Dec. 7, 1943. J. C. P. LEEMHUIS 2,335,948

BUILDING CORNER STRUCTURE

Original Filed May 31, 1938 2 Sheets-Sheet 1

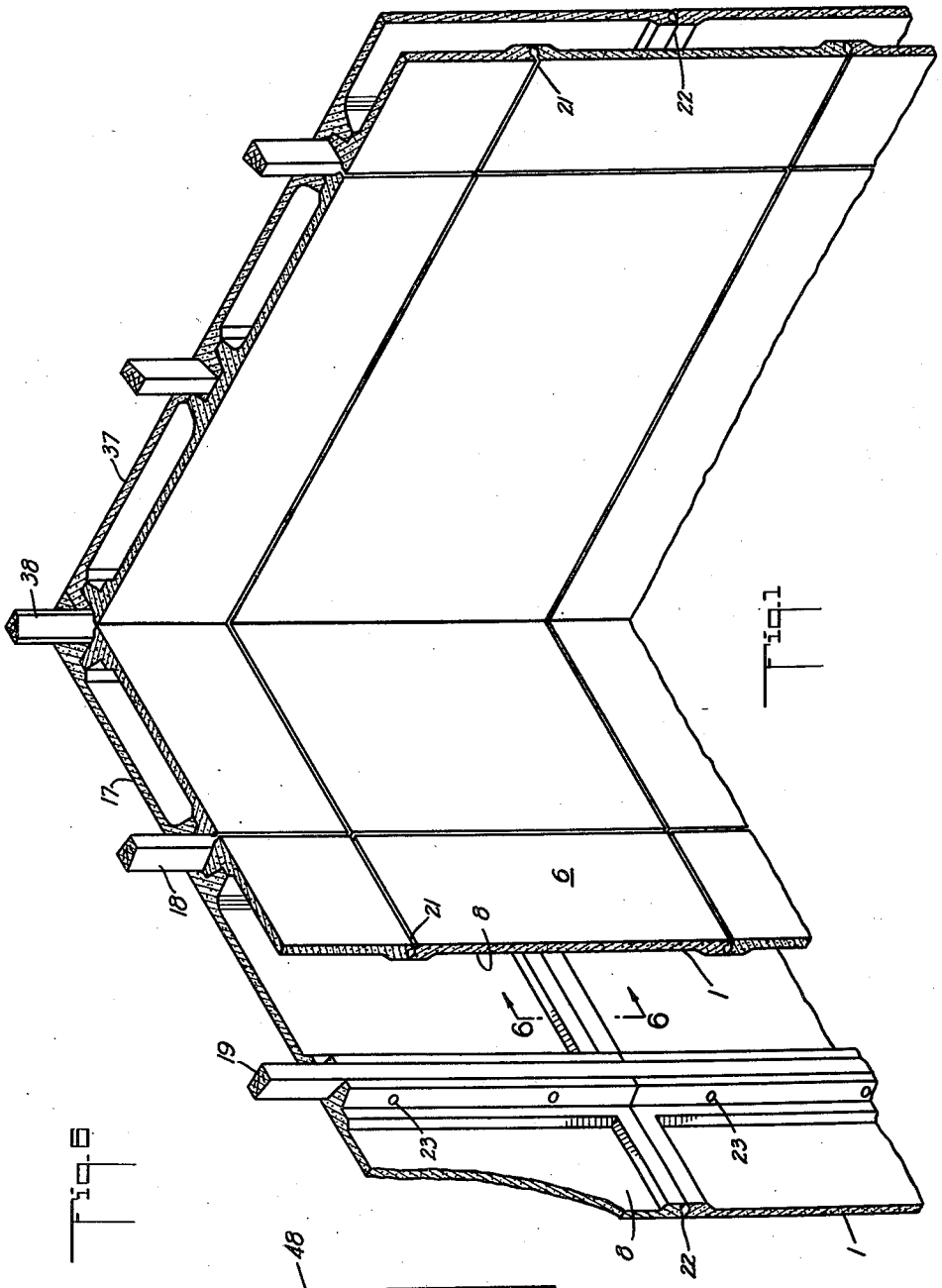


FIG. 1

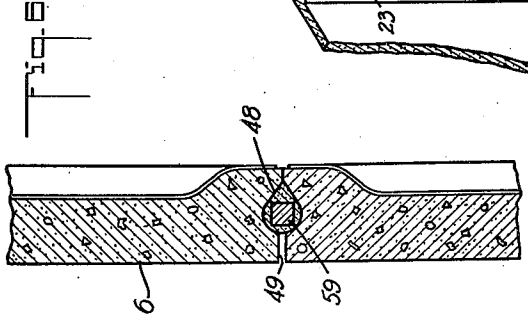


FIG. 6

INVENTOR
Johannes C.P. Leemhuis
BY John Flam
ATTORNEY

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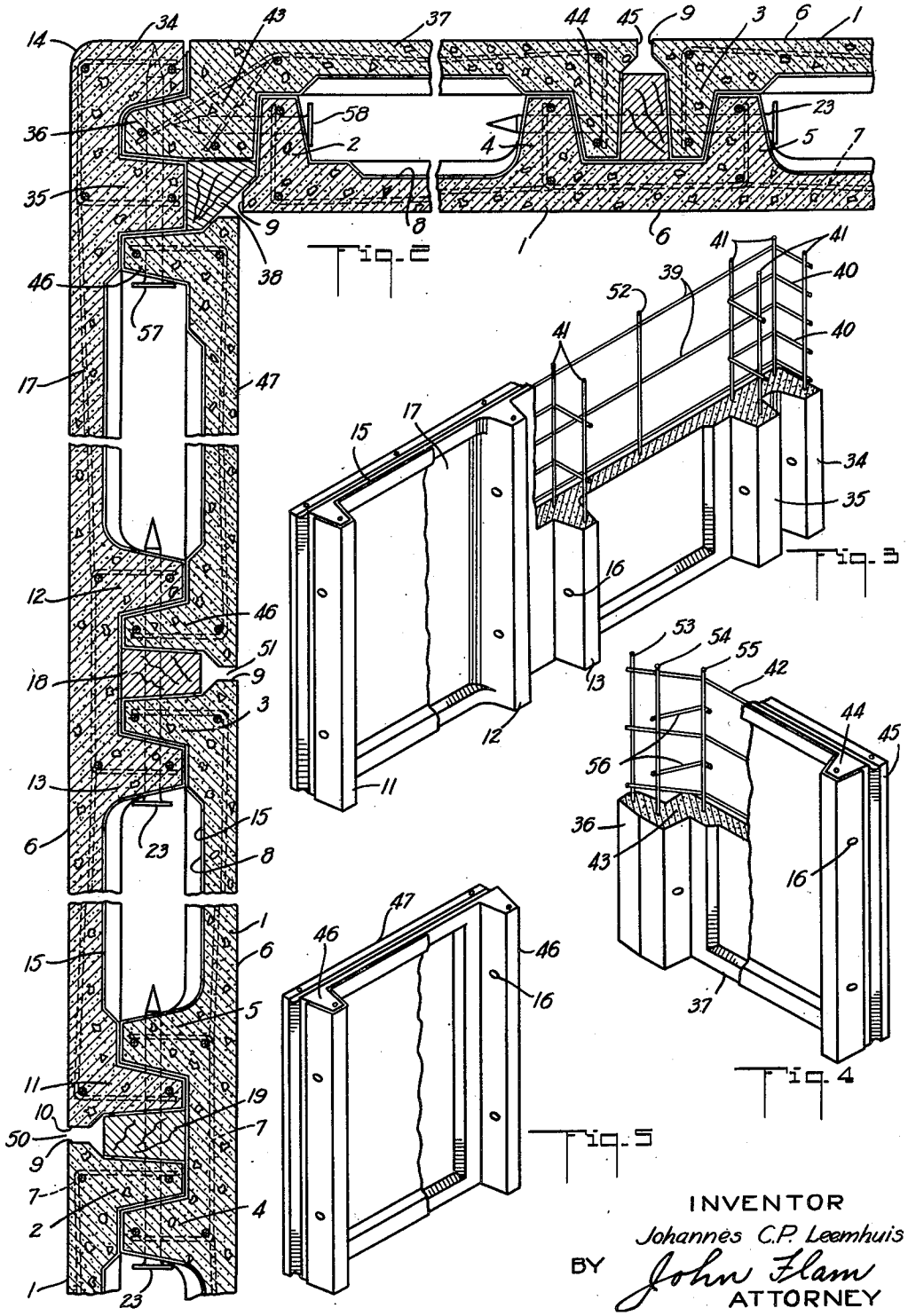


Fig. 2

Fig. 3

Fig. 4

Fig. 5

INVENTOR
Johannes C.P. Leemhuis
BY John Flam
ATTORNEY

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BUILDING CORNER STRUCTURE

Johannes C. P. Leemhuis, Los Angeles, Calif., assignor, by mesne assignments, to Edward James Donaldson, Johannesburg, Transvaal, Union of South Africa

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4 Claims. (Cl. 72—16)

This invention relates to a building structure, and especially to one utilizing preformed plates or blocks.

This application is a division of an application filed in the name of Johannes C. P. Leemhuis on May 31, 1938, Serial No. 210,921, and entitled "Building materials and methods." In this prior application a wall structure is shown as constructed of plates or slabs which are formed with interlocking vertical pillar sections, and which are so arranged as to provide an interior and an exterior flat wall surface with an air space between the wall surfaces. The courses of the plates or slabs on opposite sides of the wall are furthermore staggered. The vertical pillar sections of the plates on opposite sides of the wall are overlapped and tied together as by pins. Due to the intimate contact of these pillar sections, the wall structure is particularly adapted to resist sagging and vibratory shocks such as may be caused by earthquakes.

In order to render a construction of this character thoroughly practical, a variety of plates or slabs should be made as a standard assortment. For example, plates or slabs must be provided which are adapted to form a corner structure, for use at places where two walls meet.

It is a principal object of this invention to provide a corner structure which is effective for firmly tying the abutting walls together.

It is another object of this invention to provide a corner structure having a finished exterior surface without the need of additional finishing steps, as for example, plastering.

It is a still further object of this invention to provide a corner structure wherein the number of different types of plates or slabs required is small, at the same time not requiring that the wall length between corners be a multiple of the length of a plate.

It is still another object of this invention to provide plates with which it is possible to form the corner structure by merely overlapping the vertical pillar sections where the walls meet.

It has been found that by using the principles of construction disclosed in the prior application, the wall structure exhibits excellent qualities of strength, rigidity, and resistance to shocks; and this in spite of the fact that the plates are not joined by mortar or cement. In fact, the narrow spaces provided between adjacent edges of the plates may be left open; but for the sake of appearance, grouting may be added. The spacing between horizontal courses, however, may be utilized in a variety of other ways, if desired. For example, the grouting in these spaces may serve as a key between courses; or longitudinal metal reinforcement may be placed therein.

In accordance with the present invention, the spaces between the vertical plate edges may provide a passage for fastening elements, such as nails or bolts, to vertical studs that are continuous from top to bottom of the wall. Such studs may be of wood or of other appropriate material. They contribute very materially to the strength of the structure. They are interposed between vertical pillar sections at the edges of adjacent plates, so as to permit passage of the fastening means to the studs.

It is accordingly another object of this invention to make it possible effectively to build wall sections of preformed or precast materials, in association with continuous vertical studs that are substantially completely covered by the plates.

It is another object of this invention so to proportion and form the plates and the reinforcement therefor, that the thickness and weight of the plates may be reduced. This feature is especially advantageous, since thereby the spaces between the two sets of plates forming the two sides of a wall are sufficiently wide to accommodate plumbing, conduits for electric wiring, ducts for air conditioning, and the like, as well as to provide greater accessibility for the insertion of pins or other anchors used in assembling the wall structure. It also permits the use of continuous vertical studs of greater cross section.

It is still another object of this invention to make it possible to use reinforcing material in a simple and effective way; and more particularly to supplement the embedded reinforcement by metal bars accommodated between adjacent horizontal edges of the plates.

When walls have been built heretofore from cement or concrete blocks or plates, it has been observed that condensation or a collection of moisture may exist on the wall surfaces. The result is that at least the interior walls are required to be treated to correct this condition. It is still another object of this invention to obviate the need of any special treatment of the walls, and particularly by ensuring that the wall, for substantially its entire extent has no continuous cement or concrete thickness from one side of the wall to the other.

This result is accomplished by placing some insulation material, such as builders ply paper, felt, or the like, upon at least those surfaces of the interior and exterior plates which are intended to be placed in contact. The insulation material, being waterproof, effectively bars the seepage or collection of condensed moisture from the exterior surface to the interior surface. It is thus still another object of this invention to provide this insulation covering, preferably as an adherent layer directly overlying the plate surfaces.

This invention possesses many other advantages and has other objects which may be made more easily apparent from a consideration of one embodiment of the invention. For this purpose there is shown a form in the drawings accompanying and forming part of the present specification. This form will be described in detail, illustrating the general principles of the invention; but it is to be understood that this detailed description is not to be taken in a limiting sense, since the scope of this invention is best defined by the appended claims.

In the drawings:

Figure 1 is a pictorial illustration of a fragment of wall structure embodying the invention;

Fig. 2 is a horizontal section on an enlarged scale of the wall structure shown in Fig. 1, parts of the wall plates being broken away in order to reduce the size of the figure;

Fig. 3 is a pictorial illustration of one of the special plates used in the corner structure, a part of the plate being broken away;

Fig. 4 is a similar illustration of another special corner plate, which is used with the plate of Fig. 3;

Fig. 5 is a pictorial illustration of a special wall plate for use with the corner plates; and

Fig. 6 is a fragmentary section on an enlarged scale as seen on plane 6—6 of Fig. 1.

As shown and described in the earlier filed application, the wall structure (Figs. 1 and 2) is formed mainly of a plurality of identical plates or slabs 1, which are keyed or joined together by the aid of pins or bars.

Each of the plates 1, which are intended to be cast from concrete or other plastic cementitious material, is shown as having, adjacent the opposite vertical edges, the pillar sections 2 and 3. Intermediate these pillar sections 2 and 3 are provided the spaced vertical pillar sections 4 and 5. Each pillar section is slightly tapered toward the free edge, to provide a draw, and thus facilitate stripping from a mold.

These vertical pillar sections all extend on a common side of the plate 1. The opposite side of the plate 1 may form the exposed wall surface 6. As indicated in the prior application referred to, the pillar sections 2, 3, 4 and 5 cooperate with similar pillar sections of plates forming the opposite wall surface, to produce the hollow wall effect illustrated in Fig. 2.

The plates 1 may also conveniently be provided with reinforcing iron or steel wires or bars 7. These reinforcing elements may be appropriately supported in the mold preparatory to the casting of the plates. Since the reinforcement elements are carefully spaced so as to impart the desired strength to the structure, it is possible by this means to reduce the thickness of the plate 1, and thereby to reduce the weight of the finished product. This reduction in thickness is indicated in Figs. 1 and 2 by the panel 8, forming a rectangular recess on the reverse side of the plate between pillar sections 2 and 4, as well as between pillar sections 3 and 5. The pillar sections 2 and 3 are shown as being spaced a slight distance from the edge surfaces 9 of the plate.

All of the vertical pillars 2, 3, 4 and 5 of each plate are intended to lie adjacent to or overlap similar pillar sections of the plate that forms the opposite wall surface of the hollow wall structure. In order to connect the plates together to form a strong, self-supporting earthquake resistant structure, pins or the like may be passed transversely through the cooperating overlapped pillar sections. For this purpose, apertures are provided, extending through all of the pillar sections in a horizontal direction. The upper series of apertures is located below the top by one-quarter of the distance from the top to the bottom of the plate 1. Similarly, the lower series of apertures is located above the bottom of the plate by one-quarter of the distance from the bottom to the top. This spacing is especially convenient when assembling the wall structure by inserting the anchoring pins. They also provide a symmetrical arrangement, enabling the plates to be reversible. As the courses are laid, the insertion of the pin is readily accomplished by inserting the hand into the hollow formed between the inner and outer plates.

The manner of laying the courses in horizontal series is best illustrated in Figs. 1 and 2. For example, the plates 1 which form the exterior wall of the structure shown in Fig. 1 may be placed in a series of horizontal courses. The vertical edges 9 of the course forming one wall side is kept in alinement for the entire height of the wall; but the course forming the other wall surface are vertically and horizontally offset or staggered from the courses forming the exterior wall surfaces.

It is necessary, of course, for a complete building structure, to provide a construction for corners, formed by intersecting walls, and for this purpose, special plates or slabs are required. Thus, a plate 17 is provided to define one exterior side of the corner, and a cooperating plate 37 is provided to define the other exterior side of the angle. Plate 17 as clearly shown in Figs. 2 and 3 has a pillar 11, adjacent its inside vertical edge 10, which corresponds to pillar 2 or 3 of the standard plate 1. It also has intermediate pillars 12 and 13, corresponding to pillars 4 and 5 of plates 1. The outside edge 14 of plate 17, which edge constitutes the exterior corner, is formed by a pillar 34. Spaced from pillar 34 is another pillar 35, the two together forming a channel for receiving a pillar 36 on the cooperating corner section 37 (Fig. 4). Pillar 35 also is adapted to cooperate with the end pillar, as 2, of an inside plate. Thus, plate 17 corresponds in length to a standard plate.

Similarly, pillar 36 has an extension 43 also arranged to cooperate with the end pillar, as 2, of an inside plate. As shown, plate 37 corresponds in length to half of a plate and has a pillar 44 adjacent its inner edge 45, corresponding to pillars 2, 3, but has no intermediate pillars.

The manner in which the vertical pillar sections may be utilized to produce the staggered positioning of the plates on opposite sides of the wall may be best explained in conjunction with the wall structure illustrated in the left hand portion of Fig. 2. Therein, it is shown, for example, that the vertical joints 50 between edges 9 and 10 of the adjacent plates forming the exterior wall surface are offset with respect to the ver-

tical joints 51 between the edges of the adjacent plates forming the interior wall surface. At about the middle of that fragment of the wall illustrated in the left hand portion of Fig. 2, the edge pillar section 3 of one plate, as 1, and the corresponding edge pillar section 46 of the next adjacent plate, as 47, are shown. These pillar sections, 3 and 46, are disposed within the space between the intermediate pillar sections 12 and 13 of plate 17.

The four pillar sections 13, 3, 46 and 12, would be in contact, were it not for the separation afforded by the layers of paper 15, which cover substantially all of the inside surface of each plate. As fully set forth in a copending application filed in the name of Johannes C. P. Leemhuis August 26, 1938, Serial No. 226,920, and entitled "Method and apparatus for molding," the paper 15 is caused to firmly adhere to the plates by being placed in contact with them, while the material of which they are formed is still in a plastic condition.

This paper serves as an insulating medium between the plates forming the inside and those forming the outside of the wall structure. As it is substantially waterproof, it stops any moisture that may be condensed on one side of the wall from passing through to the other side of the wall, since it intervenes at substantially all points of contact between the plates on one side of the wall structure and those on the other side. As it is disposed over the interior surface of all of the plates, it serves to insulate completely the interior wall from the exterior wall.

Since the space between pillars 11, 12, 13 and 35 on plate 17 is the same as that between the pillars on a standard plate, it is plain that in order to offset the vertical joints 50 and 51, the first inside plate 47 must be special and approximately half the length of a standard plate. Thus, plate 47 (see Fig. 5) has no intermediate pillars, but only pillars 46, adjacent its edges. The same result can be achieved by arranging plate 17 so that it corresponds to half a plate length by having its edge 10 between the pillars 12 and 13, and using it with a standard length plate inside.

The other corner plate 37 (see Fig. 4) is shown as being a half length plate and used with a standard plate 1 on the inside. This will result in the vertical joints on the inside wall being offset with respect to those on the outside wall.

Plates 37 and 17 may be used in interchanged relationship by appropriately changing the inner wall; thus to permit the greatest possible latitude in choice of wall length, it is only necessary to provide one additional special plate to those shown in Figs. 3, 4 and 5. This may either be a half plate corresponding to plate 17, as before mentioned, or it may be a full length plate corresponding to plate 37.

It is to be noted that the edge pillar sections of adjacent plates, as 3 and 46, do not completely fill the space between the cooperating intermediate pillar sections, 12 and 13. Instead a space is provided for a vertical stud 18, which is continuous from the bottom to the top of the completed wall structure. This vertical stud 18 may be of wood or the like. Due to the vertical space 51 between the edges of the plates on the interior wall, opposite the stud 18, the stud 18 is available to be utilized as an anchoring means for elements to be supported on the interior wall.

A similar vertical stud 19 is indicated in the lower portion of Fig. 2, as accommodated between the cooperating edge pillar sections 2 and 11. These edge pillar sections 2 and 11, with the stud 19, fill the space between the intermediate vertical pillar sections 4 and 5 of a plate 1. The space 50 between the vertical edges 9 and 10 on the exterior of the wall structure permits access to the vertical stud 19.

When the course immediately above the course illustrated in Fig. 2 is laid, intermediate pillar sections corresponding to sections 4 and 5 are placed squarely above these sections 4 and 5; and similarly, the edge pillar sections 2 and 11 are laid immediately over the edge sections of the lower course.

A vertical offset is provided between the inner wall plates and the outer wall plates, as shown in Fig. 1. This is accomplished by forming the bottom course, of either the inner or outer wall plates, of plates having only one half the height of standard plates. In this way the horizontal joints 21 between adjacent courses on the inner wall are vertically staggered or offset from the horizontal joints 22 of the exterior wall, by a distance equal to half the height of a standard plate. The top course of either the inner or outer wall, depending on th height of the wall structure, is formed of similar plates of half height.

Attaching or anchoring means for the plates are provided in the form of pins 23 which pass transversely through the previously described apertures 16 formed in the pillars of all plates. These anchoring pins 23 also pass through the studs 18, 19 which are provided with suitable apertures for them. The reinforcing wires or bars 7 are so arranged as to strengthen the concrete behind the pin holes.

Due to the reduction in the thickness of the plates intermediate the pairs of vertical pillar sections 2 and 4, and 5, etc., the insertion of the anchoring pins 23 by hand is rendered easy, for adequate space is provided for the hand of the operator. As one staggered course of plates is being laid, holes 16 for the pins 23 are but one-fourth of the distance below the top of that course which is opposite the course being laid. Accordingly, it is relatively easy to insert these pins. By spacing the apertures 16 for connecting pins 23 one-quarter of the height of the plate above and below the lower and upper edges of the plate respectively, the panels are made reversible. This results in a substantial decrease in the number of molds required. It also makes the erection of the wall easier and increases the horizontal strength.

The location of the reinforcing material of plate 17 is shown in Fig. 3. This comprises a series of horizontal bars 39 extending substantially the full length of the plate, corresponding to bar 7 of a standard plate. These horizontal bars are joined in any convenient way, as by welding, to vertical bars 41, arranged in pairs in each pillar section. There may also be an intermediate vertical bar 52. The vertical bars 41 in adjacent pillar sections are joined U-shaped bars 40 spaced between bars 39.

The reinforcement for plate 37 is shown in Fig. 4. Here pillar 36, 43 is provided with three vertical bars 53, 54 and 55. The horizontal bars 42 which extend the length of the plate are joined to bar 55 and bent so as to meet bar 53. Bar 54 is joined to bar 55 by short intermediate bars 56.

Pillars 34, 35 and 36 of the corner plates and the adjacent pillar of the inside plate, as 46, are connected by pins 57, similar to pins 23, but somewhat shorter, since the holes to accommo-

date them do not extend through to the outside of pillar **34**. Pillar **43** is similarly joined to the adjacent pillar of the inside section, as **2**, by special pins **58**.

The inside surfaces of pillars **35** and **43** define an inner right angled space within which a continuous triangular corner post or stud **38** may be located. By providing a full length plate corresponding to plate **37**, and a half length plate corresponding to plate **17**, the relative positions of pillar sections **34**, **35** and **36** in alternate courses may be interchanged, resulting in a strongly keyed corner construction.

Each horizontal edge of all plates is provided with a groove **48** (Fig. 6) which defines a horizontal channel intermediate the inner and outer surface of the plate. At the outer surface **6** of the plates, the edges of the plates do not quite meet, thus forming a slot as indicated by **49**. The slot **49** may be left open if desired, in which case the groove **48** will effectively trap any moisture which may enter the slot, or the slot may be filled with grout or mortar. If desired, a reinforcing bar **59** may be placed in the slot before grouting for the purpose of additionally keying adjacent plates together.

The exposed wall surfaces may of course be treated in any desired manner for providing a decorative finish. The wall, however, can be rendered sufficiently decorative on the exterior by the addition of a layer of stucco. Or provisions may be made to embed sand within the exposed face of the plates, as by placing sand, during the molding operation, upon surfaces of these plates which rest upon the pallets. This serves to prevent the concrete mixture from which the plate is formed from adhering to the pallet, as well as giving a pleasing finish to the exterior of the wall.

What is claimed is:

1. A building corner structure assembled from preformed plates respectively defining the sides of an exterior angle, and from other preformed plates having non-overlapping edges respectively defining the sides of the corresponding interior angle, one of said plates that defines a side of the exterior angle having a pair of integrally formed pillar sections adjacent one edge of the plate, said pillar sections defining a deep channel between them, the other of the plates that defines the other side of the exterior angle having an integrally formed edge pillar section fitting into said channel, one of the plates defining one of the sides of the interior angle having an integrally formed edge pillar section overlying the inner channel defining pillar section, and means for fastening the plates together.

2. A building corner structure assembled from preformed interior and exterior plates forming respectively interior and exterior wall surfaces, each plate having vertical pillar sections on one side, the other side of the plate forming the wall surface, one of the exterior plates having an edge forming the corner, said plate having a pair of vertical pillar sections closely spaced adjacent the corner forming edge, the cooperating exterior plate having a vertical pillar section at one edge accommodated between said pair of pillar sections, pillar sections on the plates forming the interior wall surface respectively cooperating with and overlapping said edge pillar section of the cooperating exterior plate, as well as one pillar section of said closely spaced pair and means securing said pillar sections together.

3. Preformed interior and exterior plates cooperating to form a building corner structure, those plates forming the exterior walls of the structure being provided with vertical pillar sections adjacent the corner, said sections partly overlapping and forming the sides of an interior angle, the plates forming the interior walls of the structure having vertical pillar sections respectively adjacent their edges, overlying and having portions projecting inwardly beyond the sides of said overlapping pillar sections and defining with the sides of the interior angle, a space, means securing all said pillar sections together, and a vertical stud member in said space.

4. A building corner structure assembled from preformed interior and exterior plates, one of said plates forming an exterior wall of the corner having a channel defined by inner and outer vertical pillar sections adjacent an edge of the plate, another plate forming an exterior wall of the corner having a pillar section accommodated in the channel, at least a pair of plates forming the interior wall of the corner and cooperating respectively with the exterior plates, the interior plate which cooperates with the plate with the pair of channel forming pillar sections having an edge pillar overlying the inner pillar section of said pair, common fastening means engaging the said edge pillar section, the channel forming pillar sections as well as the pillar section accommodated in the channel, the other interior wall plate having an edge pillar section overlying the pillar section that is accommodated in the channel, and fastening means engaging the said edge pillar section of the other interior wall plate and the pillar section in the channel.

JOHANNES C. P. LEEMHUIS.