March 22, 1938. L. H. THOMAS 2,111,577

CONCRETE CONSTRUCTION

Filed Nov. 22, 1933 3 Sheets-Sheet 1

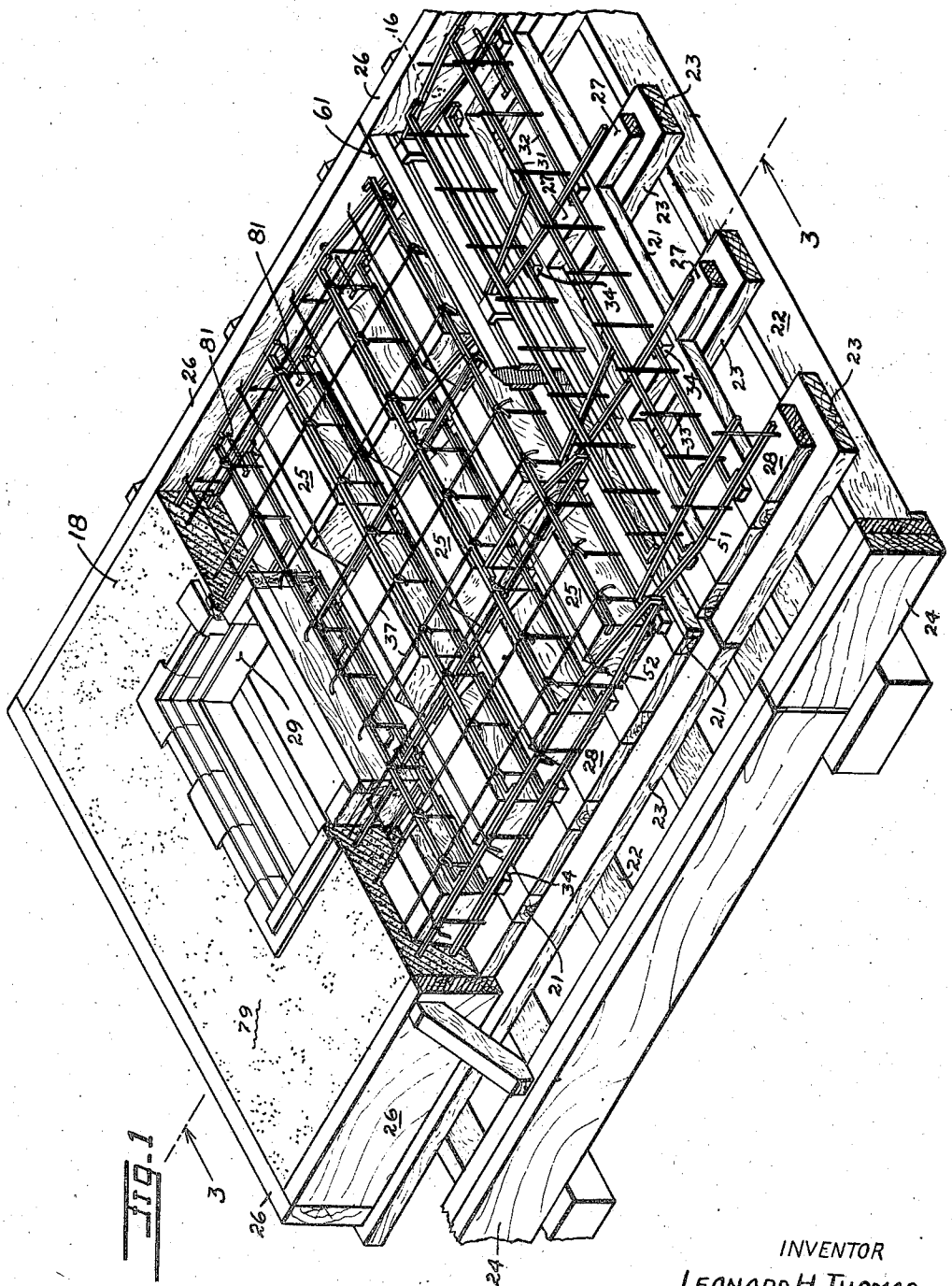


FIG. 1

INVENTOR
LEONARD H. THOMAS

BY Henry N. Young
ATTORNEY.

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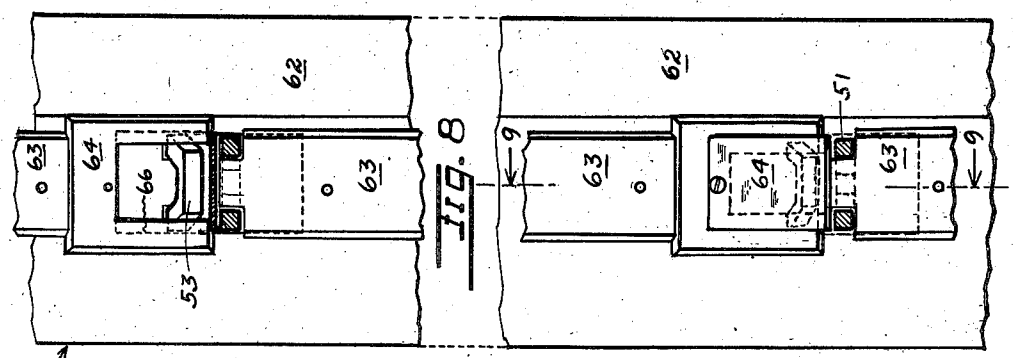


FIG. 8

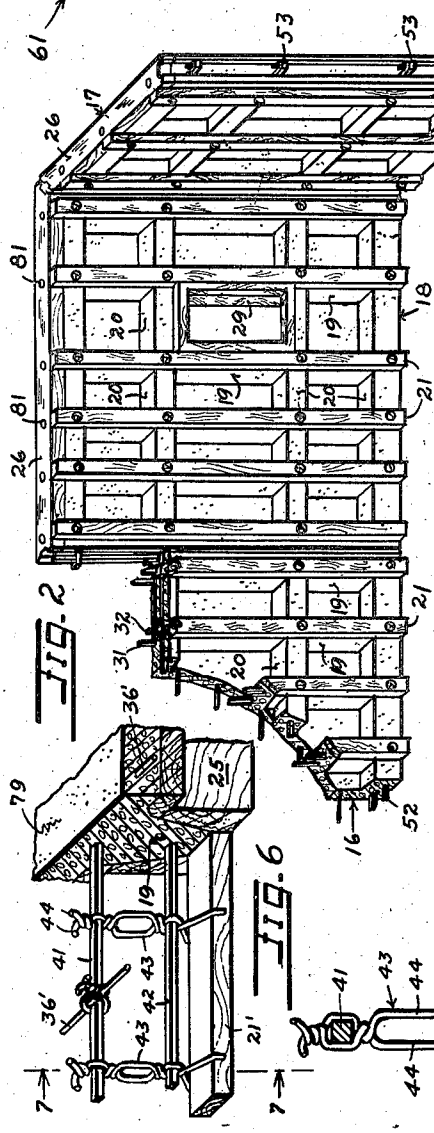


FIG. 2

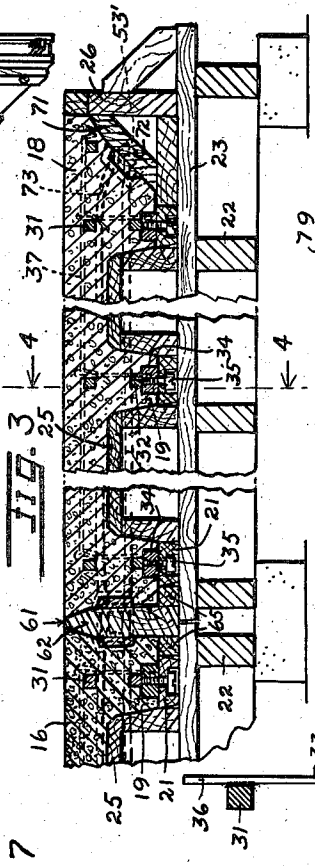


FIG. 3

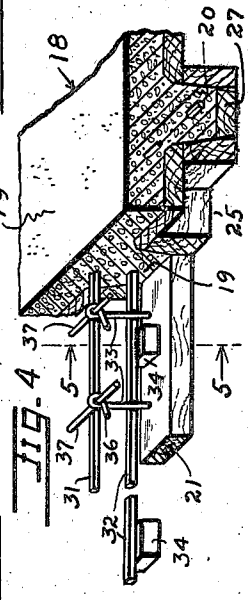


FIG. 4

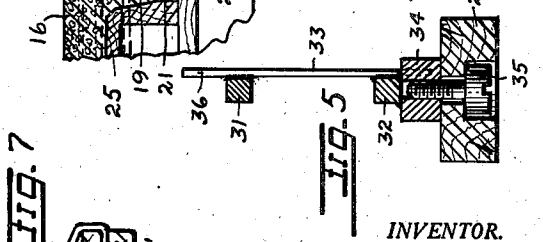


FIG. 5

FIG. 6

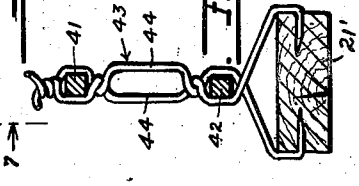


FIG. 7

INVENTOR.
LEONARD H. THOMAS
BY Henry N. Young
ATTORNEY.

March 22, 1938. L. H. THOMAS 2,111,577

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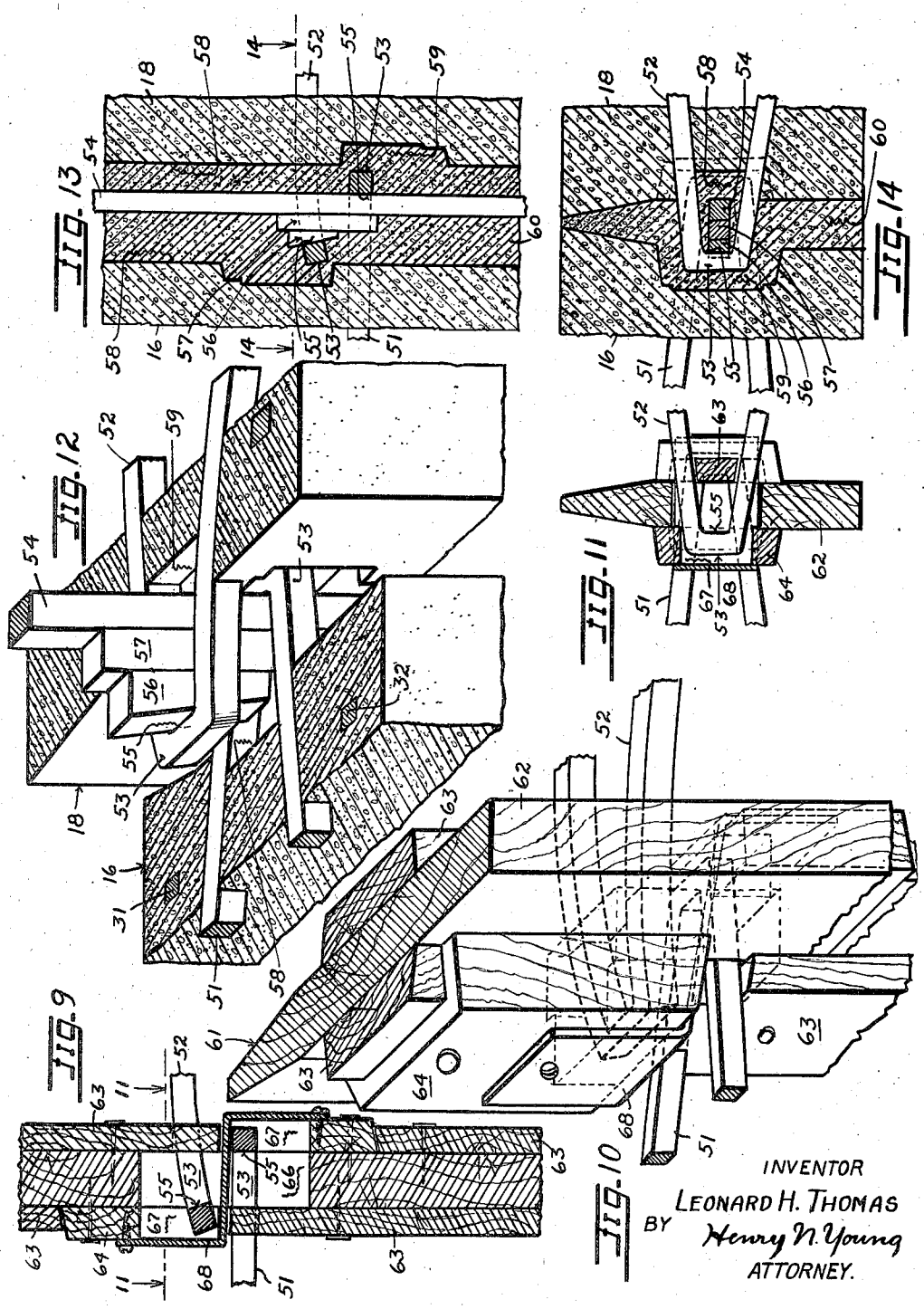


FIG. 13

FIG. 14

FIG. 12

FIG. 11

FIG. 9

FIG. 10

INVENTOR
LEONARD H. THOMAS
BY Henry N. Young
ATTORNEY.

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UNITED STATES PATENT OFFICE

2,111,577

CONCRETE CONSTRUCTION

Leonard H. Thomas, Oakland, Calif.

Application November 22, 1933, Serial No. 699,161

4 Claims. (Cl. 25—121)

The invention relates to precast wall slabs, and the associated assembly of such slabs in a unitary structure.

An object of the invention is the provision of a generally improved and particularly effective means for precasting concrete wall slabs in a prone position.

Another object is to provide for a casting of the slabs in the same relation which they are to have in their final assembly, whereby to insure their subsequent mutual fitting at their jointures.

A further object is to provide precast and cored wall slabs having one side finished in the mold and the other side provided with means to facilitate the fixing of a facing finish thereto.

Yet another object is to provide an improved reinforcing means for a slab, said means including the aforesaid means for use in fixing a facing to a slab side.

An added object is to provide a generally improved jointure at the abutting side edges of slabs in a structure formed therewith.

A still further object is to provide generally improved methods for accomplishing certain of the foregoing objects.

The invention possesses other objects and features of advantage, some of which, with the foregoing, will be set forth or be apparent in the following description of a typical embodiment of the invention, and in the accompanying drawings, in which,

Figure 1 is a fragmentary perspective view illustrating a mold for use in the casting of wall slabs in accordance with the present invention.

Figure 2 is a fragmentary perspective view showing an assembly of wall slabs embodying the invention.

Figure 3 is an enlarged fragmentary section taken generally at the line 3—3 in Figure 1, and through a finished slab on the casting deck.

Figure 4 is a fragmentary perspective view taken generally at 4—4 in Figure 3 and showing a reinforcing means of the slab.

Figure 5 is an enlarged section at 5—5 in Figure 4.

Figure 6 is a perspective view similar to Figure 4, and discloses a modification of the reinforcing means.

Figure 7 is a section at 7—7 in Figure 6.

Figure 8 is a fragmentary face view of a combination partition and core member of the mold.

Figure 9 is a section at 9—9 in Figure 8.

Figure 10 is a fragmentary perspective view of the assembly of core elements shown in Figure 8.

Figure 11 is a section at 11—11 in Figure 9.

Figure 12 is a perspective view of an interlocking means as operative between adjacent completed slabs.

Figure 13 is a vertical section through a completed jointure between adjacent slabs.

Figure 14 is a section at 14—14 in Figure 13.

As illustrated in the fragmentary view of Figure 2, the present invention concerns the production and assembly of intermediate wall slabs 16 and complementary corner wall slabs 17 and 18. The slabs are cast of concrete and are cored out from what may be conveniently termed their inner faces to define intersecting ribs 19 and 20 which provide the requisite transverse stiffness and effective thickness for the slabs while providing slabs of minimum weight. The ribs 19 provide the equivalent of studding in the slabs, the upper and lower ribs 20 comprise base and head plates for the slabs, and the intermediate ribs 20 provide a cross-bracing between the ribs 19 and carry elements for connecting adjacent slabs in an assembly thereof. Suitable reinforcement is provided within the ribs 19 and 20, and wooden furring strips 21 are shown as provided at and along the inner faces of the ribs 19.

For casting the slabs 16 and 17 and 18 as shown and described, an horizontal and elongated molding platform is provided, said platform particularly shown in Figures 1 and 3 as comprising joists 22 supporting deck boards 23 thereacross and carried by and between side beams 24. Permanent core members 25 are utilized in defining molds for the slabs; as particularly shown, the core members 25 are tray-like in structure and generally rectangular in outline, and are adapted for inverted application on and over the deck boards 23 with their open sides down. To facilitate its removal from a cast slab, each core member 25 is preferably formed with appropriately tapering outer sides whereby the ribs produced between opposed said sides of adjacent members in the mold are narrowest at their free edges and the core members are freely removable in a well understood manner.

For providing a mold on the deck of the platform, the furring strips 21 are disposed flat thereon and as spacers between core members 25 in a desired arrangement thereof whereby only the surface portions of the members above the strips thereat are exposed as bottom mold wall portions. Vertical side plates 26 are disposed on the mold deck and define the mold boundaries with their top edges defining a reference plane for the upper face of a casting in the mold. Form blocks

27 are engaged with and between adjacent members 25 and between the strips 21, and other blocks 28 are engaged between the side plates 26 and the sides of the members 25 nearest thereto whereby the upper faces of the strips 21 and the blocks 27 and 28, and the exposed side and top faces of the members 25 together, and solely, define the bottom of the mold space provided for the casting of a slab. The blocks 27 and 28 are preferably, though not necessarily, of the same thickness as the strips 21, and the latter may, on occasion, be referred to as mold members without reference to their possible use as furring strips.

It will be understood that the elements 21, 25, 27 and 28 which cooperatively define a mold bottom are each mutually engaged against the laterally adjacent said elements whereby a tight mold bottom is provided, it being noted that all of these elements are supported and held positioned on the molding floor provided by the deck boards 23 without being attached to said boards, and are therefore free for any necessary adjustment in an assembly thereof. In lieu of one or more members 25, a frame for a wall opening may be disposed on the casting deck for keyed fixing in the finished slab; in the present instance, a window frame 29 is shown as set into a slab 18 which has been cast in the mold space.

The strips 21 are secured to and mount reinforcement assemblies which are arranged for desired disposal in each line of spaces between adjacent rows of core members 25 in which a rib 19 of a slab is to be cast. As disclosed in detail in Figures 2 to 5 inclusive, the aforesaid reinforcement comprises spaced and mutually parallel bars 31 and 32 connected by spacing rods 33 secured thereto. Metallic blocks 34 are secured to each lower bar 32 at spaced points therealong, and means are provided to releasably secure the blocks 34 of a bar 32 to a strip 21. As shown, the blocks 34 comprise nuts threadedly receiving the shanks of screws 35 extending through and upwardly from the strip 21 in its center line. Preferably, and as shown, the bars 31 and 32 lie in a plane which includes the center line of the strip 21, and is perpendicular to the lower strip face. It will be noted that the blocks 34 are operative as a means for spacing the bar 32 from the mold strip which carries it.

Upper end portions 36 of the upright spacing rods 33 may extend above the bars 31 whereby these portions may be bent downwardly over and about reinforcing rods 37 laid across the bars 31 for a slab, it being noted that the plane defined by the bars 31 lies above the tops of the core members 25 and below the plane defined by the top edges of the side plates 26 whereby the bars 31 and rods 37 may lie within the outer wall portion of the cast slab. Preferably, and as indicated in Figures 4 and 5, the blocks 34 are welded to the bars 31 and 32, whereby to provide a unitary reinforcement assembly. The foregoing reinforcement assembly is designed to be plant manufactured in strips which may be cut to length whereby only the wooden strips 21 need be thereafter fixed thereto for preparing them for installation in the mold.

An alternative reinforcement assembly is illustrated in Figure 6 wherein bars 41 and 42 are held in mutually spaced relation by reason of their engagement in spaced eyes provided in spacer elements 43 which are formed by twisting a pair of wire strands 44 about the properly spaced bars. The lower end portions of the strands 44 are driven into opposite sides of a strip 21', and a cross-rod 36' of the reinforcement may be tied in place on a bar 41 by twisting a piece of wire about the members at their point of mutual crossing. It will be understood that the strip 21' and the rod 36' respectively correspond to the elements 21 and 36 of the previously described reinforcement assembly. The present type of reinforcement assembly may also be manufactured as a stock factory product for use in the disclosed manner.

Means are provided for directly securing adjacent wall slabs together in a structure formed therewith, a preferred jointure for mutually coplanar slabs being disclosed in detail in Figures 12 to 14 inclusive. As illustrated, the adjacent wall slabs 16 and 18 are slightly spaced in the assembly and tie bars 51 and 52 extend from the exposed edges of the respective slabs for interlocking in the space defined between the slab ends. The protruding ends of the bars 51 and 52 provide loops 53 which are vertically aligned for receiving a locking bar 54 transversely through the loops in a manner to thereafter prevent a separation of the slabs in their plane. Preferably, and as shown, the bars 51 and 52 are intermediately doubled to provide U-shaped loops at their bends to provide the eyes 53 and to have the remaining portions thereof embedded and anchored in the slabs at the ribs 20 thereof as a reinforcement for the ribs. The tie bars 51 and 52 and the locking bar 54 are advantageously of square section, as is shown.

It will now be noted that the bars 51 and 52 are arranged in generally aligned pairs whereby the eye loops 53 of a pair of bars are close together and mutually parallel. When the bar 54 is engaged against the inside end face 55 of one eye loop, it is arranged to be spaced from the inside end face 55 of the other eye loop of the pair, and wedge means are provided for coaction between the latter end face and the bar 54 to forcibly engage the bar with the end face of the first loop and so secure the loops against a separation thereof and of the slabs which carry them. As particularly shown, the aforesaid wedge means comprises a wedge 56 for engagement against the loop face 55 not engaged by the bar 54, and a block 57 engaged between the wedge and bar.

With the slabs 16 and 18 erected in desired spaced relation, the bar 54 is disposed through the line of eyes 53, after which the blocks 57 and wedges 56 are applied for fixing the slabs together along their mutually abutting edges. Preferably, and as shown, each loop 53 which is to be directly engaged by a wedge 56 is slightly curved toward the companion loop of a loop pair whereby the flat outer wedge face may engage flat against the opposed loop face 55. The bar 54 is large enough to be relatively stiff against flexure whereby to minimize the effect of the mutually offset coaction of each pair of loops 53 therewith.

It will now be noted that the slab edges at the loops 53 are formed to provide grooves 58 along their lengths, and that each said groove is deepened at portions 59 thereof opposite the outer ends of the loops 53 which extend theretoward from the opposed slab edge whereby to freely receive said loop ends in said groove portions. The opposed slab ends are otherwise, and correspondingly, so shaped that they are but slightly spaced adjacent the outer slab faces, and are so spaced at and inwardly of the loops 53 as to permit an op-

erative disposal of the wedges 56 from the inner side of the slab assembly.

When adjacent slabs are mutually interlocked along their opposed edges by the described means, the outer and narrow portion of the space between the slab ends is filled with concrete to a flush relation with the outer slab faces whereby to conceal the jointure at the latter. Subsequently, a form board (not shown) is placed at the inner side of said space and the remainder of the space is filled with self-setting concrete whereby a filling and sealing mass 60 is provided between the slab ends and between the wall faces. It is noted that the mass 60, through its extension into the grooves 58, keys the slabs against a relative transverse displacement, while the protrusion of said mass into the deeper groove portions 59 keys the slabs against a relative vertical shifting. The aforesaid keying functions of the filling mass 60 are understood to be important in supplementing and making rigid the described metallic interlock of the slabs.

In order to insure uniformity of jointure and external finish for abutting slabs in an erected straight course or line thereof, the slabs are preferably cast in the same order and relation which they are to have when they are associated as parts of a continuous structure. Accordingly, the casting deck or floor is elongated laterally of the slabs to be cast thereon whereby a succession of slabs may be produced in the order in which they are to be finally assembled. By reference to the fragmentary showing of Figure 1, it will be noted that adjacent molds are provided in which to cast a slab 18 and a slab 16 in the same edge-to-edge relation and approximate spacing which the slabs are to have when they are erected, said molds defined at their opposed ends by the opposite faces of a core member 61 which partitions the mold box within the side plates 24 which define opposite and mutually parallel edges of the molding space.

The core member 61 is seen to be shaped as the space which is to be occupied by a filler mass 60 when the wall is completed in place, and extends from the deck plane to the plane defined at the top edges of the plates 24. As particularly brought out in Figures 3, 8, 9 and 10, the member 61 essentially comprises a central plate element 62 extending for the full core width and having plates 63 and 64 fixed to and extending generally centrally along the plate 62 at opposite sides thereof and in alternate arrangement on each side, the plates 63 and 64 being approximately one third as wide as the plate 62 between them. When the member 61 is installed on the mold deck, the lower edge of the element 62 is engaged between the spacer strips 65 which in turn laterally engage strips 21 carrying the described assemblies of rib reinforcement; in this manner, the slabs cast in molds at opposite sides of a core or partition 61 are produced in the relative relation which they are to have when erected in a structure. At that side of the plates 63 and 64 which is toward the upper mold face, the plate 62 is tapered to a relatively narrow edge to provide the previously described narrow portion of the space between opposed slab ends.

In order that the core member 61 may receive the tie bar loops 53 within the space thereof, the central core element 62 is provided with interior slots 66 for receiving the pairs of loops 53 therein and therethrough. As particularly brought out in Figures 8 to 11 inclusive, the plates 64 are generally U-shaped and are fixed and disposed on the element 62 to receive the extremities of the loops within their openings 67. The plates 64 at the cooperating pair of loops 53 are disposed at opposite sides of the element 62 and are oppositely directed with their open ends each receiving a loop 53.

A somewhat Z-shaped metallic strip 68 is disposed with its central portion between the loops of a pair, and its end portions are fixed to the different plates 64 thereat for closing the outer sides of the openings 67, it being noted that the plates 64 extend to the central strip portion and that the width of the strip is that of the slot 66 and opening 67 through which it transversely extends. The plates 63 extend between successive plates 64 at each side of the element 62 and are notched out at their appropriate extremities for extension through the loop thereat. Preferably, and as shown, the plates 64 are somewhat thicker than the plates 63 transversely of the element 62 whereby the former plates are operative as a core means to define the enlarged portions 59 of the slab grooves 58, while the plates 63 define the remaining portions of said grooves.

It will be understood that the described core assembly 61 is designed to completely enclose the pairs of loops of the tiebars therein whereby the loops may extend from the cast slabs when the core assembly is removed. The assembly of the element 62, plates 64 and metal strip 68 may be permanent, and when such assembly is placed in the described position on the casting deck, the tie bars 51 and 52 may be placed in the mold with their loops extending into the core space therefor. When the tie bars have been placed, the plates 63 may be applied in their operative positions, this application of the plates 63 positioning and securing the loops as required. When the slabs have been cast in adjacency in the completed molds, they may be separated in their plane to free the partition core 61, it being noted that the plates 63 will simultaneously be pulled from their engagement with the element 62 with the slabs and for subsequent removal from the slabs.

Since the slab 18 is a corner wall slab and is arranged for connection with a slab 17 for providing a corner at their mutual jointure, the corner-defining edge of this slab is appropriately bevelled for coaction with a complementary bevelled edge of the slab 17. As shown in Figures 2 and 3, the said edge is arranged to make a forty-five degree angle with the plane of the slab and is otherwise formed generally as the other end face of the slab. For defining said bevelled face of the slab 18, a mold member 71 is provided at the mold end, said member comprising a plate element 72 set at an appropriate angle to the mold bottom and carrying on its inner face plate elements which correspond to the elements 63 and 64 of the core member 61. Bars 73 which provide loops 53' for use in interlocking corner slabs are so bent at said loops that the outer loop ends are parallel to the plane of the element 72, the arrangement permitting the use of a locking bar 54 and wedges 56 as at the other jointures.

Having the molds completed through the appropriate placement of the described mold and reinforcement and tying bars, the molds are filled to the level of the tops of the side plates 26 with a suitable self-setting concrete in a plastic state. Preferably, and as particularly indicated, the exposed slab faces 19 would be finished as a final surface for the slab thereat, this being made possible by reason of the horizontal position of such face of the mold and the top edges of the plates

26 providing a screeding plane for use in applying a finish to the faces 19. With slabs so completed, their finished faces 19 may provide the outer facing of a building thereof without further labor. The various slabs in the described mold would preferably have their upper faces finished together and with the same batch of grouting or other finish whereby the faces thereof may have a like appearance in the final structure. In the present instance, the mold plates 26 at the top of a cast wall slab are arranged to remain on the slab, being secured thereto by means of anchor rods 31 fixed therein and embedded in the slab.

When the present slabs are erected in place, the strips 21 may be used as a furring backing for a suitable surface finish applied thereto, or may be removed by unscrewing the screws 35. If the strips 21 are removed, the screws 35, or other screws, may be used to fasten other elements to the embedded and fixedly secured blocks 34 of the reinforcement assembly for each rib 19.

It will be understood that the described precasting of slabs in an horizontal position and in a mold such as that now described facilitates the placement of the plastic concrete in the mold, the production of uniform concrete structures, and the production of slabs with one finished face; all with the use of a minimized amount of form material and labor. Furthermore, the various features of the disclosed interlock and keying of adjacent slabs in a structure is generally applicable to horizontally disposed slabs as well as to the upright wall slabs particularly shown.

From the foregoing description, taken in connection with the accompanying drawings, the advantages of the construction and the means for producing the same will be readily understood by those skilled in the art to which the invention appertains, and while I have described the principle of operation, together with the devices which I now consider to be preferred embodiments thereof, I desire to have it understood that the devices shown and described are merely illustrative, and that such changes may be made, when desired, as fall within the scope of the appended claims.

Having thus described my invention, I claim as new and desire to secure by Letters Patent of the United States the following:

1. In combination with a mold comprising form boards defining a mold space for the casting of a concrete body, a pre-assembled metallic reinforcement disposed intermediately in the mold space to extend along a said form board and including a bar, metallic spacing members fixed to and along said bar in integral relation thereto and engaged against the said form board, and means securing the members to the said form board.

2. In combination with a mold for casting a concrete slab to have a cored face and including free core members disposed on a supporting surface for defining ribs of said slab face between them and free form boards disposed on said surface in lateral engagement with said core members whereby the core members are mutually spaced and the upper faces of said boards and the face portions of the core members above the level of said upper board faces solely define the cored face of a slab cast in said mold, a planar metallic reinforcement assembly disposed in a rib-defining portion of the mold space for embedment in a rib of the slab, spacer blocks integrally fixed to the lower edge of said reinforcement assembly, and means coactive between the blocks and a said form board releasably securing the board in fixed relation to the reinforcement.

3. In combination with means defining a mold space divided to provide portions thereof for the production of a plurality of separate slabs in the space and in the order of their erection, said means including a form element fully partitioning said space at the line of abutment of adjacent mold portions and operative as a core member to provide longitudinally grooved slab edges thereat whereby the grooves of the adjacent slab edges are cooperative to provide an open keying space between the slabs when the completed slabs are reassociated in the relation of their casting, means providing a cavity in said element, and mutually free metallic tying members extending from the slab spaces into said cavity from both sides thereof for a fixing together of their free ends in the aforesaid space between the slab edges when the completed slabs are reassociated.

4. In a mold providing a mold space divided to provide portions thereof for the production therein of separate slabs in the space and in the order of their erection, a form element fully partitioning said space at the line of abutment of adjacent mold portions and operative as a core member to provide recessed slab edges thereat whereby the recesses of the adjacent slab edges provide keying spaces between the slab ends when the completed slabs are reassociated in the relationship of their casting, means providing a cavity in said element, and mutually free metallic tying members extending from adjacent slab spaces into said cavity for a fixing together of their free ends in a keying space between the slab edges when the completed slabs are reassociated.

LEONARD H. THOMAS.