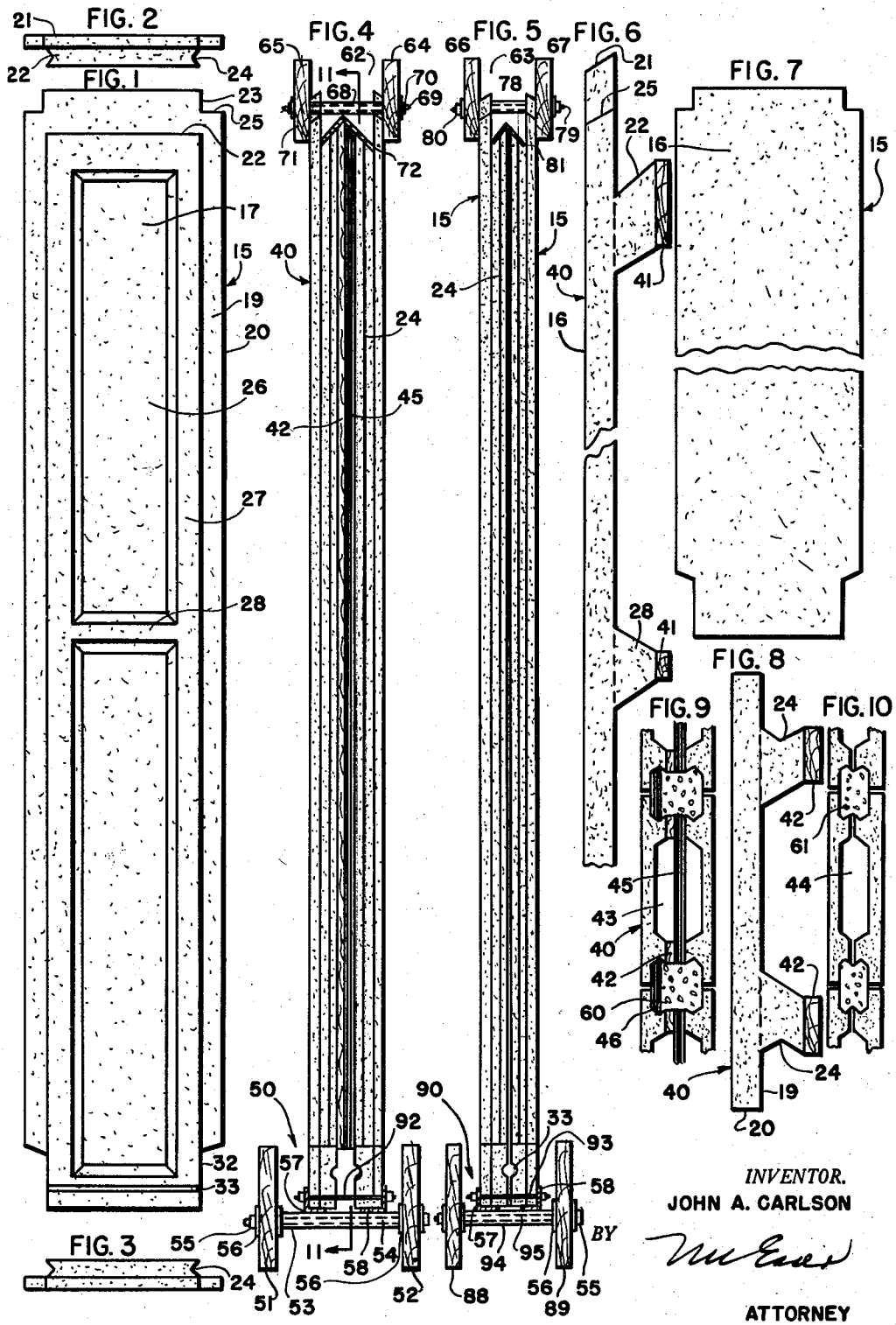
April 21, 1959 J. A. CARLSON 2,882,712

PREFORMED AND BONDED MASONRY WALL STRUCTURE

Filed June 16, 1955 3 Sheets-Sheet 1



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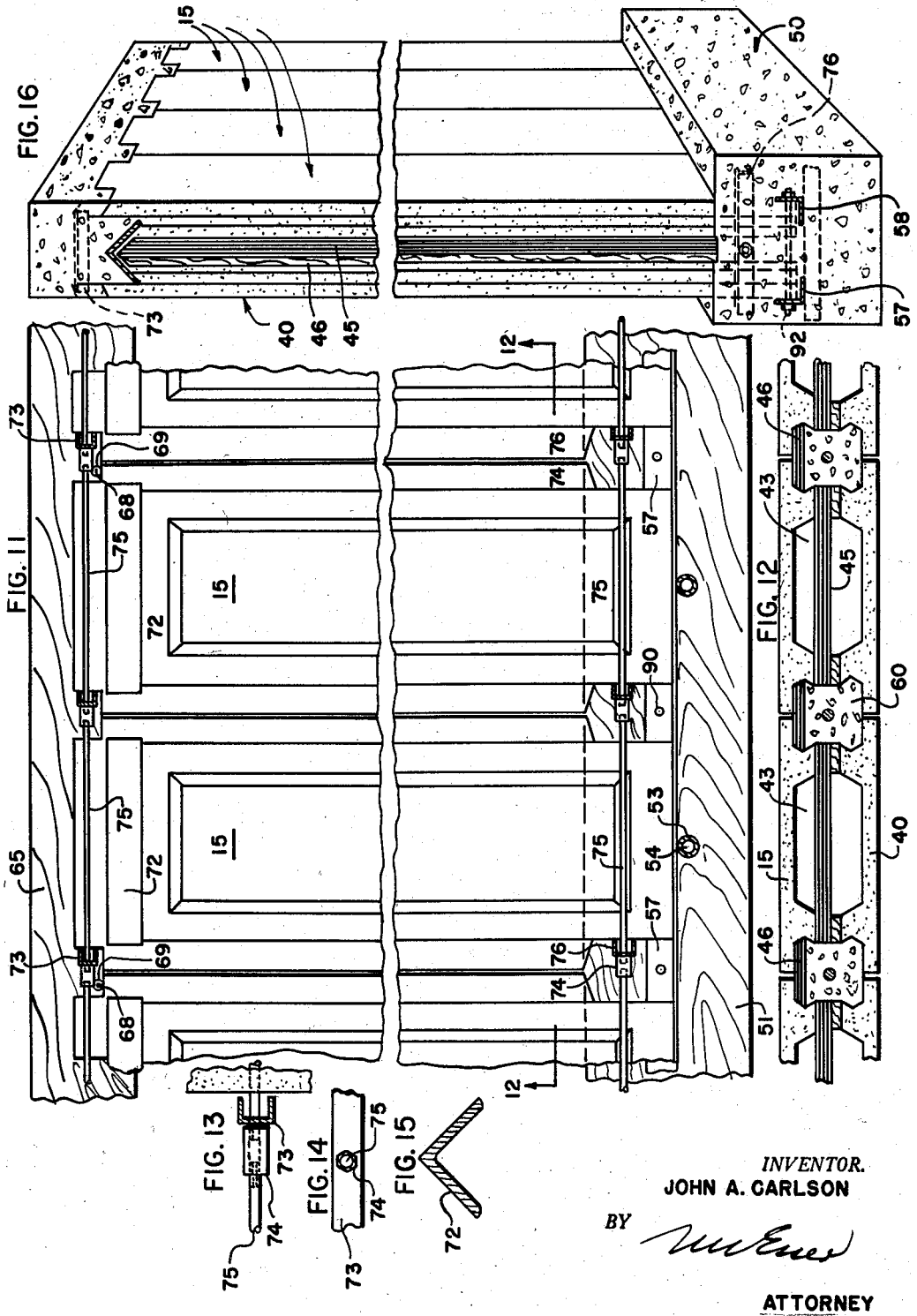
BY

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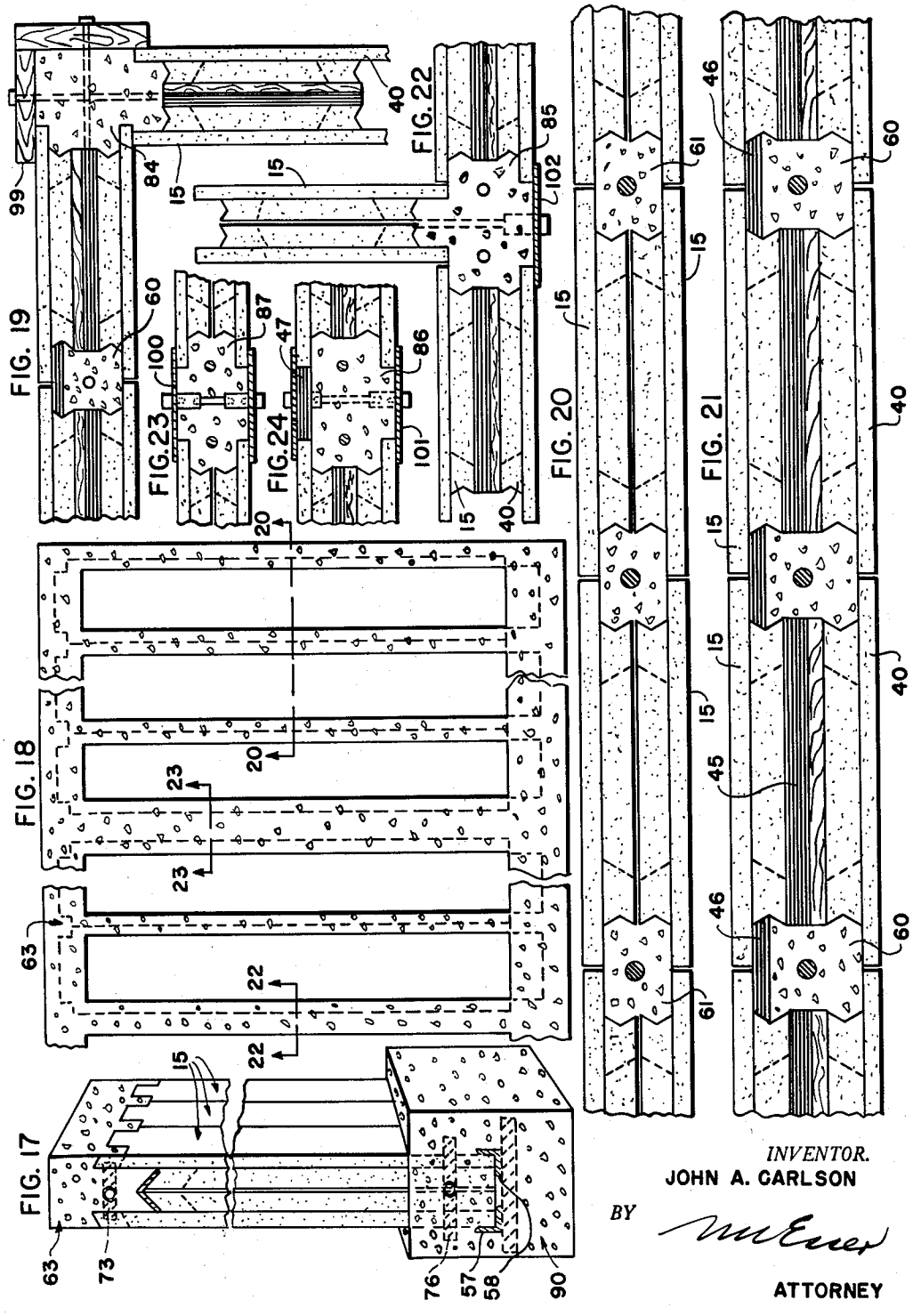
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PREFORMED AND BONDED MASONRY WALL STRUCTURE

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2,882,712

PREFORMED AND BONDED MASONRY WALL STRUCTURE

John A. Carlson, Mill Valley, Calif.

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4 Claims. (Cl. 72—16)

This invention concerns building construction of concrete and steel, and more specifically provides a new approach in a combination of precast members and reinforced poured concrete.

In the development of this invention, applicant has given special thought and consideration to achieve a superior and unique construction for the purpose of building houses and other types of buildings durable against the most destructive elements such as tornado, hurricane, earthquake, and windstorm as well as to provide a shatterproof construction to minimize danger to life and damage to property in the event of enemy attack. Moreover, it is fireproof, vermin proof and permanent in nature, providing a building of maximum strength with only a minimum of material. With all of these advantages, applicant's invention yet presents a structure competitive in material and erection costs with standard types of frame building construction of equivalent size. Furthermore, being fully insulated, it produces a construction that is cool for hot climates and warm in cold climates and absolutely proof against outside moisture.

This construction provides walls of precast reinforced concrete members and reinforced poured concrete. The precast members are simple to form and are easily and quickly assembled resulting in a sound bonded and practical wall construction. The members are interlocked with specially designed metal rods and fixtures and are then securely bonded together horizontally by embedding their bases in footings and by poured reinforced concrete girders along the top of the wall.

Pilasters are obtained by pouring concrete into prearranged molds formed mostly of the precast members themselves. Such pilasters may be formed at intervals from corner to corner or to points adjacent the joinder of a partition wall and an outside wall.

Furthermore, by the setting of the panel slabs in their proper position in the wall, back to back and lateral side edges to lateral side edges, there will be provided forms or molds where the four panel slabs abut. This mold when filled with concrete results in a concrete bonding stud, locking and bonding vertically all four members at that juncture.

The provision of such precast members, fixtures and rods referred to above, together with their assembly into a wall construction, as well as the resultant wall, constitutes the principal object of this invention.

Additional objects and advantages of this invention will become more apparent as the following description proceeds when taken in conjunction with the accompanying drawings, in which:

Fig. 1 is an elevational view of the inner surface of a panel slab.

Fig. 2 is a top end view of Fig. 1.

Fig. 3 is a bottom end view of Fig. 1.

Fig. 4 is a vertical cross sectional view of an exterior wall prior to completion with poured concrete.

Fig. 5 is a vertical cross sectional view of an interior

partition wall prior to its completion with poured concrete.

Fig. 6 is a slightly enlarged partial vertical section taken on line 6—6 of Fig. 1.

Fig. 7 is an elevational view illustrating the surface side of a panel slab, the reverse or inner side being illustrated in Fig. 1.

Fig. 8 is a slightly enlarged cross section on lines 8—8 of Fig. 1.

Figs. 9 and 10 illustrate in horizontal cross section, an exterior wall and an interior partition wall respectively.

Fig. 11 is a vertical view longitudinally and centrally of a wall, taken on line 11—11 in Fig. 4.

Fig. 12 is an enlargement of Fig. 9.

Fig. 13 is a side elevation of a clamping fixture arrangement.

Fig. 14 is an end view of Fig 13.

Fig. 15 is an end view of a girder forming member and cover.

Fig. 16 is a perspective view illustrating concrete panel slabs in position embedded in footings and top girders after concrete has been poured and forms removed resulting in an exterior wall.

Fig. 17 is a perspective view illustrating concrete panel slabs in position embedded in footings and top girders after concrete has been poured and forms removed resulting in an interior partition wall.

Fig. 18 is a side elevation of a wall taken in the center of the wall after the concrete has been poured and more clearly shows the top concrete girder, bonding studs, pilasters and footing construction according to this invention.

Fig. 19 is a horizontal cross section of an exterior wall corner.

Fig. 20 is an enlarged horizontal cross section of an interior partition wall at the level of the reinforcing ribs.

Fig. 21 is an enlarged horizontal cross section view of an exterior wall showing insulation and concrete bonding studs.

Fig. 22 is a horizontal cross sectional view showing a partition wall joining an exterior wall.

Fig. 23 is a top view illustrating forms and methods of providing necessary variation take-up joints for an interior partition wall.

Fig. 24 is a top view similar to Fig. 23 but for the exterior walls.

Referring now more particularly to the drawings, in Figs. 1, 2, 3, 6, 7 and 8 there is illustrated precast concrete panel slabs 15 and 40. The surfaces 16 on both are smooth, or may be slightly roughened if desired for finishing with stucco or plaster for its better adherence. It should be stated here that panel slabs 15 and 40 in design and with respect to the molded detail on their rear or inner surfaces are the same. Panel slabs 15 are used on the interior side of an outer wall, and are also used back to back in interior partition walls.

Panel slabs 40 with the same molded detail are cast in a mold or form, the bottom of which, has been designed for the insertion of furring strips 41 and 42. These furring strips are laid in their respective positions in the form or mold. Reinforcing wire is provided on the surface of the furring strips 41 and 42 over which the concrete is poured, so that the furring strips adhere to the panel slabs after their casting has been completed. These furring strips 41 and 42 facilitate the fastening to themselves of insulation material 45, preferably by nailing. Obviously, in certain cases it may be more advantageous to cement the insulation directly to the ribs without furring strips, and in certain cases the insulation need not be presecured at all, and may be set in place between

the panel slabs as the wall is erected. After the insulation material has been attached the panel slabs **40** are ready for the exterior side of an exterior wall.

The top edges **21** of both types of panel slabs **15** and **40**, as shown in Fig. 6 are beveled upwardly from the front surface **16** toward the rear to form a dovetail joint to lock the tops of the panel slabs into the poured concrete top girder. The tops of the panel slabs **15** and **40** are also reduced in width providing notched corners **23** and **25**, the purpose for which will be explained later.

As stated previously, the front surfaces **16** of panel slabs **15** and **40** are generally smooth but may be roughened if desired to better adhere stucco or other finishes. The rear sides **17** however are provided with integrally formed cross ribs **28**, **29** and **30** which extend horizontally across the panel slabs at the top, center and bottom. The sides are provided with longitudinal ribs **27**. All of these ribs are spaced inwardly from the edges of the panel slabs providing a margin **19**. The outer edges of the lateral ribs **27** are formed in the shape of a V **24** (see Fig. 8) and the upper edge **22** of the top cross ribs **29** slope downwardly and inwardly toward the front surface **17** of the slab.

Near the base of and crossways of the panel slabs **15** and **40**, is a molded groove **33**. When the panels are set flush back to back for an interior partition wall, the grooves **33** together provide a hole for tie rods. The base of the panel slabs **15** and **40** are also reduced in width a shown at **32**.

In Fig. 4 there is illustrated the position in an outer wall of panel slabs **15** and **40** relative to footing forms. It also shows the top girder forms in position. The footing forms **50** comprise parallel retaining members **51** and **52** which may consist of planking, steel channels or the like, uniformly spaced apart by means for a separator tube or pipe **53**. The relative positions of the retaining members **51** and **52** are securely maintained by a tie rod **54** extending through the tube **53** and bores in the retaining members **51** and **52**, after nuts **55** on either side have been tightened. To facilitate the tightening of the members **51** and **52** if made of wood, suitable inner and outer washers are employed between the tubes or pipes **53** and the planking **51** and **52** and between the planking and the nuts **55**.

Paralleling and spaced from one of the retaining members **51** for example, an angle iron **57** is secured, preferably by welding, to the tubes or pipes **53**. Another angle iron **58** rests on the tubes or pipes **53** and parallels the angle iron **57** but is not secured, so that its position may be adjusted relative to the fixed angle iron **57**. This adjustment is accomplished by cross bolts **92** which extend through bores previously drilled in the angle irons and spaced to coincide with openings provided by the reduced bottom ends **32** of the panel slabs **15** and **40**.

The remaining members will be best described in the discussion of the procedure for erecting a section of a wall incorporating a number of panels slabs **15** and **40** in pairs, back to back, and said pairs arranged side by side, panel slabs **40** for the exterior of an outside wall and panel slabs **15** for the interior surface of the exterior wall.

Two panel slabs **15** and **40** are placed back to back between the channel like angle irons **57** and **58** and intermediate a pair of cross tie bolts **92** which, after the panel slabs have been plumbed true, are tightened to securely hold them between the angle irons. To these erected panel slabs another pair of panel slabs **15** and **40** are placed side by side, the square edges **20** of each abutting together. Their reduced bases **32** are positioned between the next pair of cross tie bolts **92** which are put in place and tightened.

At this time a tie rod **75** (see Fig. 11) threaded on either end, is placed centrally within the wall between panel slabs **15** and **40**. This tie rod is approximately ¾ of an inch shorter than the width of the panel slabs and is anchored to the next adjacent pair of panel slabs.

An anchor bar **73** in the form of a channel and provided with a centrally located bore is fitted over the free threaded end of the bar **75** in a relatively horizontal position within the reduced upper corners **23** of the panel slabs. This bar **73** is in length slightly less than the thickness of the wall and bears against the reduced portions **23** of the panel slabs after a sleeve nut **74** has been threaded onto the tie bar **75**. In this manner, adjacent pairs of panel slabs are drawn tightly together. This procedure continues in repeated sequence top and bottom until a wall between at least two pilasters has been erected. It should be noted that the anchor bars **76** along the bottom of the wall are positioned within and bear against the reduced portions of the panel slabs. These lower bars **76** may be in length greater than the thickness of the wall to better cross brace the walls by engaging the concrete of the poured footings.

It should be now noted that as soon as two pairs of panel slabs have been erected and mechanically secured together as described above, there is provided within the juncture a self contained mold or form into which may be poured a concrete bonding stud **60** (see Fig. 9 or 21). Such a stud properly reinforced, concrete lock-bonds the pairs of slabs vertically in place in the wall.

For erecting partition walls, the method already described for exterior walls is repeated, the only difference between an exterior wall and a partition wall being that a partition wall is made entirely of panel slabs **15**, no insulation material being required in between. The width of the footings, the wall itself, and the top girder therefore are slightly less than in exterior walls.

After all the walls, or a reasonable length of wall section, or a wall section between two pilasters has been erected as discussed above, a thin steel angle iron **72** or **81** (see Figs. 4 and 5) may be placed over the two sloping upper horizontal ribs **22** of the panel slabs **15** and **40** for an exterior wall, and the panel slabs **15** in a partition wall. This sheet metal angle or angle iron in length extends only between one bonding stud **60** and another in the exterior wall, and from one bonding stud **61** to another bonding stud **61** in a partition wall, thus permitting the poured concrete in the bonding studs and pilasters to form a monolithic bond with the concrete poured above the angles **72** and **81** to form a continuous concrete top girder. These angle irons or sheet steel angles act as a cover preventing water from the wet concrete from running down between the various panel slabs, and in the case of the exterior wall, this cover protects the insulation material from becoming water soaked. In certain instances, the angle steel cover may be omitted, particularly where no insulation is involved.

Continuous top wall girders **62** and **63** (see Figs. 16, 17 and 18) are formed in part utilizing a form structure similar to that described in connection with the footing forms **50**. As illustrated in Fig. 4, members **64** and **65** for exterior wall construction are drawn together against the face surfaces of the upper ends of panel slabs **15** and **40** and against a spacing ferrule or tube **68** by means of a tie rod **69** extending through holes bored in the form members **64** and **65** and the ferrules or tubes **68**. Suitable washers and nuts secure the forms in the same manner as described with reference to the setting up of the footing forms **50**. The spacing ferrules or tubes **68** rest on the top edges **25** and in the reduced upper corners **23** of the panel slabs **15** and **40**.

Steel reinforcing, not shown, is incorporated into the top girder to be poured according to accepted strength standards.

This procedure of supplying girder forms for the top of the exterior wall, is repeated in every detail with respect to forms for the top girder of the partition walls, the thickness of the partition wall girder being somewhat less.

After the top and bottom forms are thus in place and a final check is made to insure that the various panel

slabs are plumb, concrete is then poured in the footing forms, the forms provided by the juncture of pairs of panel slabs themselves, and the top girder forms. All the tie rods **75** and anchor bars **73** and **76** are thereby submerged and embedded in the concrete both top and bottom, adding additional reinforcing material thereto and assuring the lock-bonding of the precast members **15** and **40**, resulting in a continuous solid monolithic construction.

The height of the walls can be varied somewhat by the height of the top girder forms used.

Figs. 9 and 10 illustrate the difference in the horizontal cross section of exterior walls and interior partition walls. Fig. 9 also shows the air spaces **43**, provided by the molded shape of the inner or back sides of panels **15** and **40**. This air space extends from cross ribs **29** to the center rib **28**, down to the base **30**, thus adding greatly to the insulation value of the wall, because these air spaces **43** are on both sides of the insulation material **45** near the center of the wall.

In the slightly enlarged showing of Fig. 12 there is illustrated in addition to the central insulation material **45**, insulation material **46** between joints of panel slabs **15** and the concrete bonding stud **60**.

Fig. 16 in perspective illustrates the panel slabs in position after the footings and top girder have been poured and the forms removed, comprising a section of exterior wall construction. It shows with clarity the purpose of the angle iron **72** which covers the center joints between the two panel slabs, and forms the bottom of the top girder. It also shows the purpose for the top beveled or sloped ends **21** and **25** of the panel slabs to more securely bond top edges of panel slabs **15** and **40** with the top concrete girder, in a dovetail manner. It further illustrates the finished footings, and shows how thoroughly the bases of the panel slabs **15** and **40** have been embedded in the footings.

Fig. 17 illustrates the same general principle of concrete footing and top girders, in fact identical to Fig. 16 excepting that it illustrates a partition wall section.

Fig. 18 more clearly shows the reinformed concrete girder, pilaster, bonding studs and footing type of construction in connection with panel slabs.

Fig. 19 shows a corner pilaster, in relation to two exterior wall sections, and also illustrates corner plank forms to complete the corner mold or form, which when filled with concrete lock-bonds the two adjoining wall sections together.

Fig. 20 shows the proper positions of the partition wall panel slabs **15** back to back, with all four lateral edges butting together, providing the self contained form which when filled with concrete lock-bonds these panel slabs with a concrete bonding stud **16**.

Fig. 22 illustrates a part of two exterior wall sections, adjoining an interior partition wall. It also shows a steel plate **102** which, with two exterior wall sections and the interior partition section completes a mold or form for the making of an exterior wall partition pilaster when poured with concrete.

Figs. 23 and 24 illustrate a method for attending to any variation that may arise in the walls between two given points. This is taken care of by the placing of a steel form plate on either side of the wall and filling the resultant space with concrete **87** and **86**. It will be noted in these two Figures 23 and 24 that when the concrete has filled this mold or form, it too will lock-bond the adjoining ends of the panel slabs into a solid monolithic concrete construction.

It will be understood that applicant's invention resides in the novel combination and cooperation of various members together with their assembly and the method of bonding them in poured concrete, for the most part in forms furnished by the precast members themselves, and that certain modifications in the arrangements illustrated will be suggested to those skilled in the art. All

such modifications as come within its spirit are intended to be within its scope as best defined in the appended claims.

I claim:

1. A wall construction for buildings including a monolithic framework of concrete reinforced with steel, comprising precast members each in the form of elongate concrete panel slabs extending vertically the height of an entire story, each of said panel slabs having a face surface and an inner surface, the inner surfaces being provided with longitudinal and cross ribs, the longitudinal ribs at least being spaced inwardly from the lateral edges of the inner surfaces thereby defining inner surface marginal portions, said lower marginal portions being relieved, footing form cross supports, a retaining piece running transverse and fixed to said cross supports, a second retaining piece running parallel to the said fixed retaining piece and adjustably spaced from the fixed retaining piece, a plurality of pairs of said panel slabs each pair positioned with their ribbed inner surfaces facing one another, adjacent pairs arranged with their lateral sides in contact, the lower ends of said plurality of pairs of panel slabs extending between said retaining pieces, threaded rods and nuts extending between the retaining pieces through said lower relieved marginal portions for securing the lower ends of said plurality of pairs of panel slabs therebetween, means extending horizontally lengthwise of the wall for mechanically securing adjacent pairs of said panel slabs in abutting side by side relationship comprising anchor bars extending crosswise of the pairs of panel slabs and bearing against said relieved lower marginal portions thereof, and threaded tie rods and sleeve nuts extending horizontally lengthwise of the wall between said anchor bars for mechanically securing said pairs of panel slabs in abutting side by side relationship, the upper surfaces of the upper cross ribs of said panel slabs sloping downwardly toward the inner surfaces of the panel slabs providing an angular bottom for top girder forms, notches in the upper corners of said panel slabs, top girder form cross supports resting in the notches in the upper corners of the panel slabs for receiving top girder forms along the upper portion of the face sides of said panel slabs and extending above the top edges thereof, and poured concrete footings embedding the bases of all of said panel slabs at least to the height of said relieved lower marginal portions thereof, the footing form cross supports, retaining pieces, the anchor bars, tie rods and sleeve nuts poured concrete filling the vertical spaces between laterally abutting pairs of said panel slabs, said spaces being defined by said inner surface marginal portions and said longitudinal ribs, and poured concrete filling the spaces above the sloping surfaces of the top ribs of the panel slabs embedding the top girder cross supports forming at least in part a top girder further bonding together said precast panel slabs due to angular girder bottom formed by the sloping upper surfaces of the upper cross ribs of the panel slabs, all of said poured concrete lock bonding adjacent precast members together with all mechanical securing and retaining means into a unitary assembly.

2. A wall construction as claimed in claim 1, including insulation material disposed between the pairs of panel slabs and in which the top edges of the panel slabs are beveled downwardly and outwardly, and an angle shaped steel member conforming substantially to the angle of the bevels of the top surfaces of the upper ribs interposed between the top surfaces of said upper ribs and the poured concrete top girder, for adding further reinforcing steel within the top girder of the wall and for capping the insulation material interposed between the pairs of panel slabs, preventing the wet poured concrete of the top girder from damaging the insulation material prior to its setting.

3. A wall construction as claimed in claim 1, in which

the upper edges of said panel slabs are also beveled downwardly and outwardly toward said outer surfaces to form dovetailed joints with concrete poured thereover for a top girder and in which the lower ends of said panel slabs are reduced in width to the extent eliminating said inner marginal portions and adapted to be inserted at least to the extent of said portion of reduced width into the poured concrete footings.

4. A wall construction for buildings including a monolithic framework of concrete reinforced with steel, comprising precast members each in the form of elongate concrete panel slabs extending vertically the height of an entire story, each of said panel slabs having a face surface and an inner surface, the inner surfaces being provided with longitudinal and cross ribs, the longitudinal ribs at least being spaced inwardly from the lateral edges of the inner surfaces thereby defining inner surface marginal portions, said lower marginal portions being relieved, footing form cross supports, a retaining piece running transverse and fixed to said cross supports, a second retaining piece running parallel to the said fixed retaining piece and adjustably spaced from the fixed retaining piece, a plurality of pairs of said panel slabs each pair positioned with their ribbed inner surfaces facing one another, adjacent pairs arranged with their lateral sides in contact, the lower ends of said plurality of pairs of panel slabs extending between said retaining pieces, securing means comprising anchor bars extending crosswise of the pairs of panel slabs and bearing against relieved marginal portions thereof and tie rods extending horizontally lengthwise of the wall between the anchor bars and in a plane extending vertically between the said retaining pieces for mechanically securing said pairs of panel slabs in abutting side by side relationship, the upper surfaces of the upper cross ribs of said panel slabs sloping downwardly toward the inner surfaces of the panel slabs providing an angular bottom for top girder forms, said upper marginal portions being relieved in the form of notches in the upper corners of said panel slabs, top girder form cross supports resting in said notches in the upper corners of the panel slabs for receiving top girder forms along the upper portion of the face sides of said panel slabs and extending above the top edges thereof, and poured concrete footings embedding the bases of all of said panel slabs at least to the height of said relieved lower marginal portions thereof, the footing form cross supports and retaining pieces, poured concrete filling the vertical spaces between laterally abutting pairs of said panel slabs, said spaces being defined by said inner surface marginal portions and said longitudinal ribs, and poured concrete filling the spaces above the sloping surfaces of the top ribs of the panel slabs embedding the top girder form cross supports forming at least in part a top girder further bonding together said precast panel slabs due to angular girder bottom formed by the sloping upper surfaces of the upper cross ribs of the panel slabs, all of said poured concrete lock bonding adjacent precast members together with all mechanical securing and retaining means into a unitary assembly.

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