May 10, 1938. C. M. HUNTINGTON 2,116,946

PRE-CAST BUILDING UNIT OR SLAB AND METHOD OF ASSEMBLING SAME

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Fig. 1.

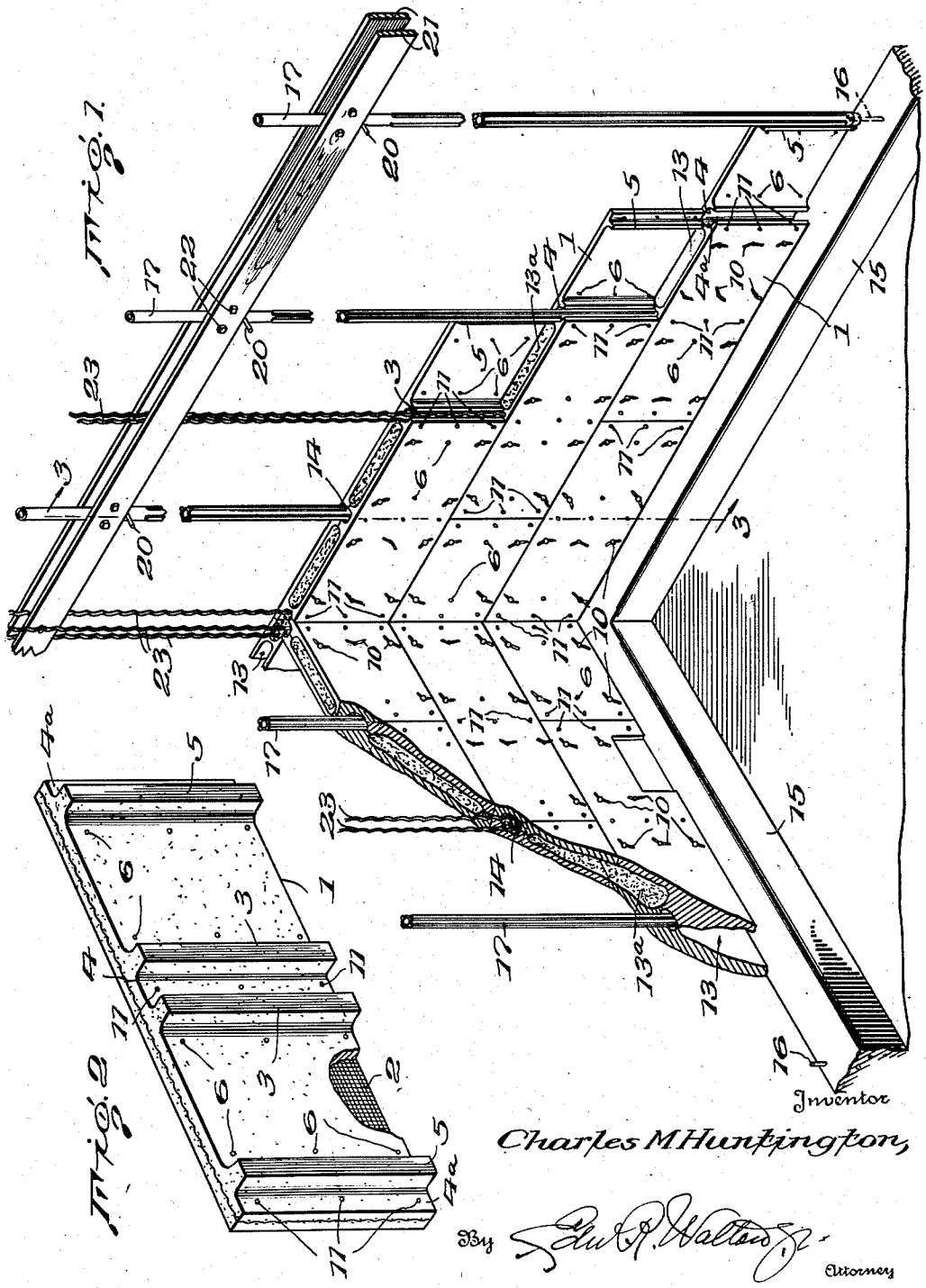


Fig. 2.

Inventor

Charles M Huntington,

By Edw. P. Walker Jr.

Attorney

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Fig. 3

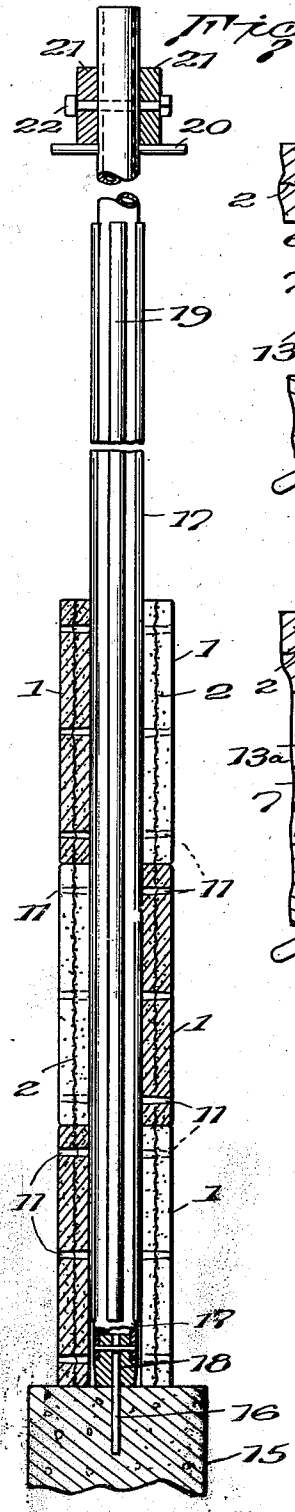


Fig. 4

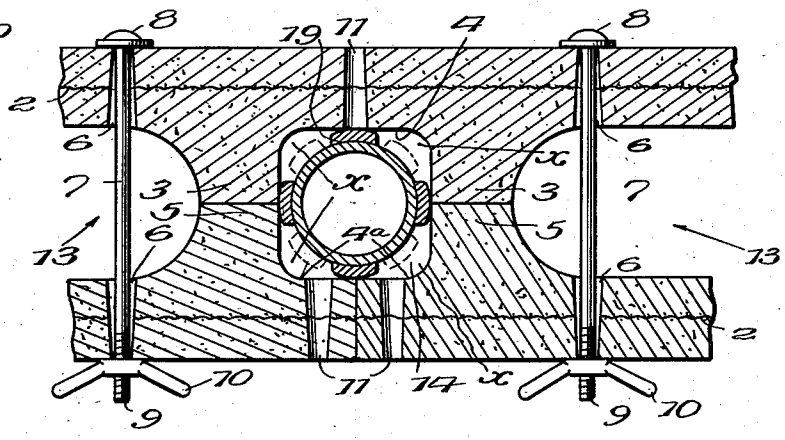


Fig. 5

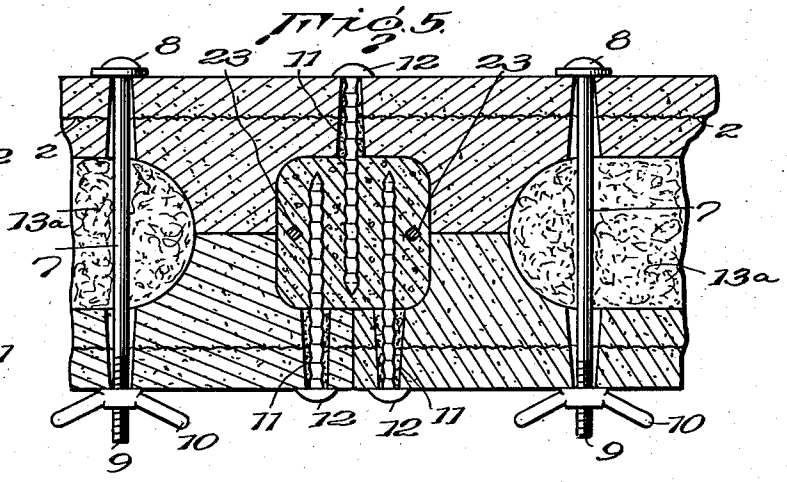
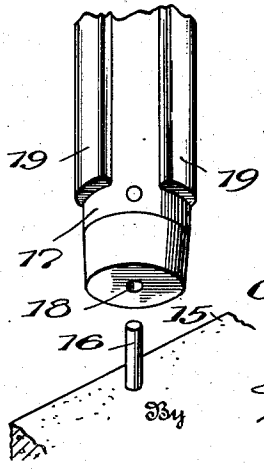


Fig. 6



Inventor
Charles M. Huntington,
By
Attorney

Patented May 10, 1938

2,116,946

UNITED STATES PATENT OFFICE

2,116,946

PRE-CAST BUILDING UNIT OR SLAB AND METHOD OF ASSEMBLING SAME

Charles M. Huntington, Ladoga, Ind.

Application July 9, 1937, Serial No. 152,847

17 Claims. (Cl. 72—30)

This invention relates to pre-cast building units or slabs and method of assembling same, and pertains more particularly to the use of a plurality of such units or slabs in double wall constructions for buildings, enclosures etc.

The primary important object of the invention is to provide an improved pre-cast slab and method of assembling a plurality of such slabs, whereby any structure formed thereof, embodies strength, insulating and moisture proof qualities.

Another important object of the invention is to provide pre-cast slabs of the above character and method of assembly thereof, whereby a double wall structure may be rapidly and economically erected at a minimum cost of labor and materials and with a considerable saving in time.

A further important object of this invention is to provide a method and means of assembling pre-cast slabs of the above character which eliminates mathematical precision in the casting of the latter when same are composed of comparatively coarse aggregate.

A still further important object of this invention is to provide pre-cast slabs of the above character, whereby they may be readily assembled into a double wall structure having passages therein for the reception of piping, wiring, insulation, etc., or which may be utilized for ventilating or air conditioning purposes.

These and other important objects and advantages of the present invention will be readily obvious throughout the course of the following specification and accompanying drawings, in which

Figure 1 is a fragmentary perspective view of a portion of a double wall constructed in accordance with the present invention;

Figure 2 is a perspective view of one of the units or slabs with parts broken away to disclose one form of reinforcement therefor;

Figure 3 is a sectional view taken on line 3—3 of Figure 1, showing the detachable guide member and the bracing therefor;

Figure 4 is a fragmentary horizontal sectional view taken through one of the detachable guide members and a portion of the surrounding wall, the dotted lines indicating the position to which the guide member is rotated preparatory to removal from the wall;

Figure 5 is a fragmentary horizontal sectional view similar to Figure 4 with the guide member removed and the space formerly occupied by the latter filled with a plastic material; and

Figure 6 is a fragmentary perspective view of the footing, guide pin and guide member for aligning the slabs during the construction of a wall.

Referring more specifically to the drawings, wherein like reference characters refer to similar and like parts throughout the several views, 1 indicates a unit or slab of preferred form which, together with similar or other slabs or units, are assembled to provide an improved double walled structure.

As shown in Figure 2, the slab or unit 1 is pre-cast of concrete or other suitable plastic material in a horizontally disposed open top mold (not shown), and during such casting is provided with an embedded metallic reinforcing element 2 of open mesh fabric or the like. While such slabs are preferably cast in a substantially flat rectangular configuration, some may be formed in any other desired shape to meet various problems encountered in building constructions.

The molds (not shown), in which slabs 1 are cast, are formed so as to provide one face of the slabs, intermediate the ends of the latter, with a pair of integrally cast and vertically extending spaced ribs 3, which results in the formation of a substantially U-shaped channel 4 substantially centrally located with respect to the ends of said slabs. Also on the same side or face of the slab, and equally spaced inwardly from each of its ends and from the ribs 3, is an integrally cast vertically extending rib 5 substantially semi-U-shaped providing a groove 4^a, which, with a corresponding groove in an adjacent slab, forms a channel corresponding to channel 4. All of the ribs 3 and 5 are of greater width at their point of connection with the slab body, and it is preferred that the distance from the center of the rib 5 to the end of the slab or unit shall equal the distance from the center of the channel 4 to the center of either rib 3, but any arrangement of ribs which provides the construction and results hereinafter described and claimed may be employed.

The slabs are further provided, adjacent the outer sides of the ribs 3 and inner sides of the ribs 5, with vertically aligned and spaced openings 6 extending transversely therethrough. The openings 6, of each slab and its opposed slab in a double walled construction, are adapted to receive temporary tie-rods 7, the latter having one of its ends headed as at 8, and their opposite ends 9 screw threaded to receive winged nuts 10. Through the bottom wall of the channels 4 and 4^a, the slab is also provided with a se-

ries of vertically aligned and spaced openings 11 extending transversely through the slab, for the reception of roughened and headed reinforcing pins 12.

Oppositely facing rows of slabs 1 are laid on edge and in end to end relation in courses, so as to cause the adjacent end ribs 5 of one row of slabs to engage or contact with the intermediate ribs 3 of the opposite rows of slabs, thus resulting in an overlapping of opposed slabs so that the channels 4a of two adjacent slabs cooperate with the channel 4 of an opposing slab to provide vertically extending tubular passageways 14 therebetween, while the spaces between the ribs 3 and 5 provide vertically extending elongated passagesways 13. The passages 13 may be used as conduits for ventilation or air conditioning, for the disposition of pipes and wiring or for insulation 13a, while passages 14 are for the reception of a cementitious material to provide load supporting, strengthening and bonding columns for the wall.

The first course of the oppositely facing rows of slabs are laid on edge and in end to end abutting relation upon the usual footing or foundation 15. The footing 15 has embedded therein, at predetermined spaced intervals, a series of vertically extending guide pins 16, said pins being so spaced as to project within the tubular column spaces 14 of the completed courses.

In proceeding with a double walled construction, the tubular passageways or column spaces 14 are adapted to receive tubular guide members 17, each of the latter having a plugged lower end socketed as at 18 for the reception of a guide pin 16 when said tubular guide member is moved vertically downwardly thereover. The guide members 17 are provided or formed intermediate their ends with a plurality of equidistantly spaced longitudinally extending cam faced ribs 19 which are four in number and preferably arcuate in cross-section.

The upper ends of the guide members 17, above the ends of the cam faced ribs 19, are provided with diametrically extending bars or handles 20. The guide members 17 are secured together at their upper ends by spaced bracing members 21 which may be detachably connected thereto by bolts 22.

Reinforcing rods 23 are adapted to be placed in tubular column spaces 14, in alternate relation to guide members 17 and when the latter are removed, the same may be replaced with other of said reinforcing rods 23 and reinforcing pins 12.

In proceeding with the assembly of the precast slabs, to construct a double-walled building or enclosure, the footing 15 is first formed in the usual manner, having vertically extending guide pins 16 embedded therein at predetermined spaced intervals.

Then, the tubular guide members 17 are vertically positioned, as shown in Fig. 1, and have their lower ends centered on the guide pins 16, which are, respectively, received in the socketed ends 18 of said guide members. Guide members 17 are placed in alternate column spaces and the reinforcing elements or rods 23, when used, may be disposed in the other alternate column spaces, as shown in Figure 1.

The guide members are further positioned to have two opposite cam faces extended in the direction of the center line of the wall and the other two at right angles to said center line as indicated in Figures 4 and 6. In so positioning the cam faces 19, each is to contact with at least one, but preferably opposite side walls of its column space 14. Upon the completion of this operation, the upper ends of the guide members 17 and the reinforcing rods 23 are clamped between bracing members 21 detachably held in position by bolts 22, which bracing members are in turn rigidly braced from outside the wall structure, by means not shown.

Then, the first row or course of slabs 1 are placed on edge and in end-abutting relation with their ribs 3 and 5, extending inwardly of the wall structure, with the channels 4 and 4a thereof partially embracing the guide member 17 and the reinforcing rods 23. Each slab is thus definitely and accurately positioned horizontally by reason of the surfaces of the channels 4 and 4a contacting with the cam ribs 19. An opposite row of similar slabs are then placed on edge in overlapping relation to the first row of slabs so that the inwardly projecting adjacent ribs 5 of each pair of slabs of said opposite row will contact with ribs 3 of said first named slabs, resulting in tubular column spaces 14 being formed. The opposite rows of slabs are then temporarily secured together by passing headed tie-rods 7 through the aligned openings 6 thereof and drawing same together by winged nuts 10. This insures the accurate positioning of the first courses both horizontally and vertically. At this point in the construction, the reinforcing rods 23 may be positioned in place whenever it is desirable to employ such rod 23.

The succeeding courses of slabs are placed on the preceding courses in staggered relation thereto, so that column spaces 14 are continuous in a vertical direction throughout the height of the wall.

As the building of the wall progresses, reinforcing pins 12 are inserted through openings 11 into the column spaces 14 containing the reinforcing elements 23 which are then filled to the top of each course by pouring concrete therein. This procedure causes the alternate column spaces 14 to be formed into binding columns as the construction of the wall progresses, and the portions of the columns thus formed, harden and tie the lower courses of slabs together in a monolithic structure to support the increasing weight of the wall as additional courses are laid. Since each slab contacts or registers with three successive column spaces, they will be held securely either at their mid-sections or ends when every alternate column 14 has been filled with concrete.

When the last course of slabs has been laid, the guide members 17 are withdrawn from the tubular column spaces 14, by first detaching bracing members 21 and then rotating the guide members, by means of bars or handles 20, through an arc of 45 degrees so as to release the cam faced ribs 19 from their points of previous contact with the walls of the column spaces and to place them opposite the non-contactible free spaces x provided by widened areas or corner portions of the U-shaped channels 4 and 4a, as shown in dotted lines in Figure 4. Upon removal of the guide members, reinforcing rods 23 and pins 12 are then inserted in the column spaces 14, and the latter filled by pouring concrete therein, so as to tie or bond the slabs together.

The spaces 13 formed between opposite rows of slabs may be filled with insulating material 13a, or the same may be used as conduits for piping,

wiring, or for air circulating ducts in ventilating and air conditioning systems.

Horizontal joints between courses may be filled with mortar as the building of the wall progresses, while the vertical joints between slabs are formed by filling the tubular column spaces 14 with concrete, as heretofore stated.

After the concrete in column spaces 14 has hardened, the temporary tie-rods 7 are removed, the openings previously receiving said tie-rods being used to assist in bonding plastic coatings to the walls, or plugged with mortar as desired.

The foregoing description has been limited to wall structures in the vertical plane. It can be readily seen however that the method of construction is also adapted to structure wherein the center plane of the wall structure is at a substantial angle to the true vertical, and the wall may be constructed at any angle that will allow the concrete or like plastic to flow into the column spaces for forming the permanent columns. Therefore, by the disclosure in the drawings, the description and claims hereof, it is contemplated to include a wall structure in an inclined position.

Having thus described my invention, it will be seen that I have provided an extremely practical pre-cast slab and the method of assembling same, either of which may be varied for practical uses. Thus, it is to be understood that while certain details of construction and the manner in which the invention is to be performed, having been described and shown for purposes of an example, the invention is not to be limited to the exact details of the description and disclosure in the drawings herewith, because the same may be modified and varied in numerous ways within the scope of the present invention, and it is intended that the invention is to include everything within the scope of the appended claims.

That which is claimed is:

1. A pre-cast wall unit comprising a slab having on one face thereof a plurality of spaced parallel transverse ribs, two of said ribs being positioned near the center of said slab and forming together with the rib supporting face of said slab, between said centrally positioned ribs, a substantially U-shaped groove, and single similar ribs positioned adjacent each end of said slab and spaced inwardly therefrom, each of said single end ribs forming together with the adjacent end portion of the rear face of said slab a groove of substantially one-half U-shaped configuration, the center plane of each of said ribs being normal to said face of the slab, and each of said ribs being of greater width at its base portion which is integral with the face of the slab than at its free outer end.

2. A pre-cast wall unit comprising a slab having a front and a rear face and having on the rear face thereof a plurality of transverse parallel spaced ribs extending outwardly therefrom, each of said ribs being of greater width at its point of connection with the rear face of said slab than at its free outer end, the center plane of each of said ribs being normal to the rear face of the slab, the reduction in rib thickness being continuous on each side of the center plane thereof from its greater width at the rear face of said slab to the free outer end of said rib, all of said ribs being positioned to form a plurality of transversely extending grooves, one of said grooves being positioned substantially centrally of said slab and others of said grooves being positioned adjacent the ends of said slab.

3. A wall structure comprising an outer portion and an inner portion, each of said outer portions and inner portions being composed of a plurality of similar pre-cast slabs, each of said slabs having a plurality of inwardly projecting spaced fins extending from the rear face thereof, the fins of opposite slabs being in contact with each other in the center vertical plane of the wall structure and cooperating to form vertical column spaces, said column spaces being filled with concrete, corrugated metal reinforcing pins extending through said slabs into the said concrete in the column spaces, the ends of the wall slabs being staggered in opposite rows of the same course and staggered vertically in adjacent courses on each side of the wall structure, and each of said slabs being secured to three successive concrete columns by a plurality of reinforcing pins in each column.

4. A wall structure comprising inner and outer walls composed of a plurality of pre-cast slabs, said inner and outer walls being spaced from each other by spaced ribs formed on and extending inwardly from the rear faces of said slabs and said ribs cooperating to form column spaces extending continuously from the base to the top of the wall structure, rigid bracing and guide members against which the surfaces of alternate column spaces engage, the remaining column spaces being filled with concrete, said wall structure containing substantially wide spaces between successive column spaces and at least one of said wide spaces having communicating openings to exterior ducts adapted to the circulation of air.

5. A wall construction comprising vertical substantially cylindrical guide members braced at top and bottom, an inner wall and an outer wall composed of pre-cast slabs, said slabs having ribs extending inwardly and cooperating to form vertical column spaces within the said wall structure, means for temporarily maintaining said slabs in position, one of said guide members being encased in each alternate column space, said guide members each having a plurality of outwardly projecting surfaces thereon arranged at 90 degree intervals on the circumference thereof, said surfaces providing guides for the positioning of said slabs, said column spaces being of such shape that rotation of the said guide member through 45 degrees will increase the clearance between the said projecting surfaces and the walls defining said column spaces to permit the vertical withdrawal of said guide members.

6. A wall construction of the character described wherein a plurality of vertical guide and bracing members are rigidly secured in line at predetermined intervals and preformed building slabs are clamped together on opposite sides of and encasing said guide members, said slabs having a plurality of ribs on the inner faces thereof and a plurality of grooves formed by said ribs, said ribs and grooves on adjacent slabs cooperating to form column spaces between said slabs, said guide members being encased in alternate column spaces, said column spaces not occupied by guide members being filled with concrete, and said concrete containing reinforcing pins extending inwardly through the outer surfaces of said slabs, thereby forming a monolithic wall structure and permitting the removal of the said guide members when the said concrete hardens.

7. A double-walled building structure, comprised of opposed rows of pre-cast slabs, each having a body of substantially flat rectangular form, a pair of inwardly projecting vertically extending spaced ribs formed on the rear face of

each of said slabs intermediate the ends of the latter to provide a groove of substantially U-shaped cross-section, and an inwardly projecting vertically extending rib formed on the rear face of each of said slabs adjacent each of the ends of the latter, whereby all of said ribs of one row of slabs together with similar ribs of opposed rows of slabs form columns and spaces therebetween.

8. A guide member for use with a building structure of the character set forth in claim 6, wherein the guide members are tubular and each has a socketed end and longitudinally extending cam-faced ribs formed thereon equi-distantly spaced about the circumference of the exterior surface of the guide member.

9. A method of forming a wall construction which wall comprises pre-formed block units having channels therein and adapted to be arranged in courses with said channels in alignment to form column spaces, said method including placing certain of said channels of each unit in each course in contact with a temporary guide, filling other of said column spaces with a cementitious material to form columns within said units, and inserting through the channel portion of each unit transverse reinforcing pins which extend into the column spaces and become anchored or embedded in the cementitious material when the latter hardens.

10. A method of forming a double-walled construction which wall comprises preformed wall units having channels therein and adapted to be arranged in courses with said channels in alignment to form column spaces, said method including the steps of placing pre-cast units on opposite sides of a temporary vertical guide with certain of said channels of each unit in contact therewith, filling the other channels with cementitious material to form columns within the wall structure, then removing the temporary guides and filling those aligned channels with cementitious material.

11. A method of forming a concrete wall construction as set forth in claim 10, further characterized by temporarily clamping said units of each course in position by passing clamping bolts through opposing units of each course, removing said temporary clamping bolts when the cementitious material between the respective units is hardened.

12. A method of forming a wall construction comprising preformed wall units adapted to be arranged in courses and having channels therein adapted to align to form column spaces whose side walls are at different distances from the longitudinal center of said column spaces, said method including placing certain of said channels of each unit in each course in contact with a temporary guide so that the shortest dimension of each column space will contact with the guide, filling other of said channels with cementitious material to form columns within the units, partially rotating said temporary guide within the column spaces to remove the same out of contact with the surfaces of the column spaces and removing the temporary guide.

13. The method of forming double-walled structures for buildings or the like, which includes casting in situ a foundation therefor, supporting spaced guiding elements on the foundation, arranging and temporarily securing precast units in staggered and vertically successive courses on the foundation and around the guiding elements so as to provide confined column spaces thereabout, removing the guiding elements in a vertical direction from said column spaces, inserting reinforcing members transversely from the exterior of said units into the confined spaces from which the guiding elements have been removed, and then filling said confined spaces with a self-hardening plastic.

14. A precast wall slab of plastic material having a front face and a rear face and having on the rear face thereof a plurality of transverse grooves, two of said grooves being positioned adjacent to the ends of said slab and each adapted to surround one fourth of the circumference of a cylindrical guide member and to make contact with the said guide member only at the edges of the groove, another groove being positioned centrally of said rear face and adapted to surround one half the circumference of a cylindrical guide member and to make contact with the said guide member only at the edges and center of said groove, provision being made by a plurality of regularly spaced holes through the slab for the insertion of tie rods for the purpose of clamping such slabs on opposite sides of and enclosing the said guide members in the spaces formed by cooperating grooves.

15. A wall structure comprising an outer portion and an inner portion, each of said outer portions and inner portions being composed of a plurality of similar pre-cast slabs, each of said slabs having a plurality of inwardly projecting spaced fins extending from the rear face thereof, the fins of opposite slabs being in contact with each other in the center vertical plane of the wall structure and cooperating to form vertical column spaces, said column spaces being filled with concrete, the ends of the wall slabs being staggered in opposite rows of the same course and staggered vertically in adjacent courses on each side of the wall structure, and each of said slabs being secured to three successive concrete columns.

16. In a device as set forth in claim 7 further characterized by at least certain of said column spaces being filled with a self-hardening plastic material.

17. In a device as set forth in claim 7 further characterized by at least certain of said column spaces being filled with a self-hardening plastic material and reinforcing pins extending from the outer surface of the slabs into said plastic material in said column spaces.

CHARLES M. HUNTINGTON.