

June 14, 1960

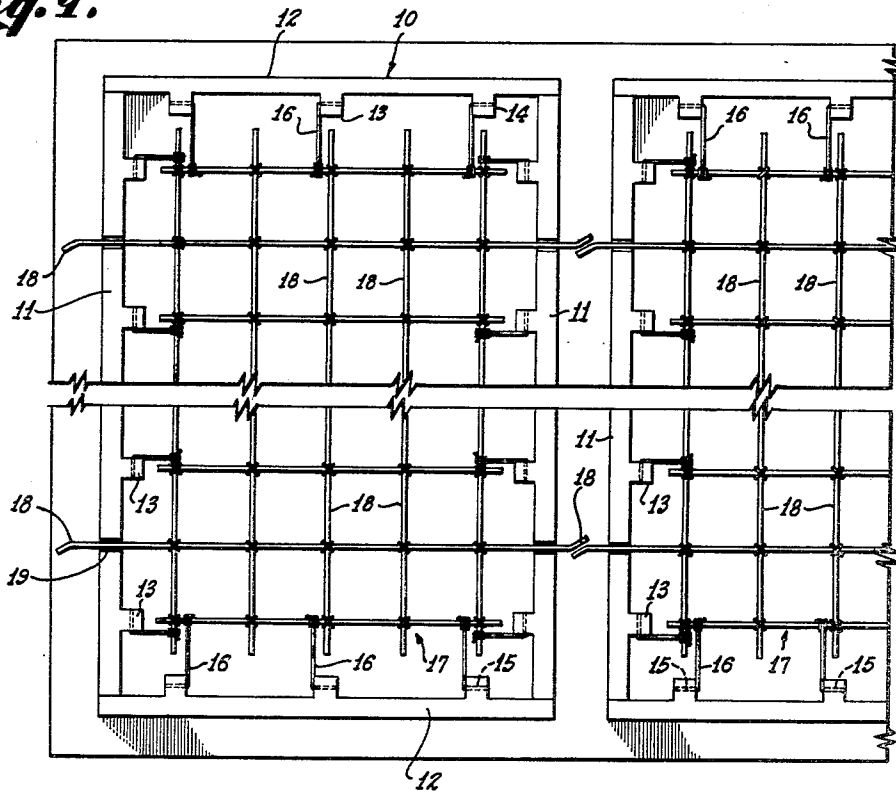
D. C. POST  
BUILDING WALL STRUCTURE AND MEANS AND  
METHOD OF FABRICATING SAME

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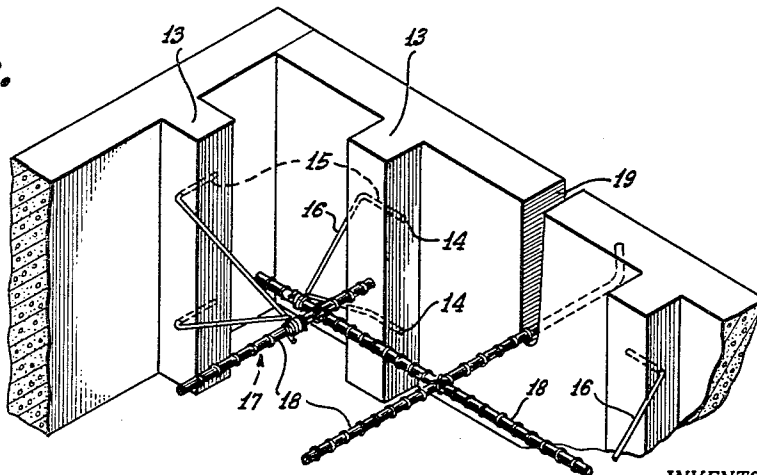
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3 Sheets-Sheet 1

*fig. 1.*



*fig. 2.*



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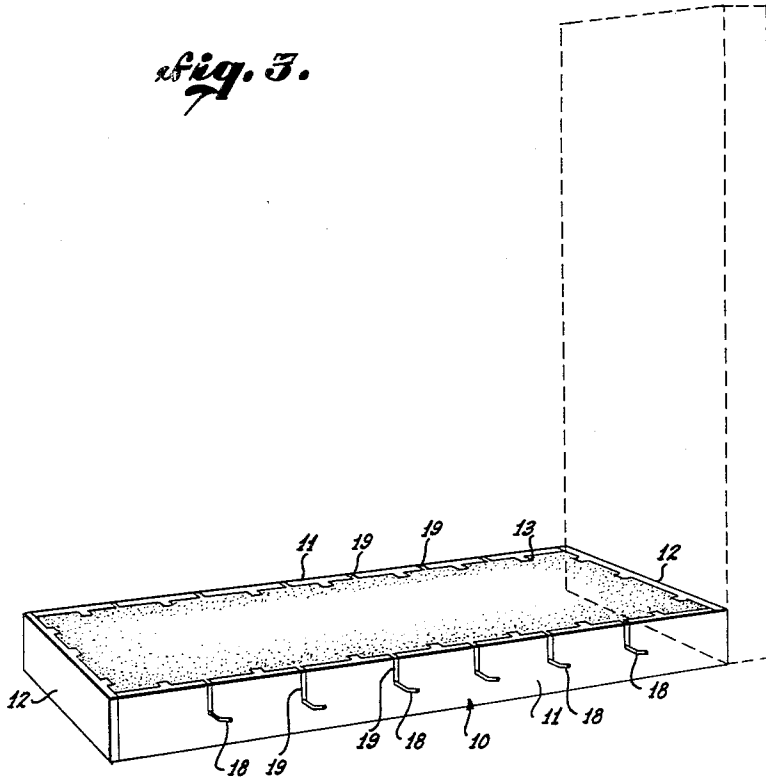
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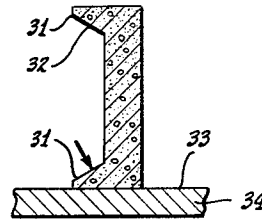
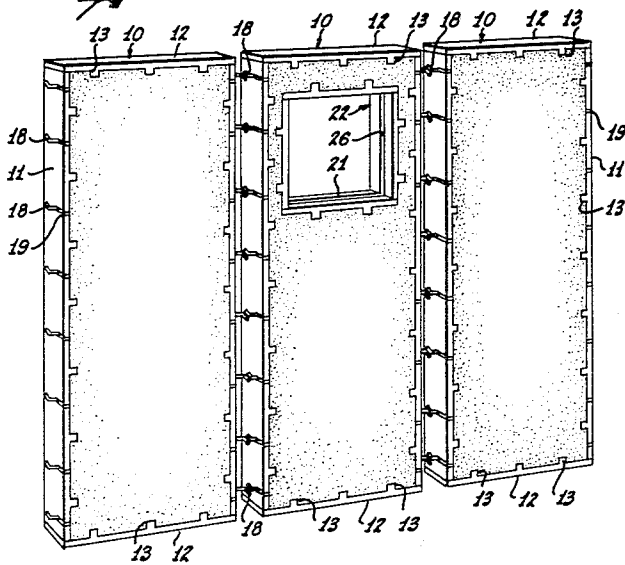
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*fig. 3.*



*fig. 4.*



*fig. 5.*

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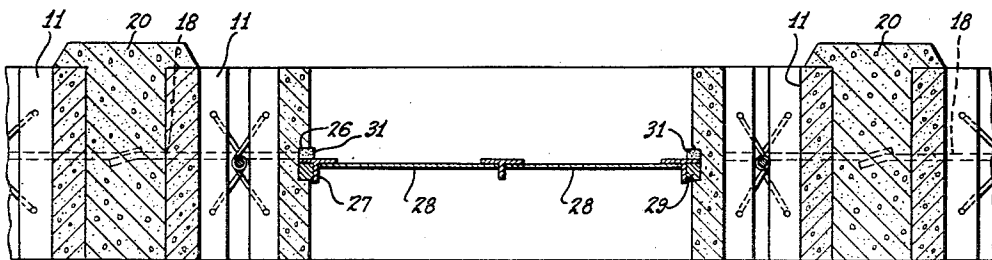
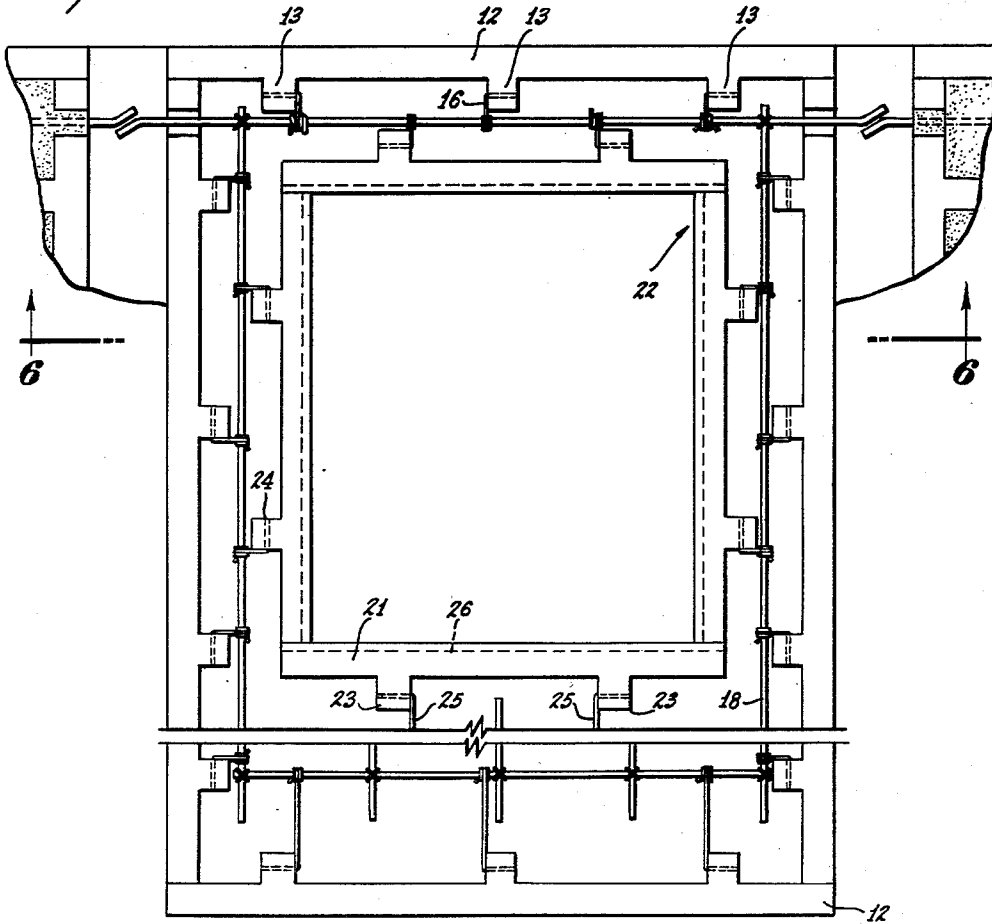
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*Fig. 5.*



*Fig. 6.*

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**BUILDING WALL STRUCTURE AND MEANS AND METHOD OF FABRICATING SAME**

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5 Claims. (Cl. 72-16)

This invention relates to building wall structures and means and method of fabricating such structures.

Many buildings are today being fabricated by the so-called "tilt-up" method, so termed because of the manner of forming the wall structure of the building. In this method of construction, a large concrete slab is cast which forms the foundation and floor of the building. Once this foundation is completed, wooden forms are constructed of generally rectangular shapes which are arranged on the surface of the cast slab or foundation. These forms are of a length equal to the desired height of the building walls and are used to cast or form concrete panels or sections. It will thus be seen that the upper surface of the foundation provides one wall element of the form used to cast the wall sections or panels. The cast panels after the forms have been removed, are tilted up into aligned vertical positions around the margins of the foundation. The cast sections or panels are then structurally interconnected by means of the pilasters or poured columns to form the vertical wall of the building.

In the structural method above described, the forms fabricated for the casting of the wall panels must be carefully assembled and external reinforcing or bracing means provided to prevent deformation of the elements of the form under forces generated by the concrete after the same is poured into the form. When insufficient or faulty bracing is provided the resultant deformation of the form during the casting operation often time produces a defective panel which cannot be used or which is usable only with additional reworking operations. Furthermore, the reinforcing elements embedded in the cast wall section of the prior method must be such as to permit the dismantling of the form after the concrete has cured. In other words, it is somewhat difficult to use reinforcing rod which must extend outwardly of the form used to cast the panel.

Although the so-called tilt-up method results in considerable savings of both time and money over conventional poured concrete wall structures, the present invention results in even further savings of both time and money. In the present invention, the forms used in the casting of the wall panels or sections become an integral part of each cast panel and the wall structure formed thereby after the panels are interconnected to form the wall of the building.

The elements of the form are preferably precast members of cementitious or ceramic material which will bond to the concrete cast into the form. The form elements, according to the present invention, are provided with spaced integral means for mounting tie members to be secured to the network of reinforcing rods used to internally reinforce the cast panel. The tie members and the reinforcing rods internally brace the forms and thus obviate the need for any external bracing means. Furthermore, the elements used to assemble the forms are provided with openings or the like for passing the end portions of those reinforcing rods which are used to structurally in-

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terconnect the wall panels or sections with the pilaster or cast column formed intermediate adjacent panels once tilted into the vertical position.

The use of the precast form elements of the present invention eliminates the previously used wooden forms which were costly to assemble and which had to be disassembled and stripped away from the cast panel after the concrete had set and hardened. The preformed elements of the present invention are more quickly assembled into the desired arrangement to complete the form and the likelihood of the form failing because of insufficient bracing is obviated.

In prior procedures used in the so-called tilt-up method, difficulties were experienced where windows or doors were to be installed or mounted in the wall structure formed by a cast panel. In the use of the present invention these difficulties are entirely eliminated as form elements can be assembled to provide a window or door opening in the completed panel. Here again the form elements become an integral part of the panel and thus remain with the panel as it is integrated into the wall structure. These form elements can be preformed with means for receiving the frame structure of the window or door to the end that the frame structure may be easily set into place once the panel is erected and integrated into the wall structure.

Other features and advantages of the present invention will be hereinafter apparent from the following description, particularly when taken in connection with the accompanying drawing, in which

Figure 1 is a plan view showing the form elements of the present invention just prior to the casing step;

Figure 2 is a fragmentary perspective view showing a part of the internal bracing means;

Figure 3 is a perspective view showing in full lines a completed panel prior to erection and in broken lines the position of the erected panel;

Figure 4 is a perspective view showing a series of erected panels before the pilasters are formed;

Figure 5 is a plan view showing the form used to provide a window opening in the completed panel;

Figure 6 is a section taken along lines 6-6 of Figure 5; and

Figure 7 is a transverse sectional view of a modified embodiment of the form element.

In the practice of the present invention, referring now to the drawing and more particularly to Figure 1 thereof, a panel-casting form 10 is provided by a plurality of precast, elongate members 11 and 12, preferably formed of a cementitious or ceramic material. The members 11 are of a length substantially equal to the designed height of the wall of the building to be constructed, while the members 12 are of a length dependent on the wall structure to be fabricated. The members 11 are arranged in a parallel relationship with the members 12 spanning the ends thereof, as shown in Figure 1 of the drawing.

The members 11 and 12 are not interconnected in the preferred practice of the invention at the jointures, although, if desired, some means can be used to interlock adjacent ends of the members. The members in the shape of the form shown in Figure 1 are arranged to provide a generally rectangular form with the opposite end portions of the members 12 overlapping and engaged with the opposite end faces of the members 11.

Each of the members 11 and 12 are formed with spaced integral bosses or abutments 13, each of which is formed with at least one passage or opening 14. The openings 14 are used to mount or anchor laterally extending arms 15 formed at one end of tie members 16, the opposite ends of which are to be secured to the network 17 of interconnected reinforcing rods 18. The network 17 is to be embedded within the panel formed and, as in pres-

ent day practice, is used to reinforce and strengthen the cast panel.

In carrying out the now preferred mode of the method herein disclosed, the tie members 16, together with the reinforcing rods 18, internally brace the form provided by the assembled elements 11 and 12. This is so, for any bending forces induced into the form members during the casting operation are taken by the tie elements 16 and the interconnected reinforcing rods 18. In addition to internally bracing the form, the tie elements together with the rods also hold the individual form members against longitudinal movement for the arms 15 of the tie elements are mounted on opposite sides of adjacent abutments 13. This mode of anchorage, as will now be seen, will hold the individual form members against longitudinal movement.

It is to be understood that the relative positions of the rods 18 making up the network 17 will vary in panels of different sizes and loadings. A feature of the present invention resides in the fact that regardless of the relative spacings of the reinforcing rods, they can, nevertheless, be securely tied into the form provided by the form members 11 and 12. This is so, for the angular relationship of the arm 15 of the tie members can be easily varied to accommodate the different angular relationships between adjacent reinforcing rods and the abutments 13. This feature permits the rods 18 to be spaced apart the distance necessary to properly reinforce the cast panel without any particular care as to the location of the rods 18 relative to the abutments 13.

It is now preferred that at least some reinforcing rods 18 extend outwardly and beyond the panel to be formed and to this end the precast form members 11 are provided with spaced elongate slots or narrow openings 19 extending inwardly from one edge face thereof to a point medially of the opposite edge faces thereof. The narrow openings 19, as best seen in Figures 1 and 2 of the drawing, permit opposite end portions of preselected rods 18 to extend laterally outward from the form elements. The extending end portions of the rods 18, as will be hereinafter shown, are used to integrate the cast panels into the wall structure.

The forms of the present invention are used in exactly the same way as are conventional wooden forms today, that is, the forms are assembled on the casting platform which may be formed by the cast foundation after a suitable bond breaking agent is applied to the surface of the foundation. Once the form is completely assembled with the reinforcing steel, the concrete is then cast or poured into the form 10 and the surface smoothed or finished as desired. After the concrete has set and hardened, the panel so formed would be ready for integration into the wall structure. As in conventional practice, support elements such as the so-called chairs would be used to support the reinforcing rods and prevent sagging of the network 17 prior and during the casting operation.

Once the concrete has set and hardened, the form members 11 and 12 are now bonded to the cast concrete and in effect become an integral part of the cast panel. The members 11 and 12 providing the casting form 10, in effect, become somewhat like frame elements extending about and bonded to the mass of cured concrete forming the body of the panel. The panel thus formed is now raised from the horizontal position of Figure 3 into the vertical position illustrated by the dotted line showing of that figure to form a vertically arranged wall section. In the now preferred method, the face of the cast panel formed by the upper surface of the casting platform or foundation forms the outer wall surface of the building so that the normally outward end of the panel is raised upwardly as the inner end of the panel moves outwardly over the foundation to the contiguous edge thereof.

The cast panels, once raised to their vertical position, are now joined through pilasters or cast columns, indicat-

ed by the reference character 20 in Figure 6, and formed in place between adjacent panels as in prior practice. The end portions of the reinforcing rods 18 projecting outwardly through the narrow openings 19 are embedded into the material forming the pilaster to reinforce the same and to integrate the wall section formed by the cast panels and the pilasters formed between the same. The outwardly projecting ends of the reinforcing rods 18 of adjacent panels need not be interconnected, although these adjacent ends may be mechanically interconnected, if desired.

Where a cast panel comprising the assembled form members and the mass of cast concrete is to contain a window or door opening, the completed form may take the structure shown in Figure 5 of the drawing. The form there shown comprises again the assembled form members 11 and 12 having the spaced abutments 13 for anchoring the reinforcing rods 18 through the tie elements 16. Where the panel is to contain, for example, a window opening, form members 21 of appropriate length are assembled to form, as shown in Figure 5, an auxiliary frame 22 within the form provided by the form members 11 and 12. The position of the form 22 will, of course, vary depending upon the desired location of the window opening and it is to be understood that the form 22 can be assembled at any desired location within the form provided by the members 11 and 12.

The form members 21 are also formed as precast, elongate members of cementitious or ceramic material formed with integral bosses or abutments 23 having passages or openings 24 therethrough. Here again the openings 24 are used to anchor the tie elements 25, used like the tie elements 16, to mount the reinforcing rod 18 in the desired spatial arrangement within the completed form.

The form members 21 may, if desired, be formed with longitudinal extending grooves 26 which may be used for mounting, for example, a window frame 27 carrying a plurality of glass panels 28. The window frame 27 can be formed with a flange element 29 to be received within the groove 26 and anchored therein by a suitable caulking material, at least partially filling the groove 26 as indicated by the reference character 31.

The cross sectional configuration of the form members may be rectangular, as indicated in Figure 2, or if desired, the form may have a cross sectional configuration of the shape shown in Figure 7 of the drawing. In the embodiment of the form shown in Figure 7 the opposite longitudinal portions of the form are provided with integral flanges 31 and the flanges 31, when the form is assembled, project inwardly of the form. The lowermost flange 31 presents, as clearly shown in Figure 7, an upwardly facing surface 32 which is engaged by the concrete as it is poured into the form and the weight of the concrete acting downwardly against this face of the flange tends to hold the form downwardly against the upper surface 33 of the foundation 34. Where this embodiment of the form element is used, less care is required to hold the form in good engagement with the upper surface 33 of the foundation.

It will now be seen that the present invention provides precast form members which, when assembled, provide a closed mold or form braced internally through the tie elements 16 and interconnected rods 18 to contain concrete cast into the form and which bonds with the material from which the form members are cast. The form members thus become an integral part of the cast panel and remain with the panel after it is tilted into the vertical position to form a wall section of the building. The method of carrying out the formation of the wall sections completely eliminates the steps of externally bracing the forms prior to the casting of the concrete thereinto and further obviates the requirements that the form members be stripped away from the cast panel after the concrete has cured. This permits a wall section to be more quickly formed and without the necessity of the costly steps of

first erecting the forms and then stripping the same from the cured concrete panel.

As should be clear now, the members 11 and 12 are easily handled and can be quickly set into the predetermined relative positions required to provide the necessary form. If desired, the members 11 and 12 can be formed of several sections of equal or different lengths. For example, sections of preselected lengths can be precast and multiples of the sections longitudinally aligned to form the complete member and where necessary, a section can be transversely severed to make up, with other sections, a member of a predetermined length. In this practice of the present invention, the sections would be merely layed end-to-end for all sections prior to the casting operation would be immobilized through the inner-connected reinforcing rods and tie elements.

It might also be mentioned that the slots 19 of the members 11 and 12 can be actually formed during the casting or molding of the members 11 and 12 or these slots can be subsequently formed in the members at the time the wall panel is to be fabricated. The slots in the latter practice of the invention would be spaced in accordance with the position of those reinforcing rods which were intended or designed to extend outwardly of the cast panel and would be formed, for example, through a sawing or like operation.

The use of the forms of the present invention also, as will now be understood, facilitates the formation of door and window openings in the completed panels, and the special form members used to provide the door and window openings, can be formed, if desired, with means for facilitating the actual mounting or anchorage of frame elements forming a part of the window or door elements.

Although the now preferred embodiment of the present invention has been shown and described herein, it is to be understood that the invention is not to be limited thereto, for it is susceptible to changes in form and detail within the scope of the appended claims.

I claim:

1. An integral panel to form an integrated wall section of the type described, comprising: a plurality of elongated members of cementitious material arranged to form a relatively large rectangular frame; a second plurality of shorter length members of cementitious material arranged within said relatively large frame to form a second rectangular frame; a cast mass of cementitious material filling and spanning the space between said two frames; and a reinforcing network of intersecting rods embedded within said mass and connecting the members of said first frame with the members of said second frame.

2. An integral panel to form an integrated wall section of the type described, comprising: a plurality of elongated members of cementitious material arranged to form a relatively large rectangular frame; a plurality of spaced bosses carried by the inwardly facing surfaces of said members; a second plurality of shorter length members of cementitious material arranged within said relatively large frame to form a second rectangular frame; a plurality of spaced bosses carried by the outwardly facing surfaces of said last named members; a cast mass of cementitious material filling and spanning the space between said two frames; a reinforcing network of intersecting rods embedded within said mass; and a tie element having one end anchored to each of said bosses and connecting the members of said first and second frames with said reinforcing network.

3. A mold member of the type described, comprising: an elongate precast body member of cementitious material; a plurality of spaced apart bosses integral with said body member and projecting from one face thereof, said bosses having passages therethrough with the longitudinal axis thereof arranged substantially parallel with the longitudinal axis of the body member and said face being provided with a pair of longitudinally extending flanges of triangular cross-sectional configuration projecting from the said face along opposite marginal portions thereof.

4. An integral panel to form an integrated wall section, comprising: a first pair and a second pair of precast elongate members of a cementitious material arranged to form a rectangular frame, the end portions of the pre-cast members of the first pair overlapping and abutting the end surfaces of the pre-cast members of the second pair; a cast mass of cementitious material completely filling the rectangular frame formed by said precast elongate members and bonded to the inwardly facing surfaces of said pre-cast elongate members, the opposite surfaces of said cast mass being substantially coplanar with the opposite edge faces of said elongate members; a network of interconnected reinforcement means embedded within said cast mass; each of said pre-cast members having a plurality of integral projections extending inwardly of the frame formed thereby, each of said projections being formed with at least one aperture; and means anchored in said apertures and fixedly attached to said reinforcement means so that said network interconnects all of said pre-cast members and holds said first pair of pre-cast members against the end surfaces of the second pair of pre-cast members to unify the frame and to reinforce and strengthen said cast mass thereby to form an integral internally reinforced panel.

5. An integral panel as set forth in claim 4 in which the two members of one of said pairs of pre-cast members constituting the two opposite side members of said integral panel have apertures therethrough and portions of said reinforcement means extend through said apertures of the side members and extend outwardly beyond the latter to be used for uniting the integral panel with identical adjacent panels in a building wall structure.

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