to the panel edges bordered by said strips 25. Secured in like manner to the inner side of panel 18 are like marginal strips 26 to project beyond a corresponding horizontal edge and a corresponding vertical edge thereof, thus providing receiving channels closed on the inner side and contiguous to the panel edges bordered by said strips 26.

In the method of producing a building wall structure according to this invention, a suitable foundation, as 27, is prepared upon which a lower course of assembled wall form building units is erected. Said first course of units are assembled one with another by engaging free vertical edges of the panels of one unit with channeled margins of next adjacent abutting units, whereby said units are interlocked one with another, and with their channeled horizontal margins upward. The lower marginal portions of the panels 11 and 18 of the first course of thus erected units are cutaway to provide suitably spaced notches 28 to receive and straddle first floor beams 29 which are supported by and upon

the foundation 27. The next course of wall form building units is now mounted upon and engaged with the first course thereof, preferably in the staggered relation shown in the drawings. The units of said second course are rigidly interlocked with those of said first course by engaging the lower free marginal portions of the panels 10, 11 and 18 thereof in the upwardly open horizontal receiving channels of the lower course, while at the same time said units of the second course are interlocked one with another by engaging the free vertical edges of said panels with the channeled margins of units next adjacent thereto. In this manner successive courses of wall form building units may be assembled and interlocked one with another until a desired height of wall is attained. It may here be pointed out that the interior finishing panels 18 may be assembled at the time the wall form building units are erected in the manner above described, or, if desired, said panels 18 may be later attached to the suspension and spacing struts, as may be most convenient in any given case.

After the wall form building units have been erected to a desired height, or from time to time as given, desired courses thereof are completed, a wet mixture of concrete is poured into the mold space *m* between the panels 10—11, thus forming a cast concrete integral wall core 30 (see Fig. 5). Where the concrete wall core 30 foots upon the initial foundation 27, the same will flow around and imbed the ends of the floor beams 29, thus firmly engaging and supporting the same against displacement.

If the building under construction is to include one or more upper floors, after the wall structure has been erected to requisite height of first story, the panels 10 and 18 of the units may be notched along their upper marginal portions, as at 31 in Fig. 8, thus permitting the insertion and interengagement with the wall form building units, and with the wall core formed in connection therewith, of second or other story floor beams, as will be obvious.

After completion of the wall structure by the casting in connection therewith of the concrete wall core 30, the outer or exterior panels 11 of the wall form building units may be removed, after first removing the nuts 17, thus exposing the exterior face of said wall core 30. Said exterior face of the wall core 30 may be treated with any surface finishing material, such for example as the coating of stucco 32 indicated in Fig. 5, or any other desired external facing material. With the interior finishing panels 18 attached and assembled to the wall structure, an interior finished wall surface is provided which requires no additional structure, and which may be left in natural condition, or which may be surfaced, if desired, with paint, paper, or other decorative coating as may be desired in any particular case. The flooring 33 may be laid over the floor beams up to the panels 18, as shown in Fig. 5, and in like manner, ceiling material (not shown) may be attached to the underside of upper story floor beams in any well known way.

From the above description it will be obvious that not only does this invention provide a very simple, rapid and efficient method and means for erecting building wall structures, with a minimum of labor and expense, but also that the resultant wall structure is of a character providing a finished interior construction of good appearance, while likewise providing a desirable air space within the wall structure adapted to provide insulation against heat, cold and moisture.

It will be understood that the means for tying together the panels 10—11—18 of the units, in desired laterally spaced relation, is subject to more or less variation. Illustrative of this I have shown in Figs. 4 and 5 a modified form of tying and spacing means; this modified arrangement includes the provisions of socket straps 34 on the oppositely facing surfaces of the panels 10—11. Combined spacing and tying bars 35, having angular tongues 36 at their ends, are engaged with oppositely aligned socket straps 34 by the insertion of their tongues 36 in the latter. By this means, the panels 10 and 11 are both secured together and spaced in relation one to the other. In like manner, similar socket straps 37 are affixed to oppositely facing surfaces of the panels 10—18, and suspension and spacing struts 38 are provided with a down-turned angular tongue 39 at their inner ends, and an up-turned angular tongue 40 at their outer ends, respectively for engagement in the socket straps of the panel 11 and the socket straps of the panel 18, whereby the latter panel is supported from the former panel in the desired off-set spaced relation.

As many changes could be made in the novel wall structure as a whole, and in the novel fabricated wall form building units entering into the construction of the same, and many apparently widely different embodiments of the fasteners of this invention could be made without departing from the scope thereof as defined by the appended claims, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

I claim:—

1. A building wall comprising a plurality of interjoined abutting wall form building units; each unit including a pair of laterally spaced panels and transverse means to interconnect the same in spaced relation to provide a cast core wall mold, means to unite the meeting edges of said panels of adjoining units in interlocking relation, combined sus-

pension and spacing struts anchored to the inner panels of said units to project laterally therefrom, and interior finishing panels adapted to be supported by said struts in off-set spaced relation to said inner panels.

2. A building wall comprising a plurality of interjoined abutting wall form building units; each unit including a pair of laterally spaced panels and transverse means to interconnect the same in spaced relation to provide a cast core wall mold, means to unite the meeting edges of said panels of adjoining units in interlocking relation, combined suspension and spacing struts anchored to the inner panels of said units to project laterally therefrom, interior finishing panels adapted to be supported by said struts in off-set spaced relation to said inner panels, and means for interengaging the meeting edges of said finishing panels as connected with adjoining units.

3. A building wall comprising a plurality of interjoined abutting wall form building units; each unit including laterally spaced inner and outer panels and transverse means to interconnect the same in spaced relation to provide a core wall mold, means to unite the meeting edges of said panels of adjoining units in interengaged relation, a concrete core wall cast between said panels of assembled units, said outer panels being removable from said core wall, said inner panels being adapted to remain as a permanent part of the building wall structure, combined suspension and spacing struts anchored to said inner panels to project laterally and exteriorly therefrom, and interior finishing panels adapted to be supported by said struts in off-set spaced relation to said inner panels so as to provide an intermediate insulating air space in connection with the finished wall.

4. A building wall comprising a plurality of interjoined abutting wall form building units; each unit including laterally spaced inner and outer panels and transverse means to interconnect the same in spaced relation to provide a core wall mold, means to unite the meeting edges of said panels of adjoining units in interengaged relation, a concrete core wall cast between said panels of assembled units, said outer panels being removable from said core wall, said inner panels being adapted to remain as a permanent part of the building wall structure, combined suspension and spacing struts anchored to said inner panels to project laterally and exteriorly therefrom, interior finishing panels adapted to be supported by said struts in off-set spaced relation to said inner panels so as to provide an intermediate insulating air space in connection with the finished wall, and means for interengaging the meeting edges of said finishing panels as connected with adjoining units.

5. A building wall comprising a plurality of interjoined abutting wall form building units; each unit including laterally spaced inner and outer panels, bolt rods affixed to said inner panels to extend to and through said outer panels, spacer members supported by said bolt rods between said panels, fastening nuts on the exterior ends of said bolt rods to retain said panels in assembled unit forming relation, means to interengage meeting edges of said panels of adjoining units, a concrete core wall cast between said panels of assembled units, said outer panels being removable from said core wall, said inner panels being adapted to remain as a permanent part of the building wall structure, combined suspension and spacing struts anchored by said bolt rods to said inner panels to project laterally and exteriorly therefrom, and interior finishing panels attachable to said struts, said finishing panels having means to interengage their meeting edges.

6. A building wall comprising a plurality of interjoined abutting wall form building units; each unit including laterally spaced inner and outer panels, bolt rods affixed to said inner panels to extend to and through said outer panels, spacer member supported by said bolt rods between said panels, fastening nuts on the exterior ends of said bolt rods to retain said panels in assembled unit forming relation, means to interengage meeting edges of said panels of adjoining units, a concrete core wall cast between said panels of assembled units, said outer panels being removable from said core wall, said inner panels being adapted to remain as a permanent part of the building wall structure, combined suspension and spacing struts anchored by said bolt rods to said inner panels to project laterally and exteriorly therefrom, said struts having angular tongues at their free ends, interior finishing panels, said finishing panels having socket means engageable with said strut tongues to anchor said finishing panels thereto.

7. A building wall comprising a plurality of interjoined abutting wall form building units; each unit including laterally spaced inner and outer panels, bolt rods affixed to said inner panels to extend to and through said outer panels, spacer members supported by said bolt rods between said panels, fastening nuts on the exterior ends of said bolt rods to retain said panels in spaced relation to provide a cast core wall mold, means to interengage meeting edges of said panels of adjoining units, combined suspension and spacing struts anchored by said bolt rods to said inner panels to project laterally and exteriorly therefrom, and interior finishing panels adaped to be supported by said struts in off-set spaced relation to said inner panels.

8. A wall building unit, comprising inner and outer laterally spaced panels, transverse means to interconnect said panels in spaced relation, means connected with marginal

edge portions of said panels adapted to interengage abutting units when assembled edge to edge, combined suspension and spacing struts anchored to said inner panel for outward lateral projection therefrom, and an additional panel adapted to be engaged with and supported by said struts.

9. A wall building unit, comprising inner and outer laterally spaced panels, transverse means to interconnect said panels in spaced relation, means connected with marginal edge portions of said panels adapted to interengage abutting units when assembled edge to edge, combined suspension and spacing struts anchored to said inner panel for outward lateral projection therefrom, angular hook-like tongues at the free ends of said struts, an additional panel, said latter panel having socketed means on its inner face engageable with said hook-like tongues of said struts to connect said latter panel in air space forming relation to said inner panel.

10. A wall building unit, comprising inner and outer laterally spaced panels, bolt rods affixed to said inner panel to extend to and through said outer panel, spacer members supported by said bolt rods between said panels, fastening nuts on the exterior ends of said bolt rods to retain said panels in assembled relation, means connected with marginal edge portions of said panels adapted to interengage abutting units when assembled edge to edge, combined suspension and spacing struts anchored by said bolt rods to said inner panel for outward lateral projection therefrom, and an additional panel adapted to be engaged with and supported by said struts.

11. A wall building unit, comprising inner and outer laterally spaced panels, bolt rods affixed to said inner panel to extend to and through said outer panel, spaced members supported by said bolt rods between said panels, fastening nuts on the exterior ends of said bolt rods to retain said panels in assembled relation, means connected with marginal edge portions of said panels adapted to interengage abutting units when assembled edge to edge, combined suspension and spacing struts anchored by said bolt rods to said inner panel for outward lateral projection therefrom, angular hook-like tongues at the free ends of said struts, an additional panel, said latter panel having socketed means on its inner face engageable with said hook-like tongues of said struts to connect said latter panel in air space forming relation to said inner panel.

Signed at Newark, in the county of Essex and State of New Jersey, this 2nd day of May, A. D. 1932.

RUSSELL C. GRAEF.