

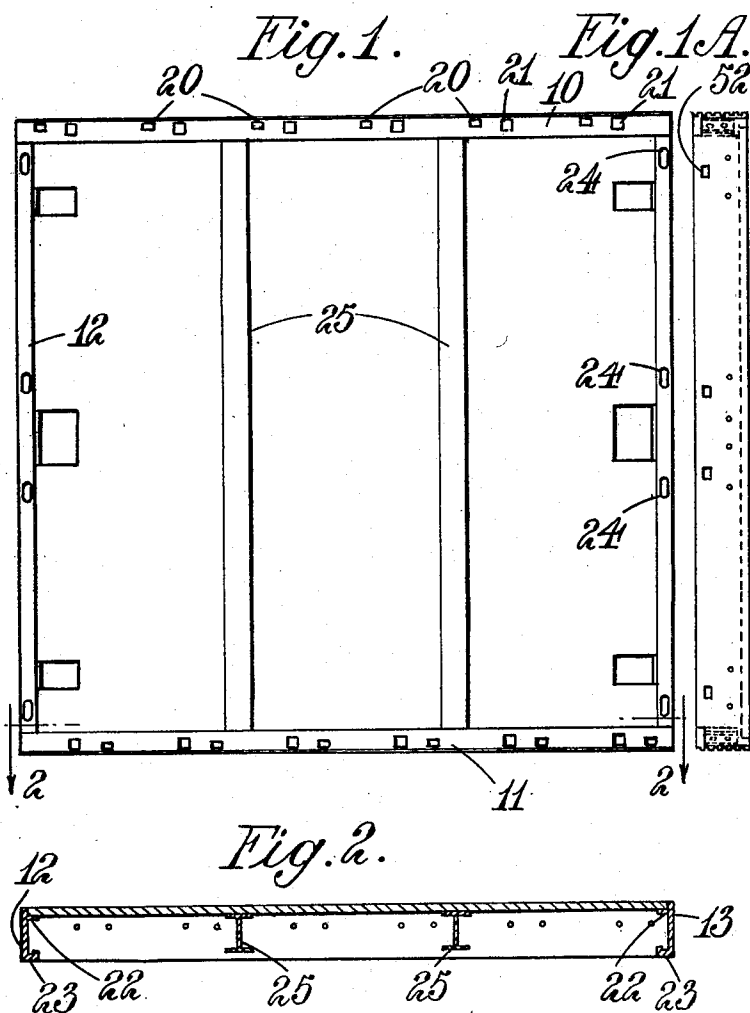
Sept. 12, 1950

W. HAMILTON
FORMWORK OR SHUTTERING FOR CONCRETE
AND LIKE STRUCTURES

2,522,360

Filed Sept. 4, 1946

8 Sheets-Sheet 1



INVENTOR
William Hamilton

By Watson, Cole, Grindle & Watson

Sept. 12, 1950

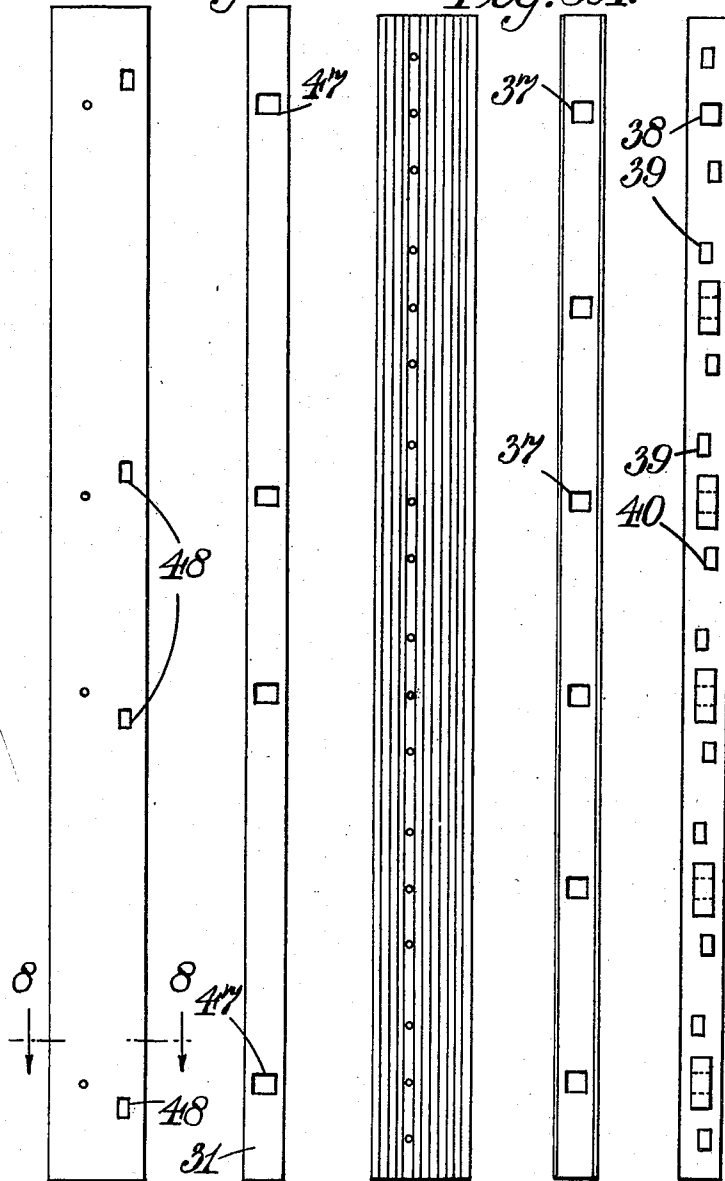
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Fig. 7. Fig. 6. Fig. 3. Fig. 3A. Fig. 3B.



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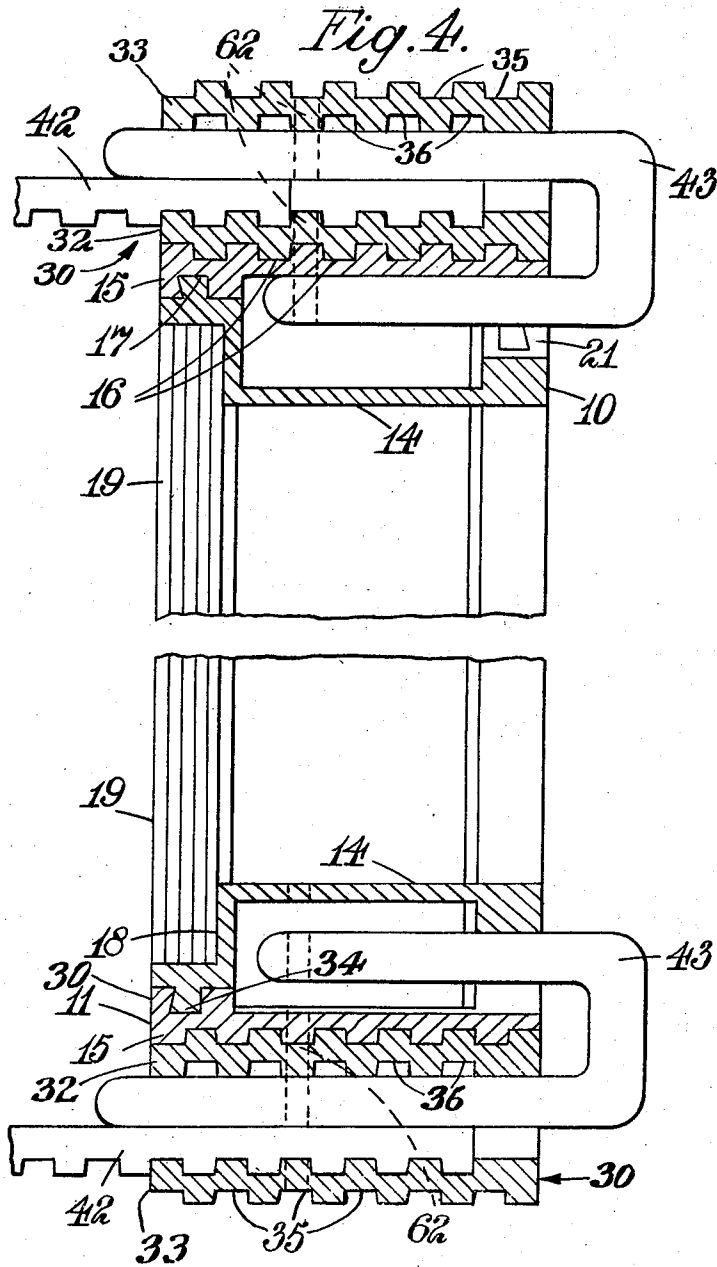
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8 Sheets-Sheet 3



INVENTOR
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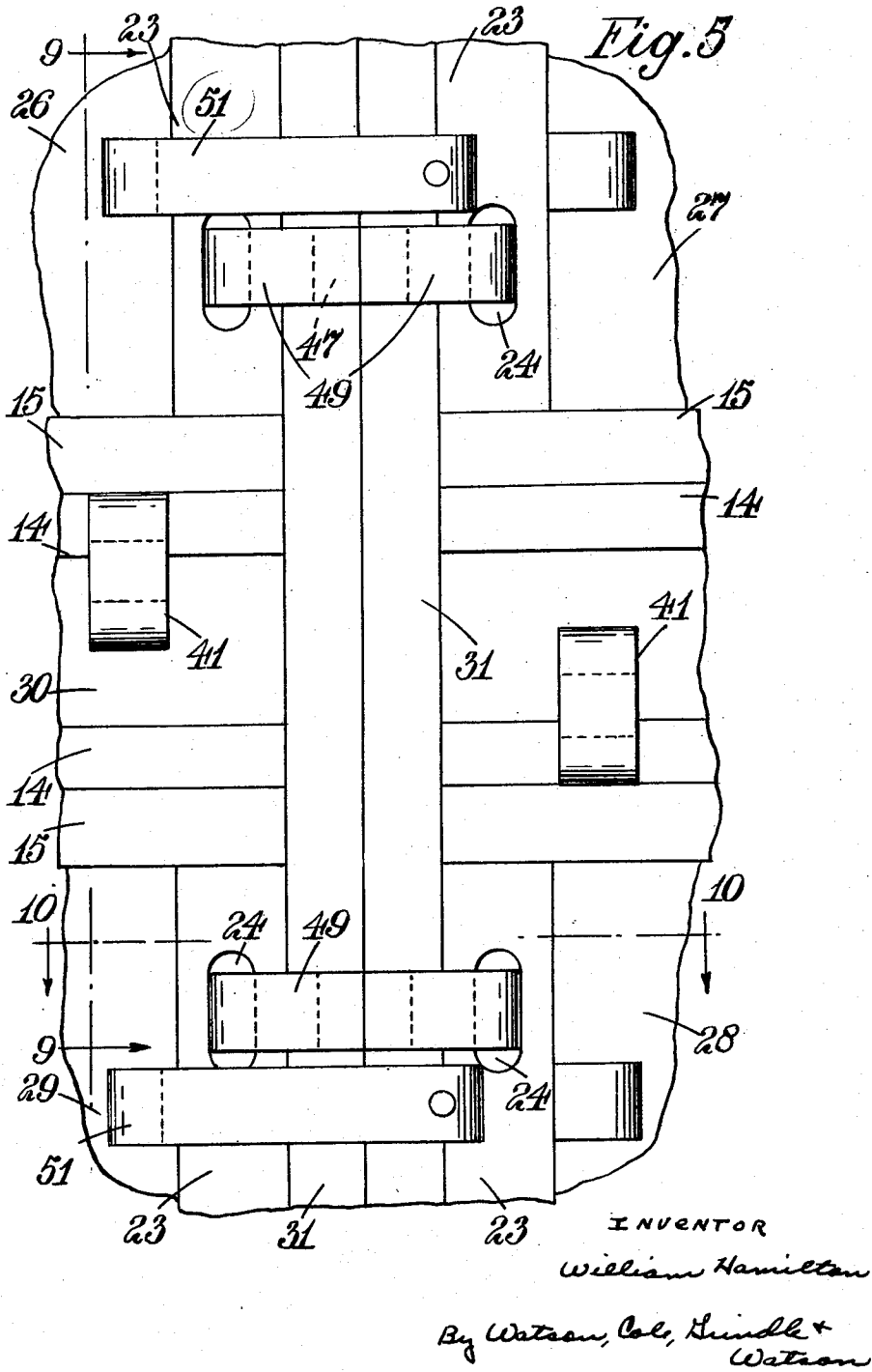
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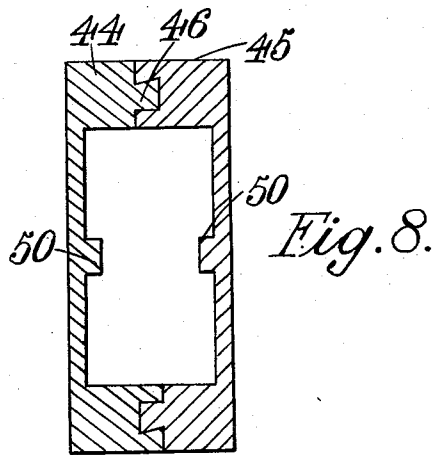


Fig. 8.

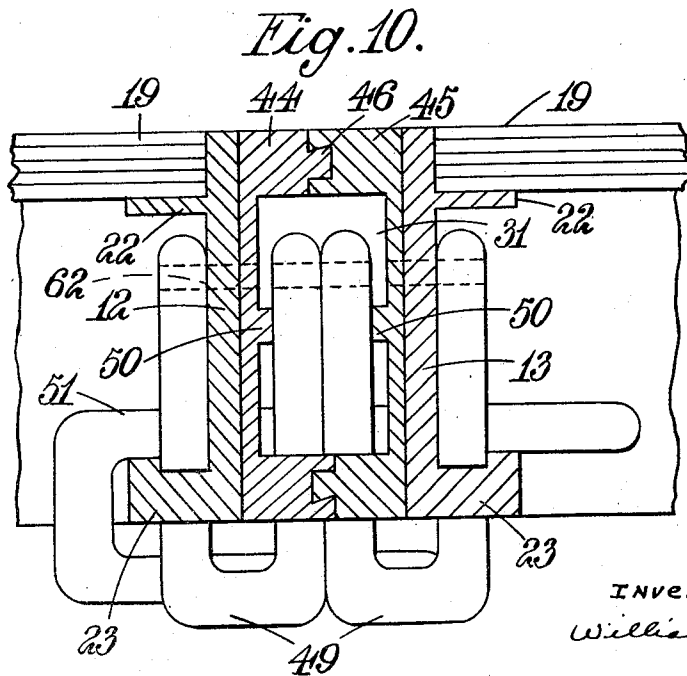


Fig. 10.

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Sept. 12, 1950

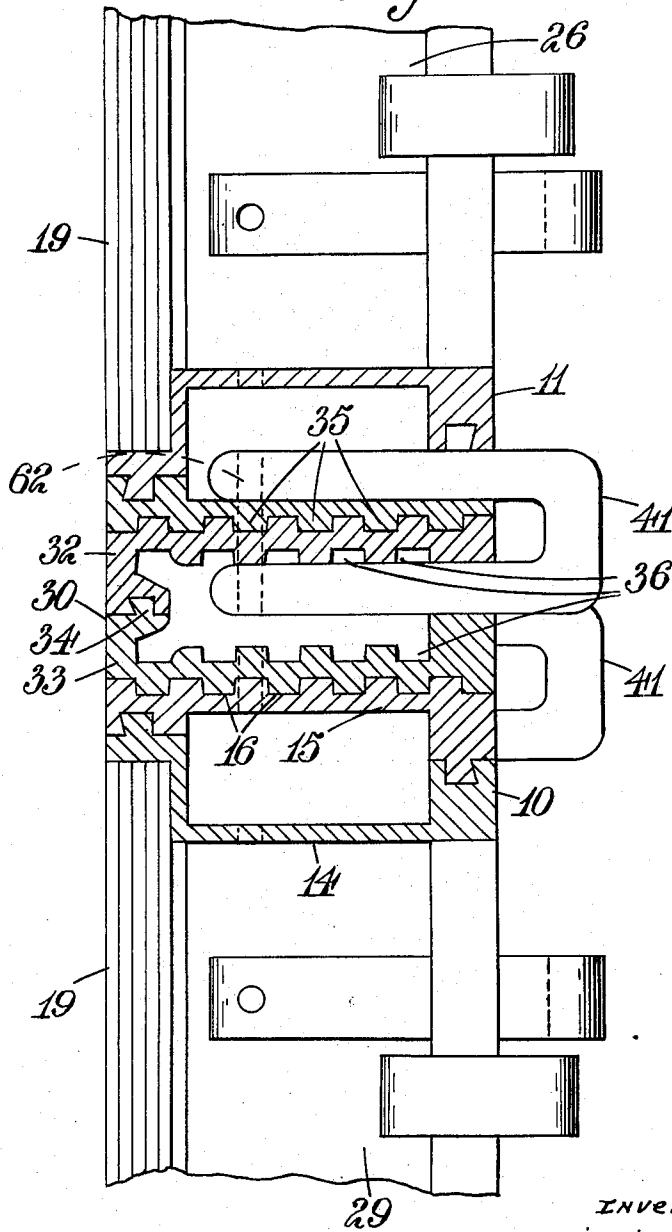
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Fig. 9.



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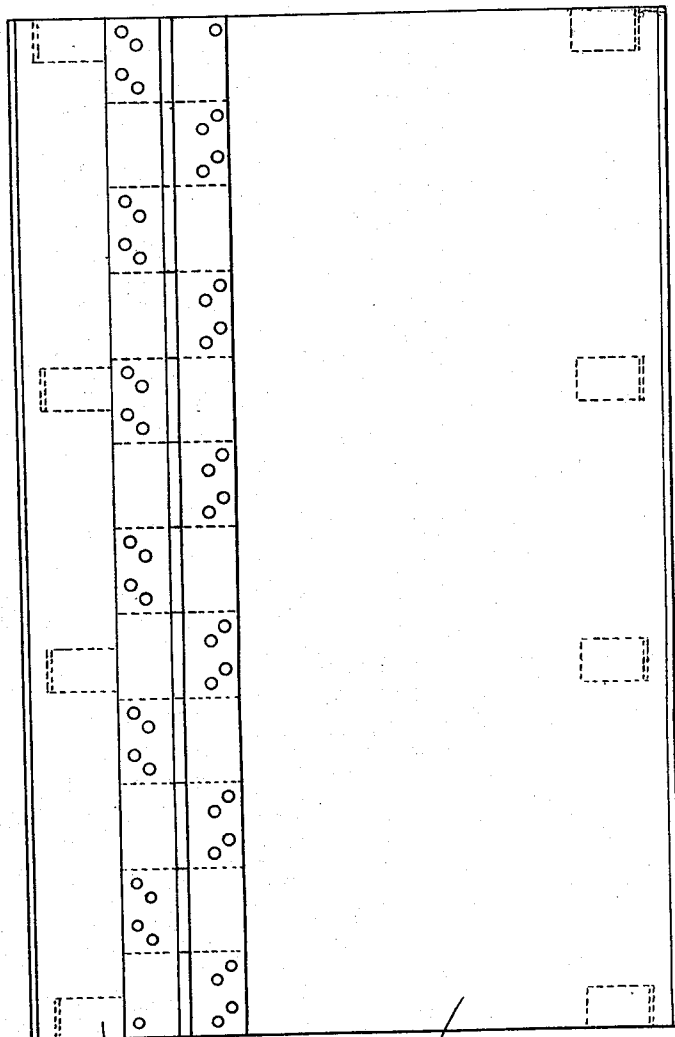
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Fig. 11

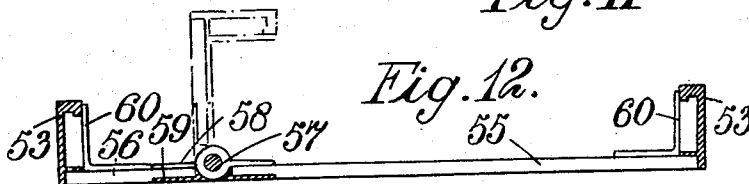


Fig. 12.

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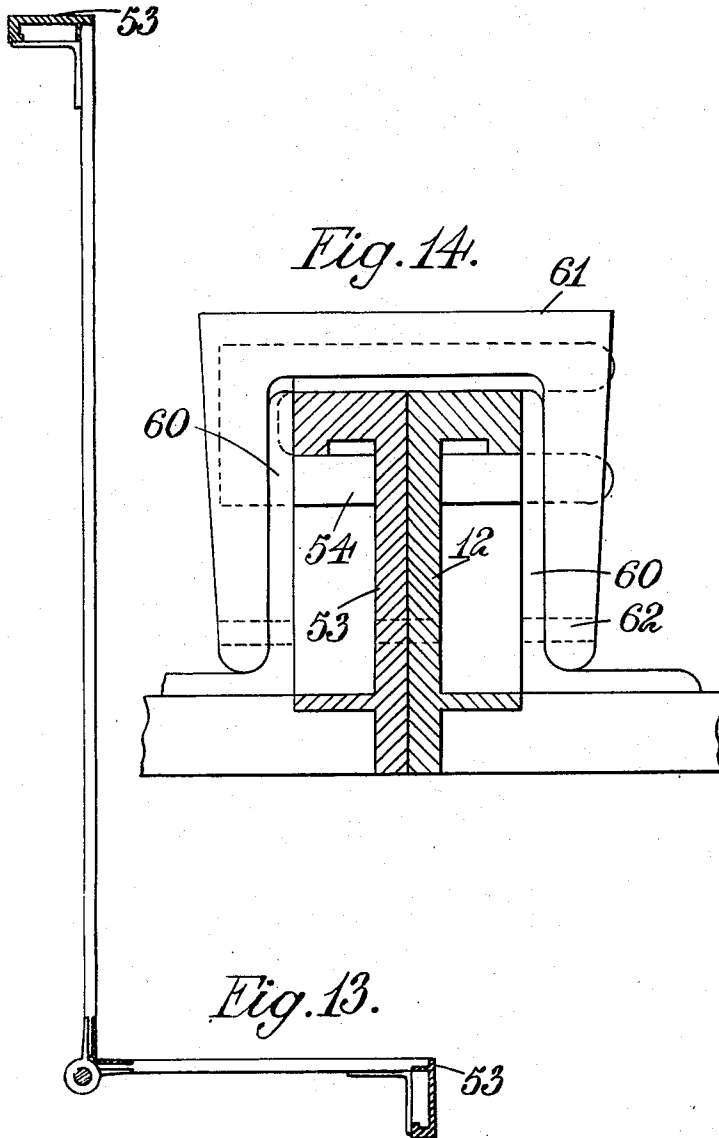
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INVENTOR

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Patented Sept. 12, 1950

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UNITED STATES PATENT OFFICE

2,522,360

FORMWORK OR SHUTTERING FOR CONCRETE AND LIKE STRUCTURES

William Hamilton, Frimley Green, England

Application September 4, 1946, Serial No. 694,764
In Great Britain June 11, 1945

Section 1, Public Law 690, August 8, 1946
Patent expires June 11, 1965

19 Claims. (Cl. 25—131)

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This invention relates to formwork or shuttering such as is used for casting in situ concrete and like structures and has for its object to provide an improved construction whereby any desired structure can be provided by the assem-

blage of an appropriate number of standardised elements which are arranged to provide an accurately dimensioned formwork which is simple and whereof the erection and dismantling can be effected with the greatest facility.
According to this invention, formwork for casting concrete comprises a number of panels arranged in the same plane as one another with intervening locating liners between at least the adjacent horizontal edges thereof, all liners being rectangular in cross-section and are so dimensioned that two opposite faces thereof lie respectively in line with the inner and outer faces of the panels, and the other faces of at least one set of liners extending parallel with one another being provided with multiple tongues and grooves extending along the length thereof and engaging complementary tongues and grooves formed in the edge faces of the panels.

The said intervening liners with multiple tongues and grooves are arranged between horizontal edges of superposed panels and liners having flat opposite faces may be arranged between flat vertical edges of the panels arranged side-by-side.

Clamping means are arranged to engage said liners and panels to maintain them in engagement.

For casting a wall or like structure, two sets of panels may be provided each arranged in a manner as set out above, and tie-rods are arranged adjustably to engage said sets of panels and/or said intervening liners so as to space them apart in parallel relationship according to the thickness of the wall required.

The aforesaid clamping means may comprise U-shaped clips the limbs of which respectively engage holes in the panels and in the intervening liners.

The abutting faces between the vertical edges of said panels and liners may be flat and additional clamping means are provided for preventing relative backward and forward movement between them.

The aforesaid tie-rods may be arranged to engage the horizontally disposed liners. The ends of the tie-rods may be provided with spaced projections along one side thereof which engage similarly spaced projections on the horizontal liners.

The horizontal liners may be provided with holes each large enough to accommodate both an end of a tie-bar and one limb of a U-shaped clip, which clips thus serve the dual purpose of holding a horizontal frame member to a liner and of hold-

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ing the notched end of the tie-bar in engagement with the liner.

The aforesaid liners may be formed in two interlocking parts shaped to provide a hollow structure.

In one form of construction for the horizontal liners, they are provided with longitudinally extending grooves on the outer faces of two opposite walls and with similar grooves on the inner face of at least one of said walls, which grooves are in staggered relationship with those on the outer face. With this arrangement, the grooves on the inner face serve as the means for anchoring the notched ends of the tie-rods.

In any of the arrangements referred to above, the aforesaid panels may comprise a frame formed from metal members secured together at right angles and recessed on one side to receive a sheet such as plywood which lies flush with said edges.

The frame members which are to be disposed horizontally may be provided with longitudinally extending grooves on their outwardly directed faces and with apertures on their side faces for receiving said clips.

Other features of the invention are set out in the following description and claims.

The following is a description of one form of shuttering according to this invention, suitable for casting a concrete wall, reference being made to the accompanying drawings, in which:

Figure 1 is a rear view of one of the panels,
Figure 1A is an end elevation looking from the right of Figure 1,

Figure 2 is a section on the line 2—2 of Figure 1,

Figure 3 is a plan view on a larger scale of a horizontal liner for locating two panels one above the other,

Figure 3A is a front elevation of the horizontal liner drawn vertically for convenience,

Figure 3B is a rear elevation of the horizontal liner also drawn vertically for convenience,

Figure 4 is a vertical section to a still larger scale through a panel and a horizontal liner,

Figure 5 is a face view on a slightly smaller scale than that of Figure 4 of the junction between four panels showing both the horizontal and vertical liners,

Figure 6 is a front view on the scale of Figure 3 of one of the vertical liners,

Figure 7 is a side elevation of the liner of Figure 6,

Figure 8 is a horizontal section to the scale of Figure 4 through the vertical liner,

Figure 9 is a vertical section on the line 9—9 of Figure 5,

Figure 10 is a horizontal section on the line 10—10 of Figure 5,

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Figure 11 is a face view of a hinged panel for one wall of the shuttering,

Figure 12 is a horizontal section through the hinged panel,

Figure 13 is a plan view of a correspondingly hinged panel for the outer wall of the shuttering, and

Figure 14 is a horizontal section between abutting side frame members of a hinged panel and rigid panel.

As will be seen from Figure 1, each panel comprises a rectangular metal frame having similar top and bottom horizontal frame members 10 and 11, and similar upright side members 12 and 13.

As will be seen from Figures 4 and 9, each of the top and bottom frame members is made up of two parts 14 and 15 which interlock to form a hollow box-like structure. The outwardly-directed face of each of the parts 15 is provided with a number of grooves 16 extending along the length thereof. The two parts of each horizontal frame member are secured together by undercut tongues and grooves 17. Each of the parts 14 is shaped to provide a recess 18 for accommodating the edges of a flat wall 19, which may be formed from plywood, and serves to retain the concrete. The rear face of each box-like horizontal member is provided with a set of rectangular openings 20 and a set of square openings 21. The shape of the upright side frame members 12 and 13 is best shown in Figure 10, and each comprises a web portion having a flat outer face extending transversely to the plane of the panel, and each having a flange 22 inset from the front end of the web to a corresponding extent to the recess 18 referred to above, so as to accommodate the flat retaining wall 19. The other extremity of each web portion is provided with a flange 23 having another set of apertures 24 along the length thereof for the purpose hereinafter described. I-section strengthening members 25 are disposed vertically between the horizontal members 10 and 11 against the back of and serve to support the retaining wall 19.

Figure 5 shows this latter arrangement at the junction between four such panels 26, 27, 28, 29. It will be seen that the panels 29 and 26 are located one above the other by a horizontal liner member 30, while a similar liner member 30 locates the panel 27 above the panel 28. The two panels 26 and 27 are located side by side in the same vertical plane, as are also the panels 29 and 28, by a two-part vertical liner 31 which extends across the ends of all four panels, in the manner hereinafter referred to with reference to Figure 10.

As will be seen from Figures 4 and 9, each horizontal liner member 30 is made up from two parts 32 and 33 which together form a box-like structure. The two parts are held together by undercut tongue-and-slot connections 34 and the outer faces are provided with tongues and grooves 35 which interengage those of the horizontal frame members 10 and 11. The inner faces of the parts 32 and 33 are provided with similar tongues and grooves 36.

As will be seen from Figures 3A and 3B, the front and back walls of the box-like liner member 30 are provided with corresponding square-shaped apertures 37 and 38, while in addition, the back wall is provided with two sets of rectangular apertures 39 and 40, the former being arranged nearer the top edge of the liner mem-

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ber, whereas the latter are arranged nearer the bottom edge.

Referring to Figure 9, it will be noted that the panels 26 and 29 are secured on either side of the horizontal liner member 30 by U-shaped clips 41, the limbs of each of which clips engage respectively one of the apertures 20 in a horizontal frame member and one of the rectangular apertures 39 or 40 in the horizontal liner.

As is known, shuttering for casting a wall comprises back and front panels which are spaced apart at a required distance according to the thickness of the wall. This spacing apart of the front and rear panels is effected by tie-rods 42 such as are shown in Figure 4, which extend through the square aperture 37 in the front wall of each box-like horizontal liner-member 30, which tie-rod is provided with tongues and grooves for engaging the tongues and grooves on the inner face of the bottom walls of the liner member 30. The tie-bars thus partly fill the cross-section of the square holes 37, leaving space for the insertion of one limb of another U-shaped clip 43, the other limb of which engages one of the rectangular apertures 20 in a horizontal frame member 10 or 11. The U-shaped clip 43 thus fulfills the dual function of maintaining the tie-bar in position and assisting in clamping the panels to the horizontal liner-member 30. The notching of the tie-rods permits varying thicknesses of walls to be cast by spacing the shuttering the required distance apart. It will be appreciated that the bars instead of engaging holes in the liner members 30 might extend through the horizontal frame member 10 or 11 therein by clips as set out above.

As will be seen from Figure 10, the vertical liner 31 is also formed in two parts 44 and 45 which are interconnected by undercut tongue-and-slot joints 46 to form a rectangular section box-like structure the outside faces of which are flat and are arranged to abut the flat side faces of the web portions of the upright side frame members 12 and 13.

As will be seen from Figure 6, the vertical liner is provided on its rear wall with a number of square configuration apertures 47, while its side wall is provided with a number of rectangular apertures 48, as seen in Figure 7. The panels are clamped on either side of the vertical liner 31 by means of U-shaped clips 49, one limb of each of which engages one of the apertures 24 in the flange 23 of the side frame member 12 or 13 and the other limb of each of which engages a square hole 47 in the vertical liner 31.

As will be seen from Figure 10, those limbs of the U-shaped clips 49 which extend into the interior of a vertical liner abut against a rib 50 formed on the inner wall thereof. Since the abutting faces of the members 12 and 44 and of the members 13 and 45 are flat means are required for so locating them that the retaining walls 19 of two adjacent side by side panels are in the same vertical plane. This means comprises a further number of U-shaped clips 51 which are arranged each to have one limb extending through a rectangular opening 52 in a side frame member 12 or 13 and through a similar rectangular opening 48 in the side of the vertical liner. By these means, each wall of the shuttering may be built up of accurately aligned panels, the inner faces of which provide a substantially continuous flat retaining wall.

In order that the shuttering may be readily taken apart, it is necessary, after the clips have

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been removed, to arrange for the liners to be lowered out of engagement with the notched tie-rods 42. For this purpose, removable spacing members are disposed between the lowermost horizontal liners and the base on which they rest. Thus, after the removal of the spacing members and the clips a drift may be entered into holes previously occupied by the limbs of the clips and by tilting the drift the liner is caused to fall away from the tie-rod. The lowermost panels can then be removed leaving the upper ones also free for removal.

Figures 11 to 14 show details in connection with hinged panels arranged to form shuttering for the corner of a wall. Figures 11 and 12 show the inner hinged panel, and Figure 13 the outside hinged panel.

The outer edge of each of the two parts of each panel is flanked by a vertical frame member 53 of similar construction to the frame member 12 or 13 hereinbefore described, and provided with apertures for receiving the U-clips 54, such as is shown in Figure 14, for securing these frame members 53 to the frame member 12 of the other part of the shuttering. Each of the upright frame members 53 is held to its panel by an angle-iron 60.

As will be seen from Figure 12, the two parts 55 and 56 of the inner panel are secured together by a hinge 57 which permits the two parts of the panel to be disposed at right angles. Each part of the hinge is provided with pairs of limbs 58 and 59 between which is located the panel. A similar arrangement is provided for the outer panel, as shown in Figure 13, which may be of larger dimensions.

As indicated above, each upright 53 is secured to an adjacent upright 12 by U-shaped clips 54, and the uprights 53 and 12 are additionally held in abutting relationship by a further U-shaped clip 61 which straddles the angle-iron 60 and may be held in position by a pin passing through the hole 62 in these parts. Holes for a similar purpose are shown in Figures 1, 2, 3, 4, 9 and 10, whereby the U-shaped clips are prevented from being jolted out by vibration.

I claim:

1. Formwork for casting concrete comprising a number of panels arranged side by side with intervening locating liners, opposed faces of which liners and of the edges of said panels being provided with interengaging multiple tongues and grooves extending along the whole length thereof.

2. Formwork for casting concrete comprising a number of rectangular panels arranged in coplanar alignment, intervening liners arranged between one set of parallel edges of said panels, the opposed faces of which liners and of the edges of said panels being provided with interengaging multiple tongues and grooves extending along the whole length thereof.

3. Formwork for casting concrete comprising a number of rectangular panels arranged in coplanar alignment, intervening liners arranged between one set of parallel edges of said panels, the opposed faces of which liners and of the edges of said panels being provided with interengaging multiple tongues and grooves extending along the whole length thereof, a second set of liners between the set of parallel edges of the panel at right angles to the first said set, the opposed faces of said second set of liners and the edges of said panels being flat.

4. Formwork for casting concrete comprising

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a number of rectangular panels arranged in coplanar alignment, intervening liners between a set of horizontal edges of said panels, the opposed faces of which liners and of the edges of said panels being provided with interengaging multiple tongues and grooves extending along the whole length thereof.

5. Formwork for casting concrete comprising a number of rectangular panels arranged in coplanar alignment, intervening liners between a set of horizontal edges of said panels, the opposed faces of which liners and of the edges of said panels being provided with interengaging multiple tongues and grooves extending along the whole length thereof, a second set of liners between the set of vertical edges of the panels and the opposed faces of said second set of liner vertical edges of said panels being flat.

6. Formwork for casting concrete comprising a number of rectangular panels arranged in coplanar alignment, intervening locating liners of rectangular cross-section between adjacent edges of said panels, the opposed faces of which liners and of the edges of said panels are provided with interengaging multiple tongues and grooves extending along the whole length thereof and the other faces of which liners are coplanar with the faces of said panels.

7. Formwork for casting concrete comprising a number of panels arranged side by side with intervening locating liners, opposed faces of which liners and of the edges of said panels being provided with interengaging multiple tongues and grooves extending along the whole length thereof, and clamping means engaging said liners and panels and adapted to maintain them in engagement.

8. Formwork for casting concrete comprising two sets of rectangular panels, the panels of each set being arranged in coplanar alignment and the two sets of panels being spaced apart, intervening locating liners arranged between adjacent edges of the panels of each set, the opposed faces of which liners and of the edges of said panels being provided with interengaging multiple tongues and grooves extending along the length thereof and tie-rods adjustably spacing apart the two sets of panels.

9. Formwork for casting concrete comprising a number of panels arranged side by side with intervening locating liners, opposed faces of which liners and of the edges of said panels being provided with interengaging multiple tongues and grooves extending along the whole length thereof, and clamping means engaging said liners and panels and adapted to maintain them in engagement, and tie-rods adjustably engaging the locating liners of the two sets of panels so as to space said sets apart.

10. Formwork for casting concrete comprising a number of panels arranged side by side with intervening locating liners, opposed faces of which liners and of the edges of said panels being provided with interengaging multiple tongues and grooves extending along the whole length thereof and U-shaped clamping members, the limbs of which respectively engage holes in the panels and in the intervening liners so as to clamp the liners and panels together.

11. Formwork for casting concrete comprising a number of rectangular panels arranged in coplanar alignment intervening liners arranged between one set of parallel edges of said panels, the opposed faces of which liners and of the edges of said panels being provided with inter-

engaging multiple tongues and grooves extending along the whole length thereof, a second set of liners between the set of parallel edges of the panel at right angles to the first said set, the opposed faces of said second set of liners and the edges of said panels being flat, clamping means between interengaging multiple tongued and grooved faces to adapt and maintain them in engagement, and other clamping means between said opposed flat faces adapted to prevent backward and forward movement between them.

12. Formwork for casting concrete comprising a number of panels arranged side by side with intervening locating liners, opposed faces of which liners and of the edges of said panels being provided with interengaging multiple tongues and grooves extending along the whole length thereof, and clamping means engaging said liners and panels and adapted to maintain them in engagement, and tie-rods adjustably engaging the locating liners of the two sets of panels so as to space said sets apart the ends of which tie-rods are provided with spaced projections along one side thereof adapted to engage spaced projections formed on said locating liners.

13. Formwork for casting concrete comprising two sets of panels each arranged in coplanar alignment, which two sets are spaced apart, intervening locating liners arranged between horizontal edges of said panels in each set, the opposed faces of which liners and of the edges of the panels are provided with interengaging multiple tongues and grooves extending along the whole length thereof, and which liners and panels are provided with holes arranged one above the other, U-shaped clamping means arranged with their two limbs in the holes in the panels and liners, which holes in the liners are larger than said limbs, tie-bars arranged in said larger holes so as to extend between the two sets of panels, which tie-bars are provided with spaced projections along one side thereof which engage similarly spaced projections on said liners and are maintained therein by said U-shaped clips.

14. Formwork for casting concrete comprising a number of rectangular panels arranged in coplanar alignment, intervening locating liners of rectangular cross-section between adjacent edges of said panels, the opposed faces of which liners and of the edges of said panels are provided with interengaging multiple tongues and grooves extending along the whole length thereof and the other faces of which liners are coplanar with the faces of said panels, which rectangular cross-section liners are formed in two interlocking parts spaced to provide a hollow structure.

15. Formwork for casting concrete comprising two sets of rectangular panels so arranged that the panels in each set are in coplanar alignment, intervening locating liners of rectangular cross-section between adjacent horizontal edges of said panels, the opposed faces of which liners and of the edges of said panels are provided with interengaging multiple tongues and grooves extending along the whole length thereof and the other faces of which liners are coplanar with the faces of said panels, which rectangular liners are formed in two interlocking parts to provide a hollow structure, the inner faces of which opposite the outer groove faces are likewise grooved but in staggered relationship, the side faces of which hollow aligning members are provided with holes therein, tie-bars arranged to extend between the two sets of panels through said holes, which tie-bars are provided with projections

thereon arranged to engage the tongues and grooves on the inner faces of the horizontal tie-bars.

16. Formwork for casting concrete comprising a number of panels each comprising a frame formed of metal members secured together at right angles and recessed on one side to receive a sheet which lies flush with the faces of said members, which panels are arranged side by side with interlocking liners between said frame members, opposed faces of which liners and of the frame members are provided with interengaging multiple tongues and grooves extending along the whole length thereof.

17. Formwork for casting concrete comprising a number of panels each comprising a frame formed of metal members secured together at right angles and recessed on one side to receive a sheet which lies flush with the faces of said members, which panels are arranged side by side with intervening locating liners between said frame members, opposed faces of which liners and of the frame members are provided with interengaging multiple tongues and grooves extending along the whole length thereof, which frame members and liners are provided with holes opposite one another and U-shaped clips engaging those holes and adapted to maintain the tongues and grooves of the two parts in engagement.

18. Formwork for casting concrete comprising a number of panels each comprising a frame formed of horizontal and vertical metal members secured together at right angles and recessed on one side to receive a sheet which lies flush with the faces of said members, which panels are arranged side by side with intervening locating liners between said frame members, opposed faces of which liners and of the metal members are provided with interengaging multiple tongues and grooves extending along the whole length thereof, which horizontal frame members are provided on their outer faces with multiple tongues and grooves engaging similar tongues and grooves of the locating liners and which vertical frame members are provided with a web portion extending transversely to the panel and provided at one end with a flange for supporting said sheet, and another flange at the other end provided with apertures and vertical liners between adjacent vertical members of said frame also provided with apertures and U-shaped clips arranged to engage both sets of apertures.

19. Formwork for casting concrete comprising a number of panels arranged side by side with intervening locating liners, opposed faces of which liners and of the edges of said panels being provided with interengaging multiple tongues and grooves extending along the whole length thereof, which panels at the ends of the rows of panels are each formed in two parts disposed at an angle to one another.

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