March 9, 1937. P. BETZLER 2,073,548

BUILDING CONSTRUCTION

Filed May 12, 1936 2 Sheets-Sheet 1

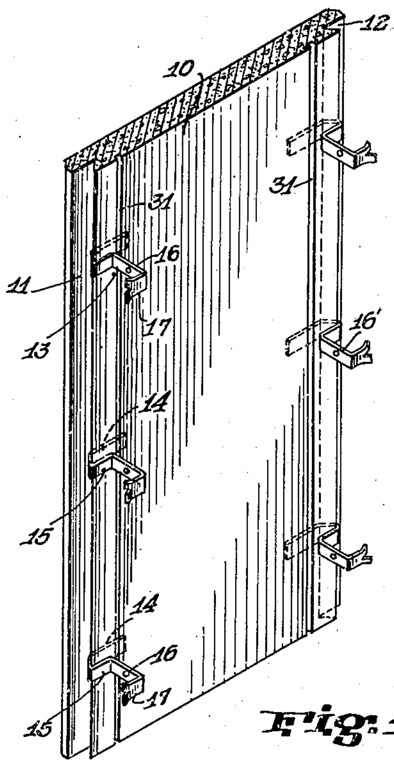

Fig: 1

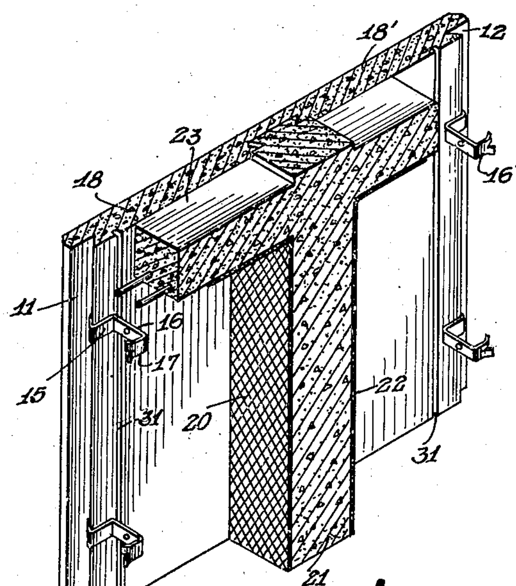

Fig: 3

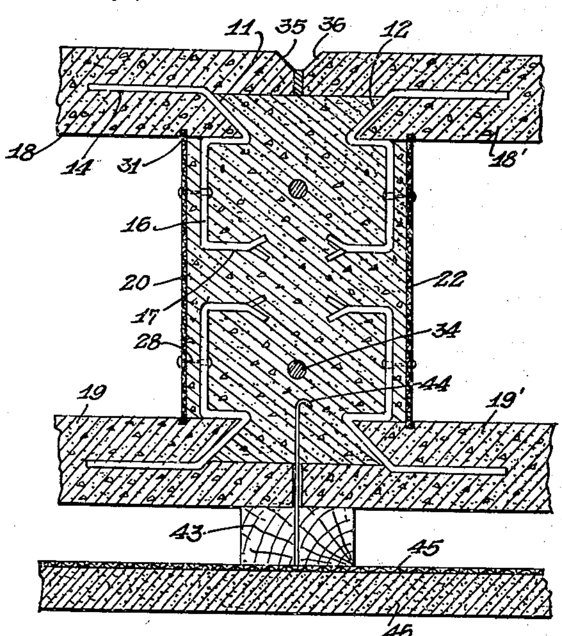

Fig: 2

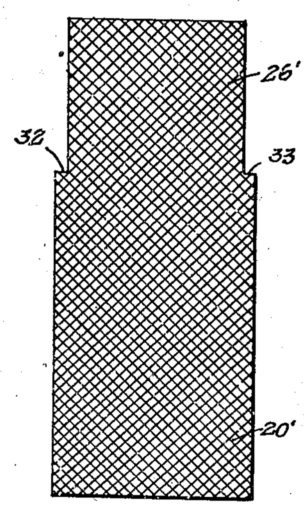

Fig: 5

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BUILDING CONSTRUCTION

Filed May 12, 1936 2 Sheets-Sheet 2

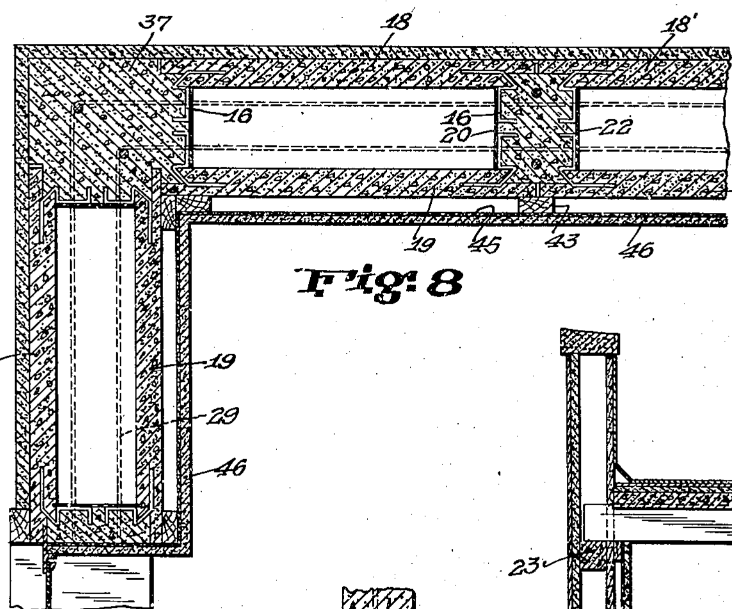

Fig: 8

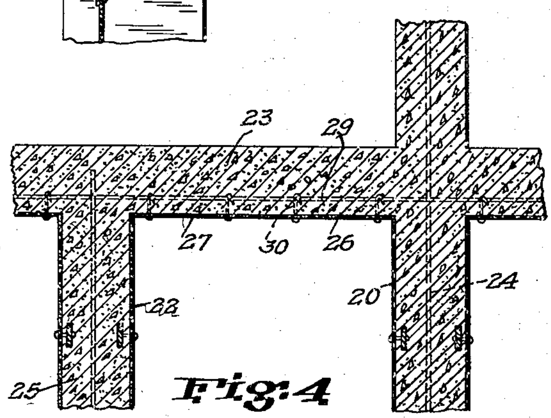

Fig: 4

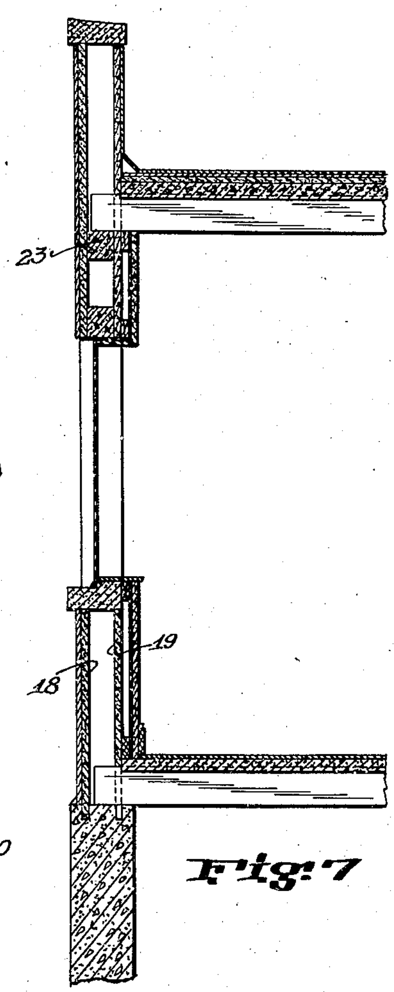

Fig: 7

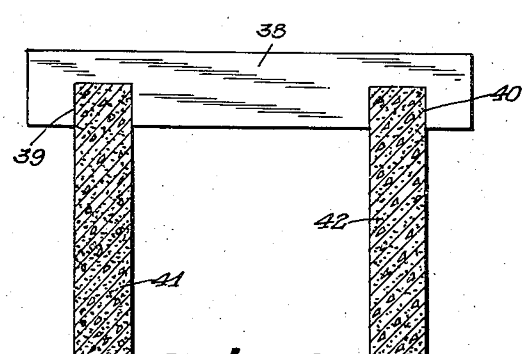

Fig: 6

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2,073,548

BUILDING CONSTRUCTION

Paul Betzler, New York, N. Y.

Application May 12, 1936, Serial No. 79,316

9 Claims. (Cl. 72—30)

This invention relates to building construction and more particularly refers to improvements in building units and in the construction of walls in which said building units are employed.

Primarily, my invention relates to an improved method of building hollow walls in which the advantages to be derived from the use of precast slabs of concrete or some such suitable plastic material are utilized together with the advantages pertaining to the ordinary method of concrete construction where the walls and other parts of a building are poured and allowed to harden in situ.

In this manner, walls can be built very rapidly at relatively low cost, yet possessing a strength and solidity which can favorably compare with those possessed by concrete walls of the monolithic type.

Accordingly, the primary object of the invention is to provide a novel and improved construction of hollow wall comprising an outer wall element and an inner wall element, said wall elements being built out of precast units or slabs made of preferably reinforced cementitious material, arranged side by side, and column elements interposed at spaced intervals between said wall elements, said column elements being poured in situ and permanently binding the wall elements to each other so as to virtually impart to the wall the qualities of a monolithic wall.

Another object is to provide a building unit or slab of a novel and improved design comprising a web like body and anchor members extending from its inner surface, adapted to become embedded within a column element cast between two wall elements formed of a number of such slabs.

A further object is to provide a building unit or slab of the character specified having a groove extending all along each of its vertical edges, adapted to form with a similar groove of a similar slab arranged side by side in the same plane therewith, a recessed groove adapted to cooperate with the anchors with which each slab is provided in solidly binding said slabs to a column cast in situ between two wall elements each formed of a number of such slabs.

A still further object is to provide in a hollow wall construction comprising an outer and an inner wall element each consisting of precast building unit or slabs arranged side by side and provided with inwardly extending anchor members, a novel and improved method of utilizing said anchor members and the inner surfaces of the wall elements for producing molds adapted for the pouring of concrete between the two wall elements in order to obtain column elements as well as bond beams solidly binding together the building units and the wall elements formed thereby in a virtually solid monolithic wall.

Other objects and advantages of the present invention will more fully appear as the description proceeds and will be set forth and claimed in the appended claims.

My invention is illustrated by way of example in the accompanying drawings, in which:

Fig. 1 is a view in perspective of the building unit or slab employed in my method of wall construction, in its preferred form;

Fig. 2 is a horizontal section of part of a wall embodying my invention illustrating the relation between adjoining slabs and wall elements and a column joining said elements together;

Fig. 3 is a fragmentary view in perspective of one of the wall elements shown in Fig. 2, illustrating the relation between two adjoining slabs, a column and a bond beam;

Fig. 4 is a fragmentary section through a wall embodying my invention;

Fig. 5 is a detail view of a length of metal lath prepared for use in forming a mold for a column and a bond beam integral therewith;

Fig. 6 is a fragmentary cross section of a wall in course of erection showing the manner of retaining the two spaced wall elements while the grout for producing a column element is being poured;

Fig. 7 is a fragmentary vertical cross section of a wall embodying my invention; and

Fig. 8 is a horizontal section thereof.

In a patent entitled, Interlocking unit constructions, issued to me May 6, 1930, #1,757,763, I have described a building unit or slab of a special construction comprising a web body having one of its longitudinal edges inwardly bent at an angle to the surface of said body to form a rib integral therewith and having its other longitudinal edge bent inwardly laterally and outwardly to form a hook sectioned beam or column member, adapted to receive and interlock with the rib member of an adjoining unit.

In another patent entitled, Building slabs, issued to me December 1, 1931, #1,834,892, I have described and claimed an improved building unit or slab comprising a web body and two ribs, preferably tapering in section, extending therefrom in proximity of each longitudinal edge thereof, one of said ribs being spaced inwardly of the adjoining longitudinal edge and the other rib being offset outwardly of the adjoining longitudi-

nal edge so as to form therewith a recess adapted to receive and interlock with the projecting longitudinal edge of an adjoining slab or unit.

In still another patent entitled, Wall constructions, issued to me December 27, 1932, #1,892,605, I have described and claimed a wall construction comprising two transversely spaced wall elements each consisting of a plurality of superimposed horizontal sections, each section consisting of a longitudinal series of substantially flat units placed edge to edge and interlocking with one another by means of a tongue and groove joint, the units composing one of the wall elements being positioned and connected to the units composing the other wall element by means of separately insertable tie members extending therebetween, said tie members also forming an interlocking connection between the adjoining edges of units belonging to adjoining horizontal sections, so as to form a single wall structure in which each unitary element directly or indirectly interlocks with all the others.

In all the arrangements advocated in my previous patents, the stability of a structure is mainly dependent upon the interlocking connection provided between adjoining units, and only in a minor degree depends upon such bond as may exist between the precast units or slats and such other elements which may be produced in situ in order to complete the structure. In the case of the arrangement described in Patent #1,892,605 practically all the elements going into the construction of a wall are precast and detachably connected to one another so that the wall is demountable and therefore to a certain degree lacks the solidity of a permanent structure.

In my present invention I have endeavored to retain the advantages pertaining to the elongated slabs shown in my first and second patent above referred to and also the advantages of the hollow wall construction shown in my last mentioned patent, further improving the last named type of construction by providing column elements of a permanent character and poured in situ as the means for securely joining together and interlocking with the two wall elements, so as to form a structure having great rigidity and strength, yet adapted to be produced at relatively low cost, because of the considerable savings in material and labor made possible thereby.

In Fig. 1 I illustrate the preferred form of building unit or slab which may be used in connection with my invention. In the same it will be seen that the slab essentially consists of a preferably reinforced web body **10** having each vertical or longitudinal edge of its inner surface formed with a recess **11, 12**, extending for the entire length thereof, the sectional outline of said recess forming one-half of a dove-tailed groove which will result when two slabs are placed edge to edge alongside of each other, as shown in Fig. 2.

Each longitudinal edge portion of the slab is further provided with a number of vertically spaced anchor elements such as shown at **13**, said anchor elements having their inner end **14** embedded into the slab and their outer end bent towards the opposite edge along the inner surface of the slab as shown at **15**, then bent outwardly of said inner surface at right angles thereto as shown at **16** and then bent once more at right angles in a transversal direction as shown at **17**, so that tracts **15, 16, 17** of said anchor form a C section horizontally projecting from the inner surface of the slab.

By virtue of this construction when two slabs are placed opposite each other, one forming part of one of the wall elements as shown at **18** in Fig. 2 and the other forming part of the other wall element as shown at **19**, the tract **16** of the anchors of one of the slabs will remain in the same vertical plane with the tracts **16'** of the anchors of the other slab, thus forming vertically spaced points of attachment for a slat or lath such as shown at **20** forming one of the sides of a mold for pouring the grout or concrete going to form the column **21**.

As shown in Fig. 2, the mold for the column is completed at the opposite end by another slat or lath **22** which is attached to the anchors inwardly projecting from slats **18', 19'** which are placed edge to edge alongside slats **18, 19** respectively.

It is thus seen that the mold is formed by the two sides **20, 22** and by the edge portion of the inner surface of slats **18, 18'**, and slats **19, 19'** delimited thereby, said edge portions including the vertical dovetailed grooves formed by the adjoining recesses **11, 12** of the slabs. The anchors **16—16'** will thus remain embedded in the resulting column element, so that said column will firmly join together adjoining slabs of the same wall element and one wall element to the other through the intermediary of said anchor members: furthermore, the strength of the bond thus created between these various elements is still further enhanced by the two dove-tailed tenons formed as part of the column element going to fill the dove tailed grooves formed by adjoining grooves **11, 12** in each wall element, the resulting structure having substantially the strength and rigidity of a monolithic wall.

In proximity of the ceiling of each story produced as a building goes up, the various column elements formed in the wall are joined by horizontal bond beams as such as shown at **23**, which are produced at the same time therewith, by horizontally extending the column molds between the two wall elements at such points where the bond beams are to be provided.

To this end the lath **20**, of one column **24** is bent horizontally towards an adjoining column **25** as shown at **26**, and the lath **22** of said column **25** is bent horizontally toward the other column **24** as shown at **27** so as to provide a bottom for the horizontal mold section extending between said two columns within which can be poured grout to form the bond beam **23** as shown in Fig. 4. The vertical portions of the laths can be secured to tracts **16—16'** of the anchor members, by means of tie members or clips such as shown at **28**, and the horizontal portions **27** of said laths can be suspended from longitudinal reinforcing bars **29**, running along the line of bond beams, by means of wires or suspension members **30**.

In order to hold the edges of the vertical portions of the laths against bulging, I prefer to provide the slabs with longitudinal grooves such as shown at **31** within which the edges of said laths can be inserted. The upper portion **26'** of a lath **20'** shown in Fig. 5, which upper part **26'** is to be bent horizontally to form the bottom of the bond beam mold as explained, is preferably trimmed along its edges as shown at **32, 33**, in order to reduce its width to correspond to the distance between the faces of the slats in opposing wall elements, which distance is somewhat less than the distance between the bottoms of opposing grooves **31**.

The column elements are preferably reinforced by vertical bars **34** in the usual manner, such bars providing a vertical bond between the various superimposed column sections as they are built.

The longitudinal edges of the outer surface of the slats are preferably beveled to a certain extent as shown at **35** so that when two slabs are placed edge to edge as shown in Fig. 2 together they form a vertical V shaped groove **36** which will become filled with the outer coating of stucco or other material and improve the bond between said coating and the underlying slabs. Furthermore, the added thickness that the outer coating will have at such points will serve to effectively conceal the junction line between adjoining slabs, which might otherwise be ill concealed by a relatively thin layer.

In Fig. 8 I show how two walls can be joined at a corner by means of a corner column **37** which can be poured by producing a mold, two sides of which will be constituted by slats or laths secured onto the anchor members of the adjoining slabs and the other two sides of which may be built up in any desired or well known manner.

In order to maintain the wall elements at the proper distance from each other before the column elements are poured therebetween, said wall elements may be held in place by means of any suitable positioning and retaining device such as for instance, the tie member **38** shown in Fig. 6 which is provided with recesses **39** and **40** properly spaced for placement over the edge portions of the wall elements **41**, **42**, retaining them at the proper distance from each other. Said tie members can, of course, be removed before the bond beam between the two wall elements is formed.

In Fig. 2 I show how the inner surface of the wall thus erected can be provided with means for securing metal lath thereto as a foundation for plastering. In the same it is seen that a furring strip **43** can be used, said furring strip being provided with a series of vertically spaced anchoring members or clips **44** insertable between the edges of two adjoining slabs. In this manner, the anchoring members **44** projecting within the dove-tailed groove **11—12**, formed by the inner edges of the slabs will remain securely embedded within the column element **21**, the furring strip remaining on the outside of the inner surface of the wall. This being done the usual metal lath foundation **45** may be secured onto the furring strips and the plaster **46** may be applied onto the metal lath in the usual manner.

If desired, in order to facilitate handling and erecting, at the same time increasing the rigidity of the slabs and lessening the chances of breakage, the slabs can be formed with one or more longitudinal ribs laterally spaced from the edges thereof without in any way modifying their arrangement in the building of a wall.

It is also within the scope of my invention to build a wall comprising one wall element only and column elements and bond beams binding and reinforcing the structure at its inner side in the manner explained, in which case the inner surface of each column element may be directly provided with a furring strip onto which the lath for plastering can be secured. Such a construction will be found to provide sufficient strength and rigidity when used in building small houses which have to be produced at a relatively low cost, although the heat insulating properties of such a wall are naturally less than in the case of a wall comprising two wall elements separated by an air space. Furthermore, although I prefer to use slabs made of cementitious material such as reinforced concrete, it is possible to substitute in their place slabs or units made out of sheet metal, said units being joined into a solid wall structure by column elements and bond beams poured in situ in the manner above described.

Other constructional details of the invention may vary to a certain extent from those shown without departing from the inventive idea; the drawings will therefore be understood as being intended for illustrative purposes only and not in a limiting sense. Accordingly, I reserve the right to carry my invention into practice in all those ways and manners which may enter, fairly, into the scope of the appended claims.

I claim:

1. A building unit of the character specified, comprising a web body having its inner surface formed with a recess running along each of its lateral edges, said recess extending from the inner toward the outer surface of said body and becoming wider as it so extends, so as to form, with a similar recess of another unit placed edge to edge with said building unit, a female housing adapted to receive a male tenoned member registering therewith, and anchoring members having a part embedded within said body and a part projecting therefrom, adapted to form a bond between said units and said tenoning member when said tenoned member is obtained by pouring self hardening plastic cementitious material within said housing, whereby said tenoned member will laterally bind one of said units to the other.

2. A building unit of the character specified, comprising a web body having its inner surface formed with a recess running along each of its lateral edges, said recess extending from the inner toward the outer surface of said body and becoming wider as it so extends, so as to form, with a similar recess of another unit placed edge to edge with said building unit, a female housing adapted to receive a male tenoned member registering therewith, and anchoring members having a part embedded within said body and a part projecting therefrom at right angles to said inner surface, from a point inwardly spaced from the edge of said recess, the projecting parts of the anchoring members along each edge being all in the same plane parallel to said edge, and being adapted to form a bond between said units and said tenoned member when said tenoned member is obtained by pouring self hardening plastic cementitious material within said housing.

3. A building unit of the character specified, comprising a web body having its inner surface formed with a recess running along each of its lateral edges, said recess extending from the inner towards the outer surface of said body and becoming wider as it so extends, so as to form, with a similar recess of another unit placed edge to edge with said building unit, a female housing adapted to receive a male tenoned member registering therewith, anchoring members having a part embedded within said body and a part projecting therefrom, at right angles to said inner surface, from a point inwardly spaced from the edge of said recess, the projecting parts of the anchoring members along each edge being all in the same plane parallel to said edge, and being adapted to form a bond between said units

and said tenoned member when said tenoned member is obtained by pouring self hardening plastic cementitious material within said housing, and a groove parallel to each recess extending along the inner surface of said body at a point inwardly spaced from the plane of the parts of the anchoring members projecting therefrom.

4. A wall construction composed of two transversely spaced wall elements, each consisting of a plurality of units arranged edge to edge, each unit having its inner surface formed with a recess running along each of its lateral edges, adjoining recesses of adjoining units together forming a female housing extending from the inner toward the outer surface of the wall element and becoming wider as it so extends, the vertical housings thus formed in each wall element being directly opposite the vertical housings formed in the other, anchoring members having a part embedded in each lateral edge portion of each unit and a part projecting from the inner surface thereof towards the opposite wall element, and self hardening originally plastic cementitious material poured between said wall elements forming vertical columns filling each set of opposite vertical housings and embedding the anchoring members adjacent thereto.

5. A wall construction composed of two transversely spaced wall elements, each consisting of a plurality of units arranged edge to edge, each unit having its inner surface formed with a recess running along each of its lateral edges, adjoining recesses of adjoining units together forming a female housing extending from the inner toward the outer surface of the wall element and becoming wider as it so extends, the vertical housings thus formed in each wall element being directly opposite the vertical housings formed in the other, anchoring members having a part embedded in each lateral edge portion of each unit and a part projecting from the inner surface thereof, at right angles thereto, toward the opposite wall element, the projecting parts of opposite anchoring members being in the same vertical plane and forming a support for one of the faces of a mold completed by a similar face supported by the anchoring members projecting from the adjoining edges of the adjoining units and by the inner edge portions of the inner surfaces of said units intervening between said faces, and self hardening originally plastic cementitious material poured within each mold, forming vertical columns filling each set of opposite vertical housings and embedding the anchoring members adjacent thereto.

6. A wall construction composed of two transversely spaced wall elements, each consisting of a plurality of units arranged edge to edge, each unit having its inner surface formed with a recess running along each of its lateral edges, adjoining recesses of adjoining units together forming a female housing extending from the inner toward the outer surface of the wall element and becoming wider as it so extends, the vertical housings thus formed in each wall element being directly opposite the vertical housings formed in the other, anchoring members having a part embedded in each lateral edge portion of each unit and a part projecting from the inner surface thereof towards the opposite wall element, and self hardening originally plastic cementitious material poured between said wall element forming vertical columns filling each set of opposite vertical housings and embedding the anchoring members adjacent thereto, and horizontal beam members connecting adjacent vertical columns.

7. A wall construction composed of two transversely spaced wall elements, each consisting of a plurality of units arranged edge to edge, each unit having its inner surface formed with a recess running along each of its lateral edges, adjoining recesses of adjoining units together forming a female housing extending from the inner toward the outer surface of the wall element and becoming wider as it so extends, the vertical housings thus formed in each wall element being directly opposite the vertical housings formed in the other, anchoring members having a part embedded in each lateral edge portion of each unit and a part projecting from the inner surface thereof, at right angles thereto, towards the opposite wall element, the projecting parts of opposite anchoring members being in the same vertical plane and forming a support for one of the faces of a mold completed by a similar face supported by the anchoring members projecting from the adjoining edges of the adjoining units and by the inner edge portions of the inner surfaces of said units intervening between said faces, and self hardening originally plastic cementitious material poured within each mold, forming vertical columns filling each set of opposite vertical housings and embedding the anchoring members adjacent thereto, and horizontal beam members connecting adjacent vertical columns.

8. A wall construction composed of two transversely spaced wall elements, each consisting of a plurality of units arranged edge to edge, each unit having its inner surface formed with a recess running along each of its lateral edges, adjoining recesses of adjoining units together forming a female housing extending from the inner toward the outer surface of the wall element and becoming wider as it so extends, the vertical housings thus formed in each wall element being directly opposite the vertical housings formed in the other, anchoring members having a part embedded in each lateral edge portion of each unit and a part projecting from the inner surface thereof towards the opposite wall element, self hardening originally plastic cementitious material poured between said wall elements forming vertical columns filling each set of opposite vertical housings and embedding the anchoring members adjacent thereto, horizontal beam members connecting adjacent vertical columns, reinforcing vertical bars within said columns, and reinforcing horizontal bars within said horizontal beam members.

9. A wall construction comprising a plurality of units arranged edge to edge, each unit having its inner surface formed with a recess running along each of its lateral edges, adjoining recesses of adjoining units together forming a female housing extending from the inner toward the outer surface of the wall element and becoming wider as it so extends, anchoring members having a part embedded in each lateral edge portion of each unit and a part projecting from the inner surface thereof, column elements at the back of said wall filling said housings and embedding the anchoring members adjacent thereto, so as to laterally bind adjoining units to one another, and horizontal beam members connecting adjacent vertical columns.

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