Jan. 21, 1947. H. T. BATTIN 2,414,628

BUILDING STRUCTURE

Filed Dec. 11, 1943 3 Sheets-Sheet 1

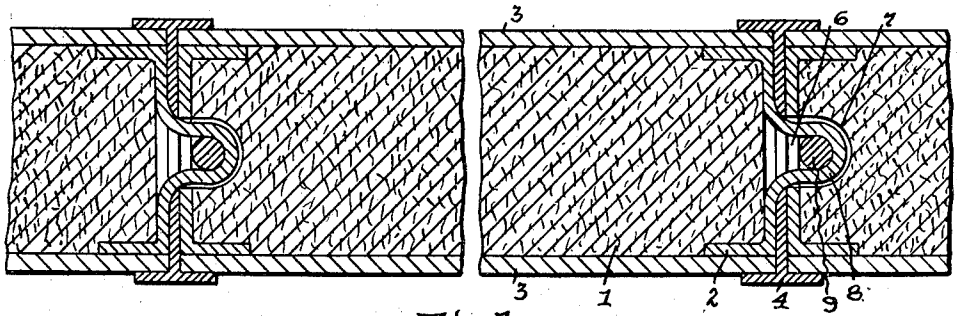


Fig. 1.

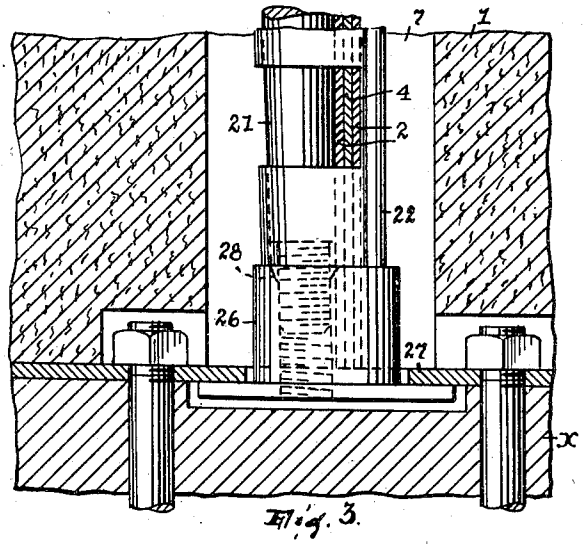


Fig. 3.

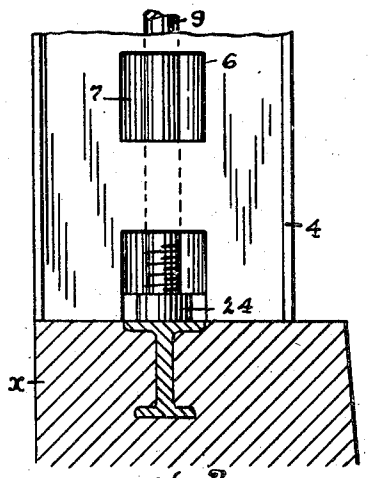


Fig. 2.

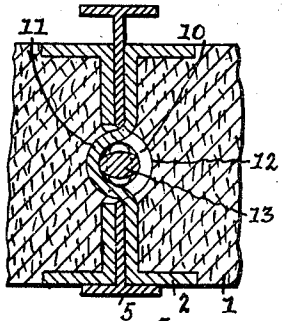


Fig. 5.

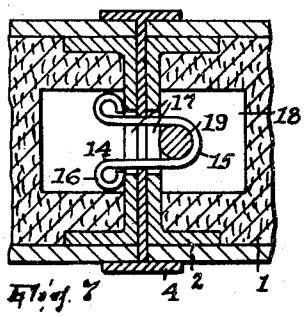


Fig. 7.

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BUILDING STRUCTURE

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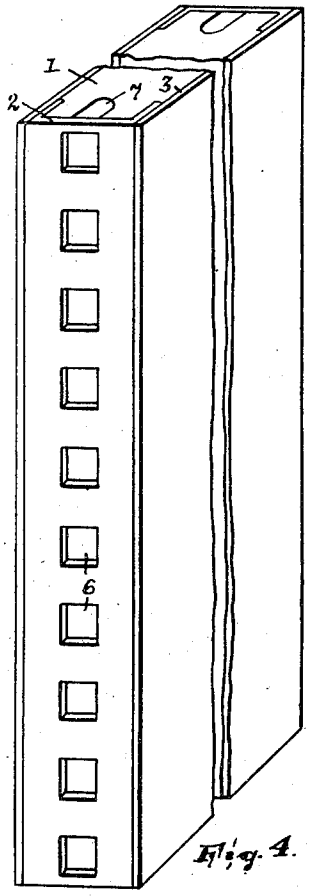


Fig. 4.

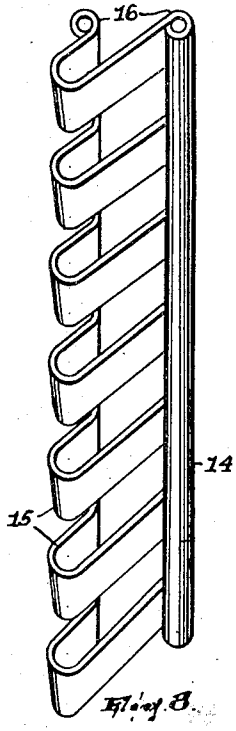


Fig. 8.



Fig. 6.

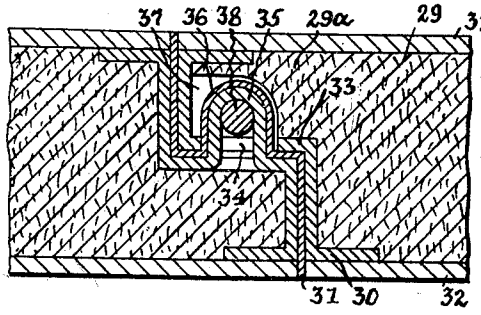


Fig. 12.

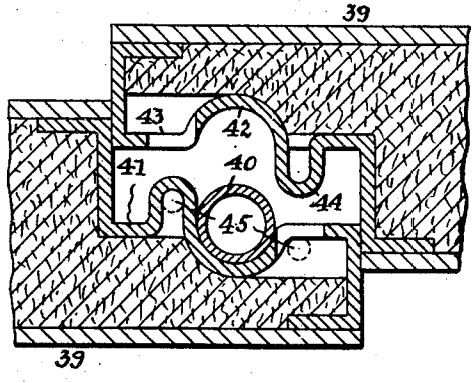


Fig. 13.

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BUILDING STRUCTURE

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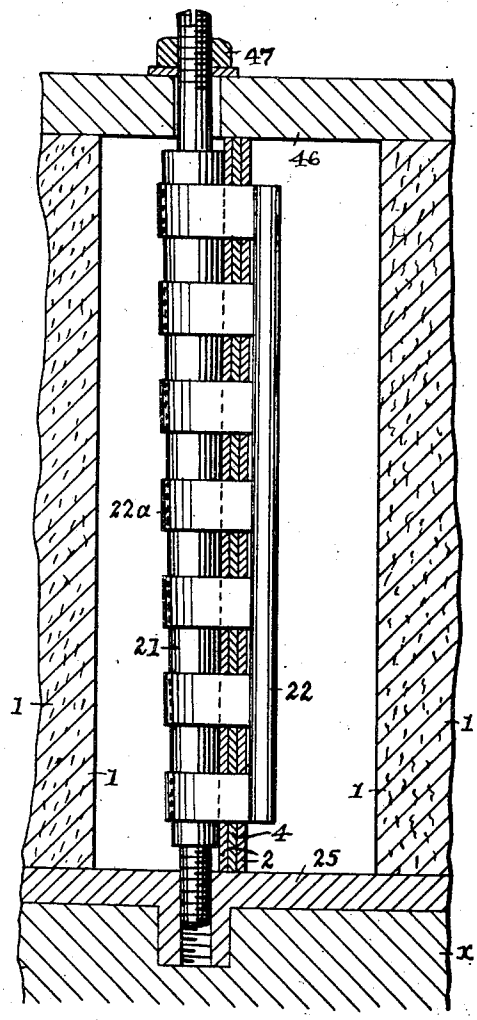


Fig. 9.

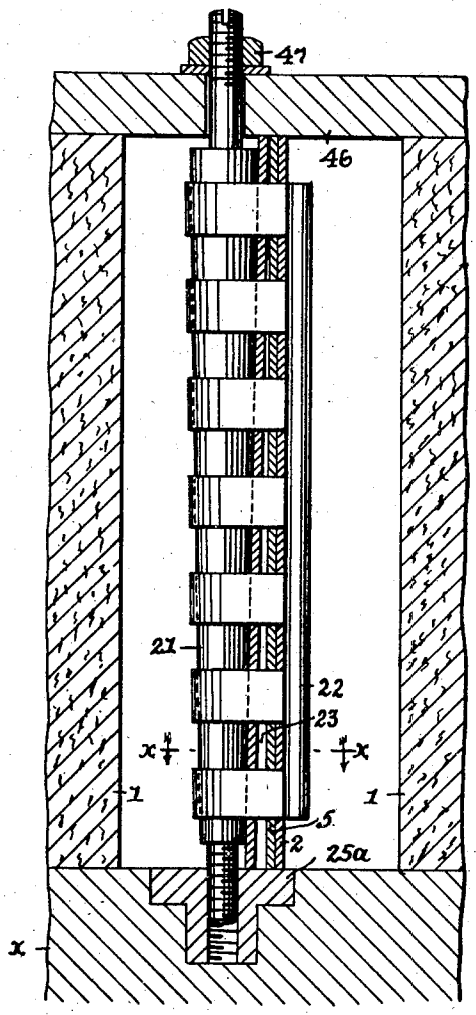


Fig. 10.

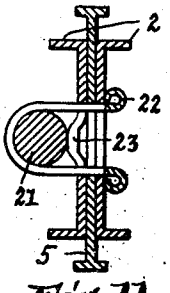


Fig. 11.

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UNITED STATES PATENT OFFICE

2,414,628

BUILDING STRUCTURE

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Application December 11, 1943, Serial No. 513,874

10 Claims. (Cl. 20—4)

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This invention relates to building structures of the class commonly known as "pre-fabricated," and particularly to building structures of this class in which the upright walls, and it may be the floor, ceiling and roof walls, are made up largely of pre-fabricated elements, to wit, panels, each of considerable area.

A pre-fabricated panel is one whose body is formed of some light molded and usually insulating material, as cellular rubber, plastic or paper, and is provided at at least two opposite margins thereof with reinforcing members, as channels, fitted over and usually cemented to the body, there usually being a finishing and protective coating or layer of some light but tougher material than that of some body covering and cemented to one (as the outer) or each broad face of the body; the channels are formed of some material, as a plastic, fiber or metal, having a high degree of strength.

My principal and ultimate object is to use such panels in the forming of building walls and to use them with the following particularly in mind: A primary or skeleton frame is to be constructed whose parts are desirably light in weight (and hence readily assembled or disassembled) but so wanting in strength that, whereas each is strong enough to serve its purpose in such mere skeleton frame, existing alone, they have not the strength to resist the loads and other stresses to be imposed on them in the finished wall. Given such skeleton frame with an element thereof between the channels of two adjoining panels, the panels are to exist interlocked and desirably so interlocked under binding strain that the channels and element of the skeleton frame between them together constitute a unitary part of the ultimate or permanent frame of the wall—strong enough to withstand, permanently, all stresses imposed on the completed wall. In all aspects of my invention, however, I do not wish to be limited to the presence of the skeleton frame.

It will be advantageous to construct the wall so that, the skeleton frame being more or less complete, any panel may be assembled with or disassembled from said frame by movement in a direction through rather than by movement in coincidence with the plane of the wall. For this it is another purpose of my invention to provide.

The aforesaid interlock may be accomplished as between laterally adjacent panels in a single tier (or of course adjoining, as superposed tiers) thereof by a bar between and paralleling the channels of such panels, and, as one expedient permitting the assembling or disassembling of the

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panels by movement in a direction through the wall, resort to a coupling appliance enterable to or retractive from its operative position in a direction crossing the axis of the bar may be had; other expedients to the same end may be resorted to, as will appear.

In the drawings, in which the invention is illustrated by reference to an upright wall of whose skeleton frame the element between adjoining panels is termed an upright,

Fig. 1 shows a fragment of a wall of my invention in horizontal section;

Fig. 2 is a side elevation of an upright and the interlocking means, showing how the anchoring to the foundation, appearing in section, may be effected;

Fig. 3 is a longitudinal vertical section of the wall and foundation, illustrating a modified form of the interlock and the anchoring;

Fig. 4 is an isometric view of a panel, partly broken away;

Fig. 5 is a horizontal section showing a modification of the type of interlock appearing in Fig. 1;

Fig. 6 is a side elevation of the locking bar of Fig. 5;

Fig. 7 is a view like Fig. 5 but showing the interlocking means including the mentioned coupling appliance;

Fig. 8 is an isometric view of such appliance;

Fig. 9 is a schematic longitudinal vertical section of the wall, foundation and a beam supported by the wall, with the locking means of Fig. 3;

Fig. 10 is a similar view showing a modification of such means;

Fig. 11 is a horizontal sectional view on about the line x—x of Fig. 10; and

Figs. 12 and 13 are horizontal sectional views of a wall embodying other modifications of the invention, the panel in Fig. 13 being partly displaced from its normal position.

A panel of the type preferably and usually to be used comprises at least the compressed molded body 1, as of cellular and preferably insulating material, as paper or rubber or other plastic, and the channels 2 formed of thin metal or other light material, as compressed fiber or plastic substance, having their grooves filled by and being firmly cemented to the body so as to be in effect integral therewith, as by aconite or urea formaldehyde; and desirably there will also be layers 3 of laminated plywood or other light material, tougher than the body, covering and securely cemented to its broad faces and to the channels, the union by cementing or otherwise of the chan-

nels and both panels being such as to withstand stretching strains tending to part them in those instances where, as will appear, such strains may be more or less thus effective. In the forming of an upright wall the panels are each to stand with its channels upright, the channels reinforcing in each instance the otherwise weak panels.

To form the skeleton frame the uprights thereof are preferably metal beams having angular cross-sectional form, as I-beams **4** having their grooves formed to receive and snugly fit the panels, as shown in Figs. 1 and 7, though to increase their resistance to bending strains, without much increasing their weight, the uprights and hence their grooves may be wider than the channels **2**, as shown by Figs. 5 and 11 at **5**.

The panels and uprights, including specifically the panel channels, are to be seated on the sill or foundation *x* and the wall they go to form is usually to be confined thereto against lateral displacement if not anchored thereto and the elements of such wall interlocked, as will appear.

As for the interlocking, whereas it may of course in some instances exist as affecting two panels immediately adjoining each other, it is especially considered herein only in the case where an upright is interposed between two panels. In any event, the channel **2** of at least one of two adjoining panels is provided with a vertical series of apertures and the body **1** thereof formed with a vertical groove in registry with the apertures and which, with the channel, forms a passage. The passage is to receive a locking bar thrustwise entered thereto downwardly thus to enter devices extending through the apertures and in some way anchored to the other panel-channel. Thus:

In one form (Figs. 1 and 4) **6** is the mentioned series of apertures in a channel of one panel and **7** the vertical groove or passage in its body **1** and hence inward of the channel. The channel of the adjoining panel has portions **8** thereof in registry with the apertures **6** bent out of the channel to form eyes and entered through said apertures into passage **7**; the eyes are here integral with the channel and in that sense anchored thereto. **9** is the locking bar extending down through the eyes inward of the channel of the panel having the passage.

In Fig. 5 the channels of both panels are formed alike, or each with the series of apertures **10** and eyes **11**, **12** being the passage; the eyes of each channel penetrate the apertures and extend into the passage of the other panel. **13** is the locking bar.

In Figs. 3 and 7 to 11 the eyes exist as portions of an auxiliary coupling appliance distinct from the elements to be interlocked. Thus in Figs. 7 and 8 a strip **14** of strong sheet material, as metal, is slotted, at the same intervals as the apertures of the panel channels, transversely and then bent to longitudinally channeled form or generally U-shaped as viewed lengthwise to provide a unitary series of eyes **15** between the slots, the longitudinal margins or terminals of the strip providing exterior flanges **16**, preferably existing as rolls; the strip is somewhat elastic. The channels of both panels are apertured at registering intervals, as at **17**, each two registering apertures forming a duct, and the body of each panel formed with the vertical passage **18**. In assembling in this case, the panels being positioned as shown, the coupling appliance is entered downwardly into one passage **18** and then shifted laterally to pass its eyes through the ducts and into the other passage, whereupon a locking bar **19** is applied as already indicated and shown by Fig. 7. In this operation the series of eyes exist anchored to that channel against which the flanges **16** bear; and they may undergo tension incident to taper of the bar.

Since in each of the forms described an upright, **4** or **5**, exists between each two panels, to accommodate the mentioned eyes it is provided with apertures **20** to register with those of the panel channel or channels.

The locking bar may be a plain cylindrical bar, in which case it and the parts of the channels between which it enters should as snugly as possible interfit so that the panels and upright will exist in substantially fixed relation to each other. But the bar may be made to insure interlocking of the parts under appreciable binding strain, or be formed as follows:

In Figs. 5 and 6 the locking bar **13** is oval in cross-section and may have a flattened heard **13***a* whereby, with a suitable tool, to turn it to cause it to bind the panels to the upright.

Or the bar, **21**, may be tapered, as in Figs. 3, 9, 10 and 11, Figs. 10 and 11 being more or less schematic views. In these views an independent coupling device **22**, generally like that already described, is shown. In Fig. 9 the bar is somewhat inclined and in order for it to exert uniform binding with respect to all the eyes **22***a* the latter are graduated accordingly in girth, the panels and uprights in this case being shown in all respects the same as in Fig. 7. In Figs. 10 and 11 the locking bar is vertical and to insure uniformity of pressure vertically as between the channels and intervening upright that channel with which the bar contacts may have the portions **23** (Fig. 11) between its apertures bent off toward the bar and which successively decrease upwardly in their protrusion from the channel.

The locking bar, as shown in Figs. 3, 9 and 10 may be anchored to the foundation if it is cylindrical or otherwise circular in cross-section so that it may be free to be turned around its axis. Thus it may have its lower end threaded so as to be screwed into a threaded socket in an anchorage member **24** in Fig. 2 or **25** and **25***a* in Figs. 9 and 10 existing as a fixed part of the foundation. Since such construction may involve difficulty in entering the bar into the socket the latter may be formed in a member **26**, shown in Fig. 3, which is confined to the foundation by overhanging flanges **27** thereof against upward and to limited rectilineal displacement horizontally, the mouth of the socket being chamfered, as at **28**, so as to guide the threaded end of the bar into the socket.

The locking bar may in some instances, as in Fig. 5, simply be held to the foundation against lateral displacement, as by having a reduced lower terminal **13***b* in Fig. 6 to be set in the foundation.

In all the forms so far described, excepting that of Figs. 7, 8 to 10, the placement or removal of any panel must be effected in coincidence with the plane of the wall. In the Fig. 7 form, because the eyes are independent of the panels, each channel may be placed in or removed from the wall in a direction through said plane. This is also true of the constructions of Figs. 12 and 13.

In Fig. 12 each upright marginal portion of the body **29** of any panel is generally formed with a projecting flange **29***a* and the corresponding channel **30** is so shaped as to conform to the

cross-sectional contour of such flanged body, as is also true of the upright 31. (32 designates the covering layers for the body.) At vertical intervals that portion 33 of one channel which connects its portions angularly related to the plane of the wall is formed at intervals with a vertical series of apertures 34. The corresponding portion of the other channel has the bent-out eyes 35 to register with and enter such apertures; and, in this example, the upright has similar eyes 36 in laminated relation to the eyes 35. To accommodate such eyes the flange of the one body is formed with a vertical passage 37. 38 is the locking bar, which in this example has the cross-sectional circular form.

In Fig. 13 the panels 39 are formed, generally flanged, the same as in Fig. 12; but instead of the angular upright there shown a cylindrical upright or column 40 is used. That portion 31 of each channel which connects its portions angularly related to the plane of the wall exists with a bend at 42 of semi-circular form so that such portions may embrace the column. At one side of bend 42 each channel has a vertical series of apertures 43 and at the other side it is formed with a vertical series of eyes 44. The eyes 44 of one panel are arranged to register with the apertures 43 of the other. When the two panels have been brought into a common plane bars 45 may be passed down through the eyes 44 to interlock the panels.

At 46 is shown a beam which here represents a part of the ultimate superstructure of the wall; in the present example it may be a beam on which to support a ceiling and floor or the roof. In any event, it may be utilized to confine the locking bar against lateral displacement at its upper end and the bar may be used to tie down such beams, as by the upper end of the bar penetrating the beam and being threaded and having screwed thereon a nut 47, whereby to tension the bar, assumed to be anchored to the foundation.

In all the forms shown, and in accordance with my invention, the load and other stresses are borne by the channels of adjoining panels and the element of the skeleton frame between the channels, which channels on the one hand and said element on the other would alone be too weak to withstand such stresses since they are to be light and hence readily assembled and disassembled.

Having thus fully described my invention, what I claim is:

1. A building wall including adjoining panels, each panel including a body of light molded substance, an elongated load sustaining channel having sides embracing and rigidly secured to the adjoining margin of said body, an elongated load sustaining element to form a part of the skeleton frame of said wall and arranged between and parallel with both channels, said body of one panel having a passage wholly inward and extending lengthwise of the corresponding channel, the latter channel and said element having apertures arranged in series lengthwise of and open to such passage, the channel of the other panel having coupling devices anchored thereto and penetrating the respective apertures, and a locking member in the passage and engaged with the several devices and coacting therewith to clamp the panels and element together, each of the parts formed by the channels and said element having in itself insufficient strength, but such parts together and as thus clamped having sufficient strength, to sustain the load and other stresses imposed on the portion of the wall formed by such panels and element.

2. In combination adjoining wall elements having passages respectively extending through their adjoining portions in substantially parallel relation to each other and each open at one end and a duct connecting the passages, and means interlocking said elements together, including a coupling appliance in the passage of one element and anchored thereto, said coupling having a part thereof extending through the duct toward the other element, said appliance being retractive from the latter element independently of the first-named element, a locking member in the passage of the latter element and obstructing retractive movement of said part through the duct but movable to free the same, said appliance being elastic and generally U-shaped as viewed lengthwise of said passages and having roll-shaped terminals engaging the first-named element within the passage thereof and the first-named passage affording clearance to said appliance when moved in the direction to retract said part from said other element.

3. The combination set forth in claim 2, characterized by said locking member having that portion thereof which is in engagement with said parts of said appliance tapered in one direction of its length.

4. In combination, adjoining wall elements having passages respectively extending through their adjoining portions in substantially parallel relation to each other and each open at one end, ducts connecting and arranged as a series extending lengthwise of said passages, means interlocking said elements together, including a coupling appliance in and extending lengthwise of the passage of one element and having lengthwise disposed parts thereof extending through the respective ducts toward the other element, said appliance being retractive from the latter element independently of the first-named element, an elongated locking member in the passage of the latter element and obstructing retractive movement of said parts through the ducts but movable to free the same, the first-named passage affording clearance to said appliance when moved in the direction to retract said parts from said other element.

5. In combination, with a foundation and superstructure above the same, a building wall including panels arranged upright and to lie in a common upright plane, each panel including a body of light molded substance and an upright reinforcing channel seated on the foundation and supporting the superstructure load, said channel having sides embracing and rigidly secured to the adjoining upright margin of said body, an upright adapted to form a part of the skeleton frame of said wall and arranged between the channels and seated on the foundation and also supporting the superstructure load, means wholly between the upright faces of the wall, including a tensioned member tying said foundation and superstructure together and clamping together the channels, each of the elements formed by the channels and upright having in itself insufficient strength, but such elements together having sufficient strength, to sustain the superstructure load and other stresses imposed on the part of the wall formed by such panels and upright.

6. In combination, with a foundation and superstructure above the same, a building wall including panels arranged upright and to lie in a

common upright plane, each panel including a body of light molded substance and an upright reinforcing channel seated on the foundation and supporting the superstructure load, said channel having sides embracing and rigidly secured to the adjoining upright margin of said body, an upright adapted to form a part of the skeleton frame of said wall and arranged between the channels and seated on the foundation and also supporting the superstructure load, means wholly between the upright faces of the wall, including a tensioned member tying said foundation and superstructure together and clamping together the channels at vertically spaced intervals, each of the elements formed by the channels and upright having in itself insufficient strength, but such elements together having sufficient strength, to sustain the superstructure load and other stresses imposed on the part of the wall formed by such panels and upright.

7. In combination, with spaced portions of the frame of a building, adjoining panels forming a wall between said portions, one panel having a passage extending therethrough from one such portion to the other and an aperture leading from the passage to the surface of such panel adjoining the other panel, the latter panel having a coupling device anchored thereto and extending therefrom through the aperture and into the passage, and means in the passage engaged with said device and tying said portions of the frame together.

8. In combination, with spaced portions of the frame of a building, adjoining panels forming a wall between said portions, one panel having a passage extending therethrough from one such portion to the other and apertures arranged in

series extending lengthwise of the passage and which lead from the passage to the surface of such panel which adjoins the other panel, the latter panel having coupling devices anchored thereto and extending therefrom through the respective apertures and into the passage, and an elongated locking member extending lengthwise of and in said passage and engaged with said devices and tying said portions of the frame together, and said locking member having that portion thereof which engages said devices tapered in one direction of its length.

9. A building wall including adjoining panels, each panel including a body of light molded substance, an elongated load-supporting channel having sides embracing and rigidly secured to the adjoining margin of said body, an elongated load-supporting element adapted to form a part of the skeleton frame of said wall and arranged between and parallel with both channels, said body of one panel having a passage wholly inward of and extending lengthwise of the corresponding channel, the latter channel and said element having apertures arranged in series lengthwise and open to such passage, the channel of the other panel having coupling devices anchored thereto and penetrating the respective apertures, and a locking member in the passage and engaged with the several devices and coacting therewith to clamp the panels and element together.

10. The combination set forth in claim 9 characterized by said locking member having the portion thereof which is in engagement with each of the several devices tapered in one direction of its length.

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