

[54] **APPARATUS FOR SHUTTERING
POURED CONCRETE STRUCTURES**

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[72] Inventor: **Joseph W. Ferenc**, 175 E. 62nd St.,
New York, N.Y. 10021

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264/33

[51] Int. Cl. B28b 7/22

[58] **Field of Search..** 25/131 SD, 131 SC, 131 Z, 131 CP, 25/131.6, 131 P, 131 H; 249/13, 24, 25, 26, 27, 47, 178, 179, 185, 22, 34; 139, 19; 264/31, 33, 34

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Primary Examiner—J. Spencer Overholser

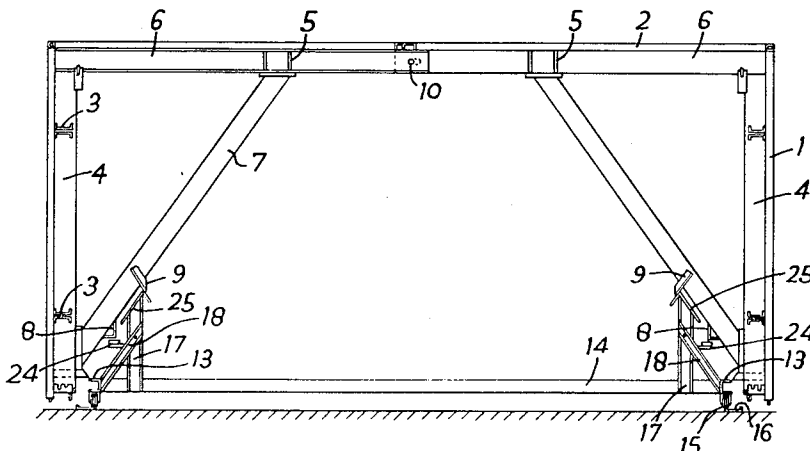
Assistant Examiner—B. D. Tobor

Attorney—McGlew and Toren

[57] **ABSTRACT**

Apparatus for forming a poured concrete structure includes an inverted U-shaped shuttering member movably supported on a carriage. While supporting the shuttering member, the carriage can be moved over rails for placing the shuttering member in the location where it is to form the structure. When it is properly located, the carriage can displace the shuttering member laterally and vertically into the exact position for forming the poured concrete structure. Means are incorporated into the shuttering member for holding it in position to pour the structure so that the carriage can be removed from its position supporting the shuttering member.

4 Claims, 20 Drawing Figures



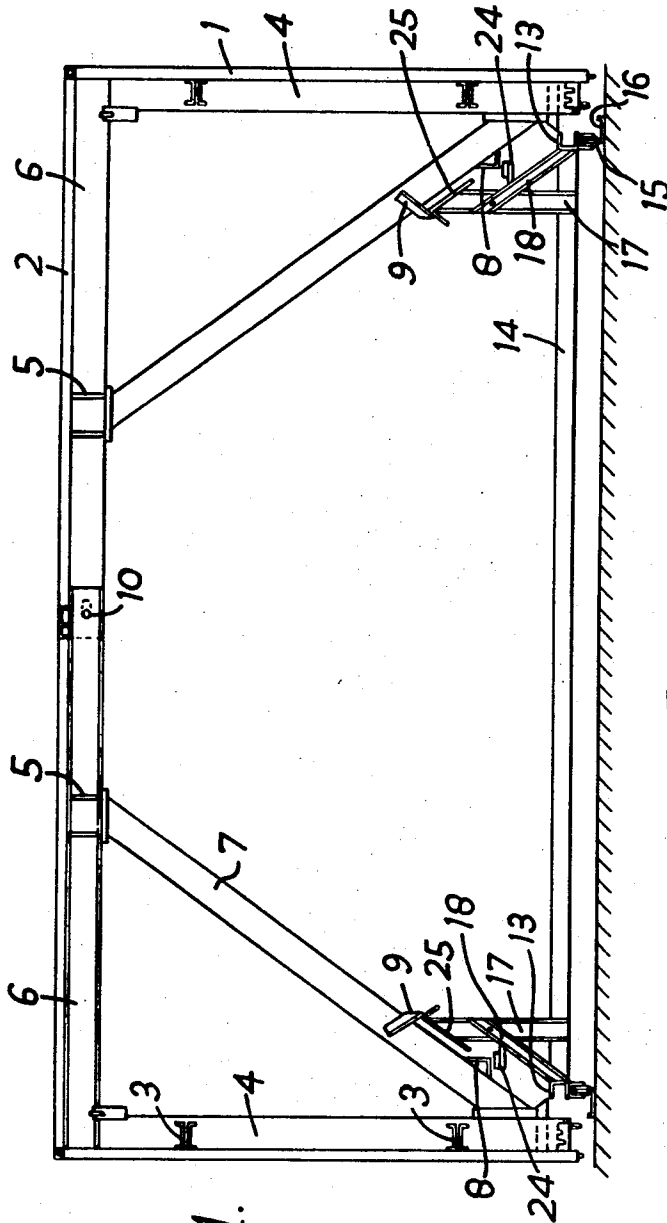


Fig. 1.

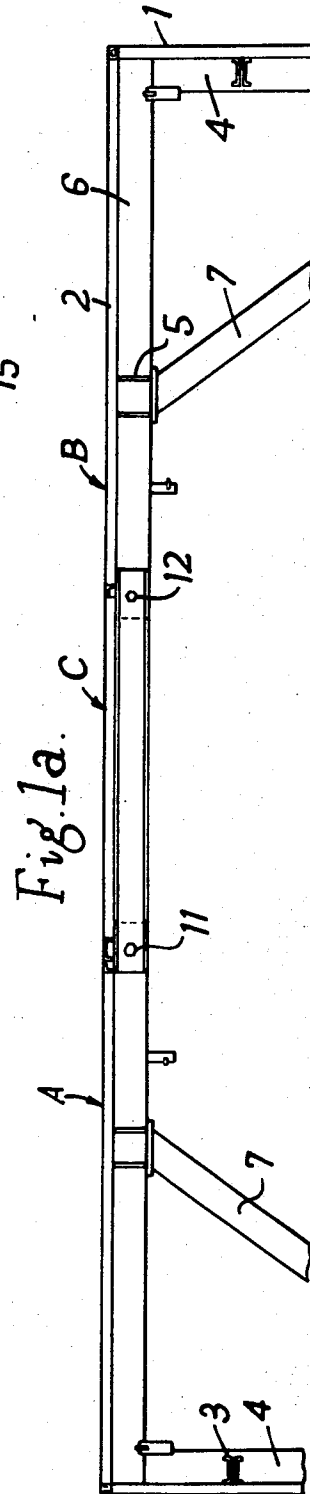
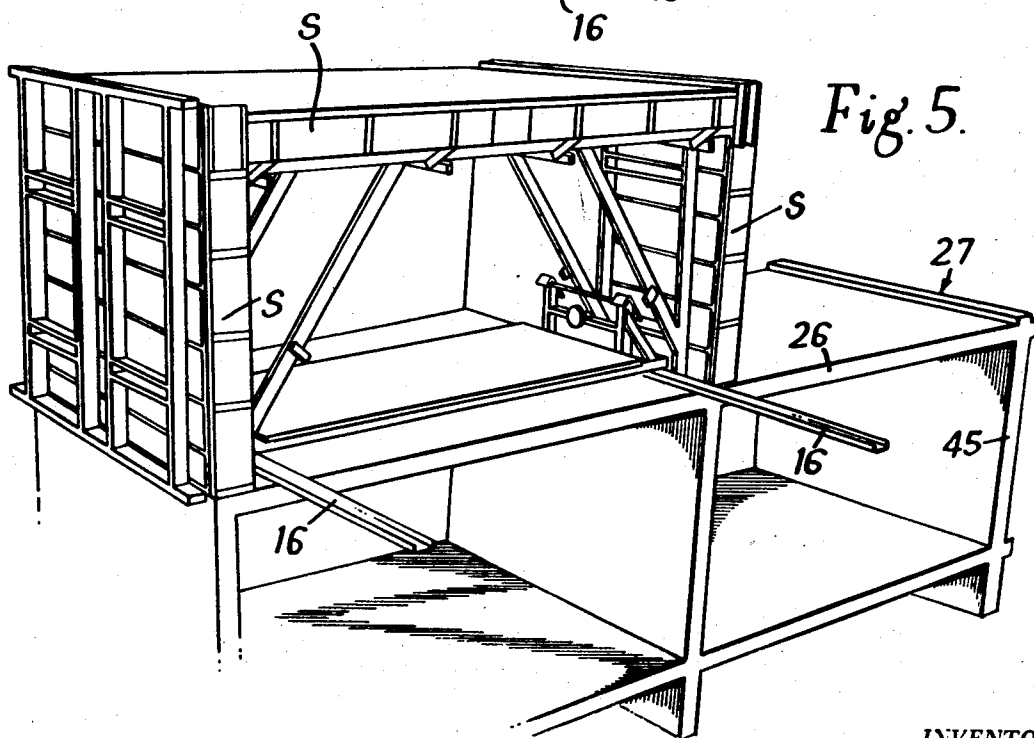
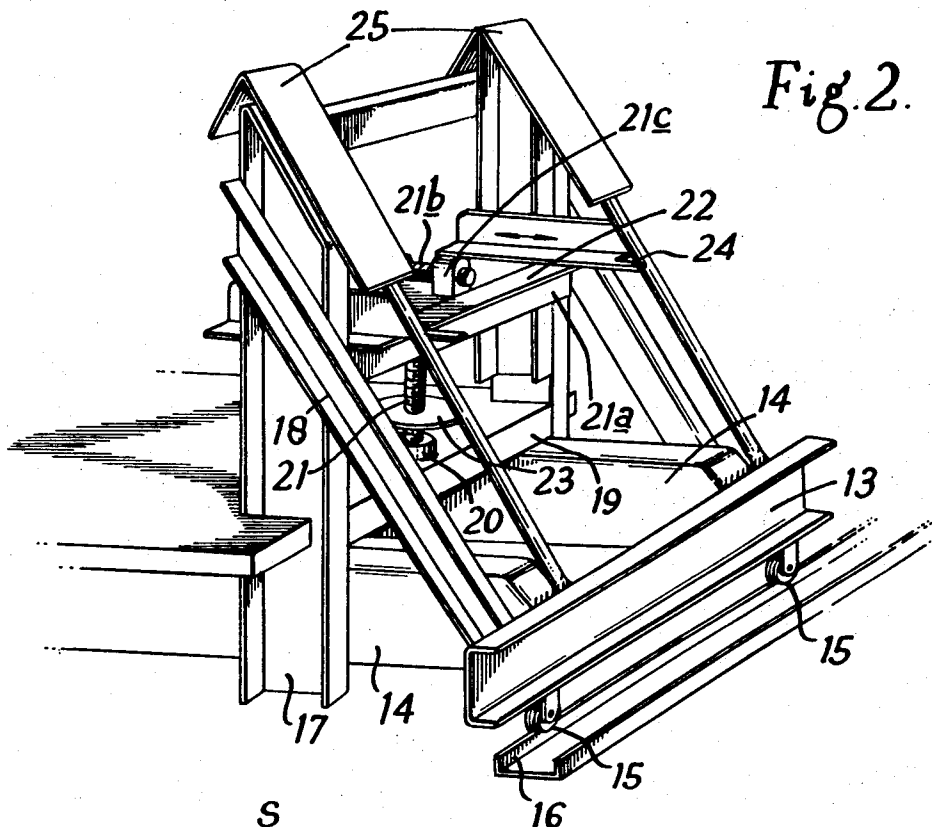


Fig. 1a.

INVENTOR.
JOSEPH W. FERENC
BY *McGraw and Toren*
Attorneys



INVENTOR.
JOSEPH W. FERENC

BY *McGraw and Tosen*
Attorneys

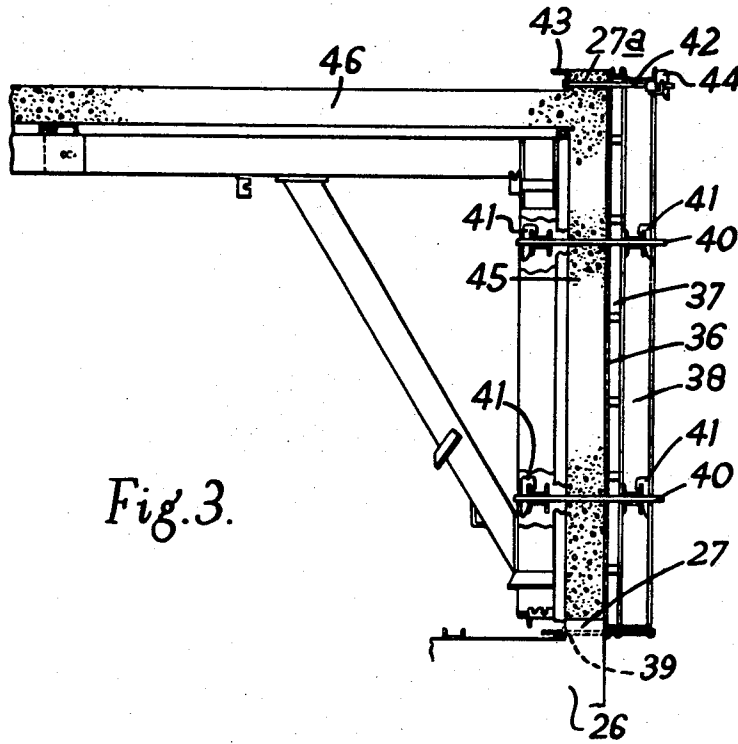


Fig. 3.

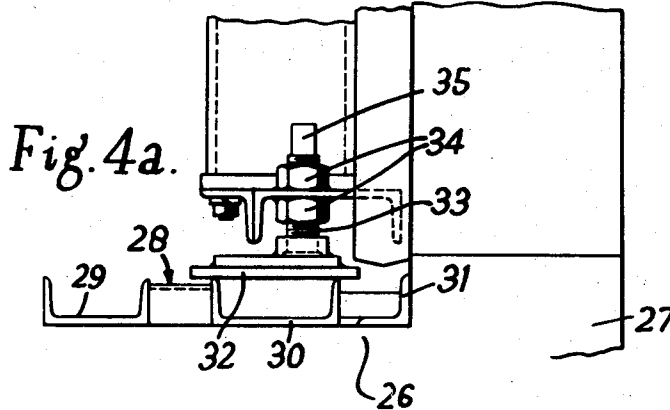


Fig. 4a.

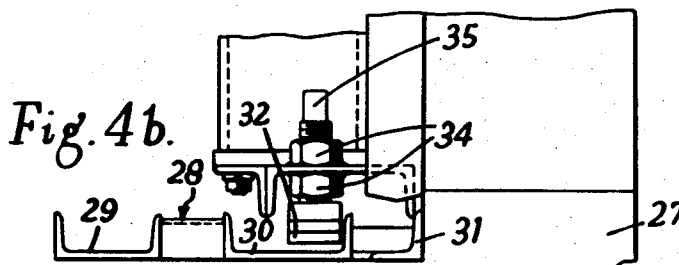
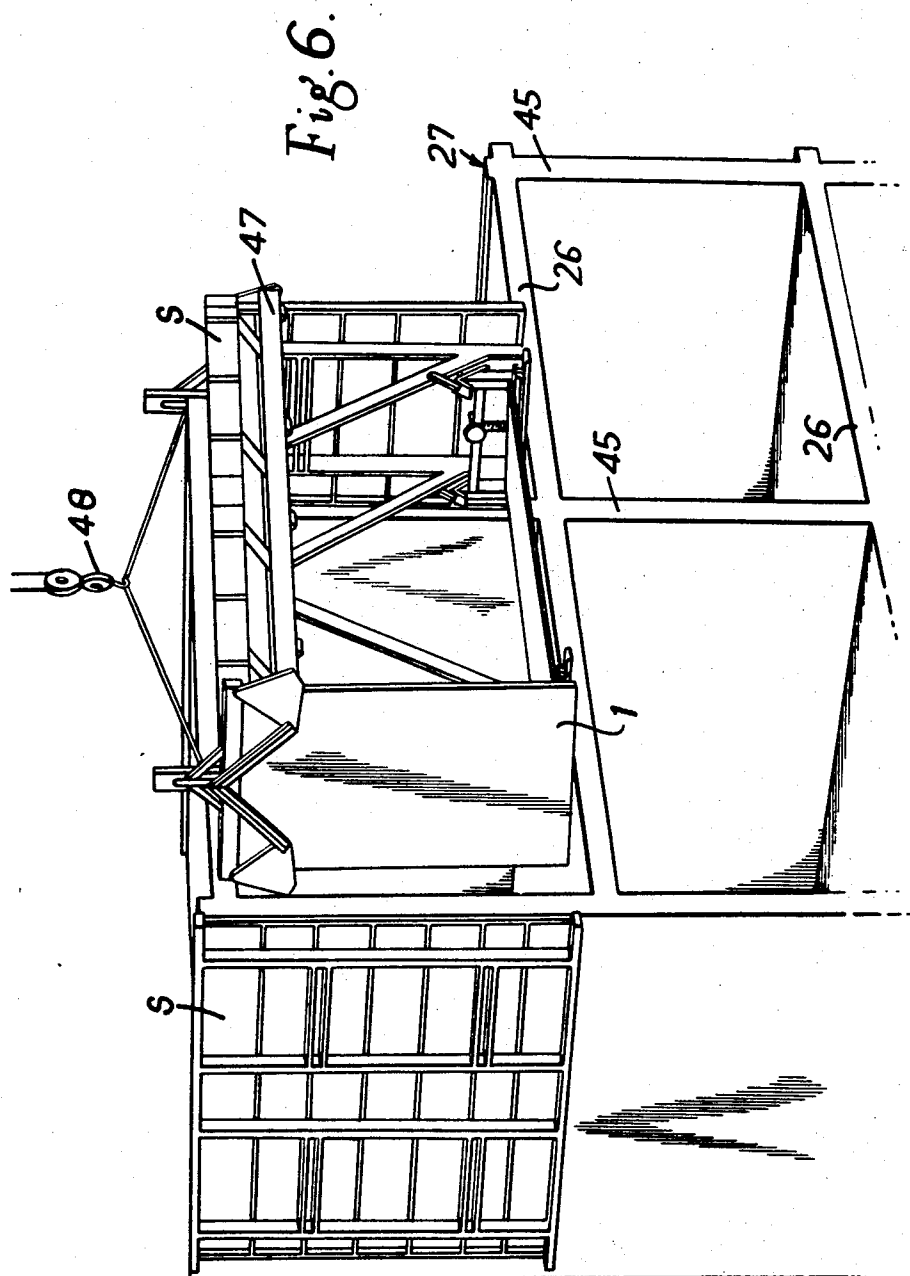


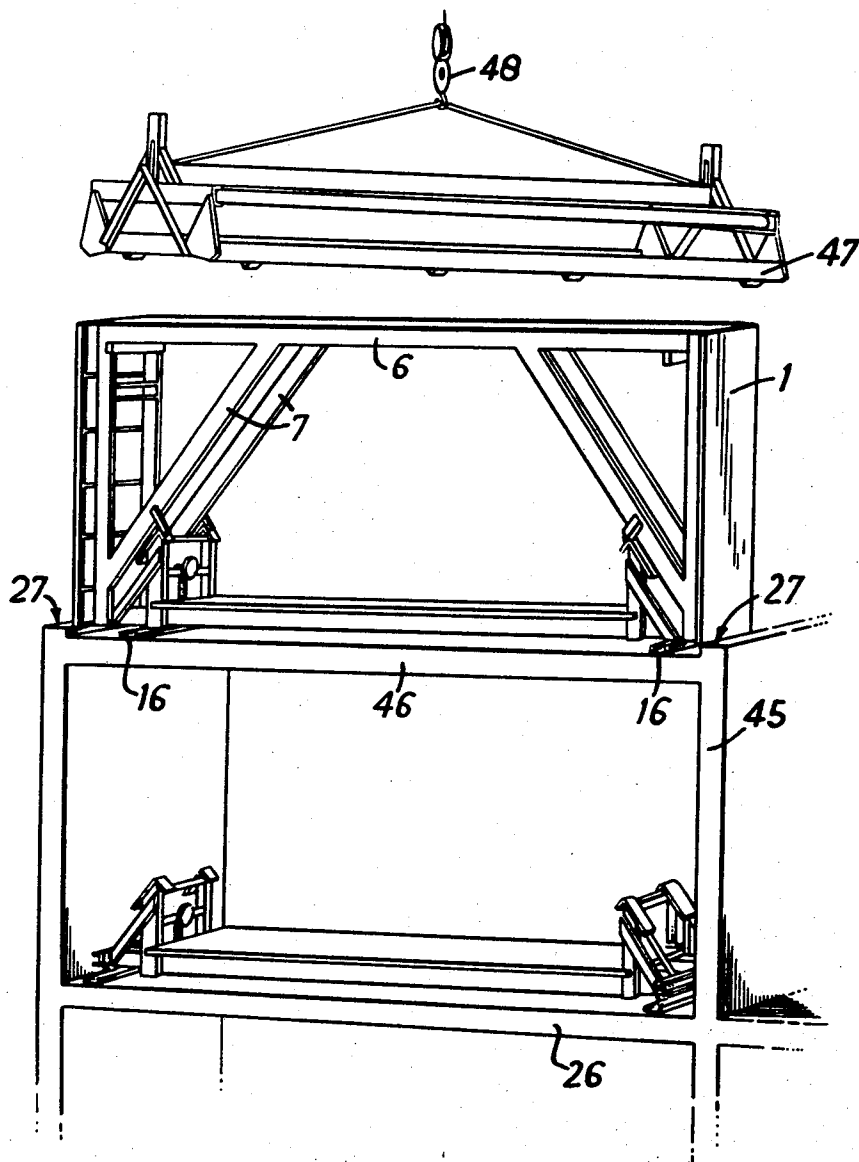
Fig. 4b.

INVENTOR.
JOSEPH W. FERENC
BY *McGlew and Toren*
Attorneys

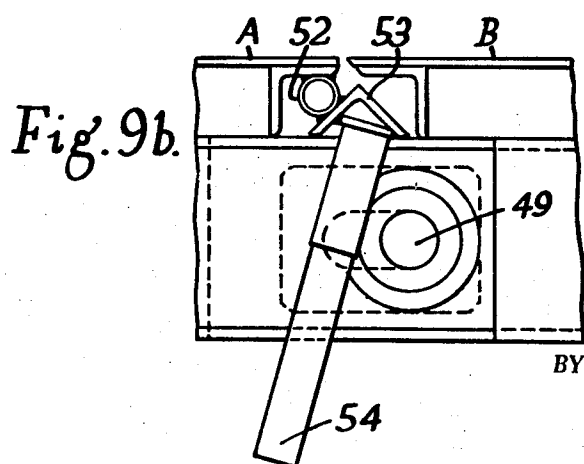
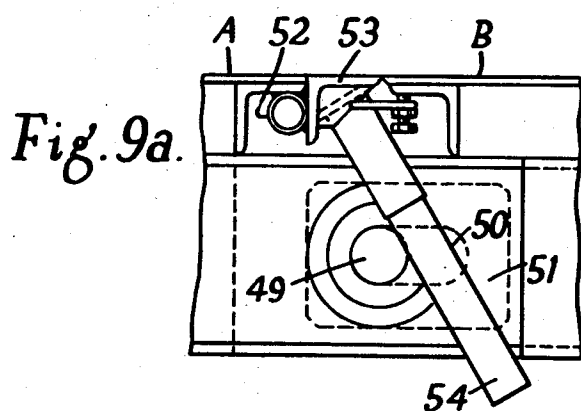
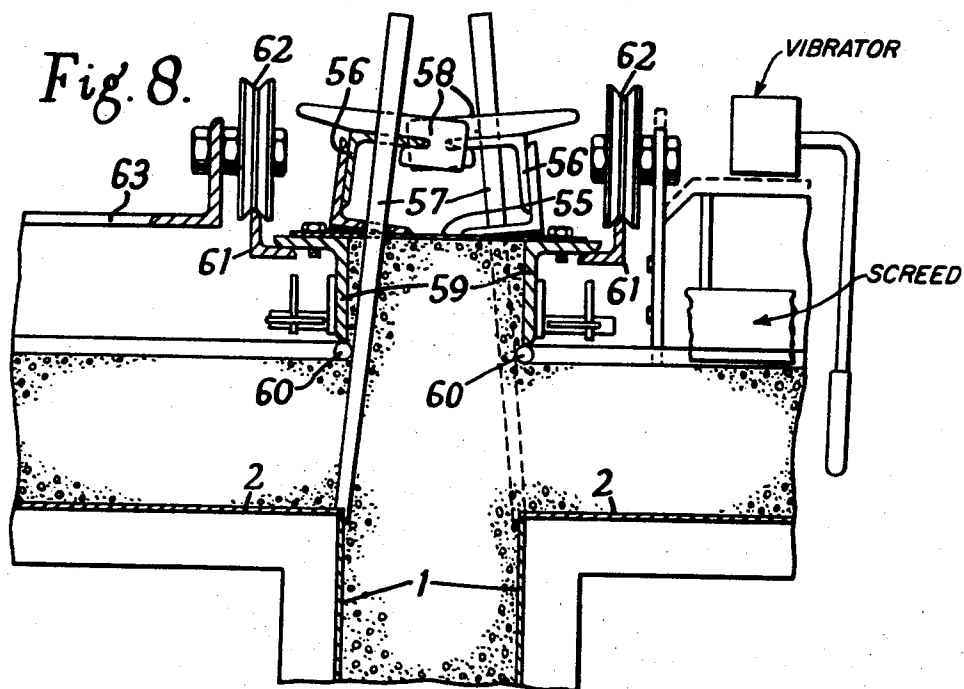


INVENTOR.
JOSEPH W. FERENC
BY *McGraw and Toren*
Attorneys

Fig. 7.



INVENTOR.
JOSEPH W. FERENC
BY *McGraw and Toren*
Attorneys



INVENTOR.
JOSEPH W. FERENC
McGraw and Toren
Attorneys

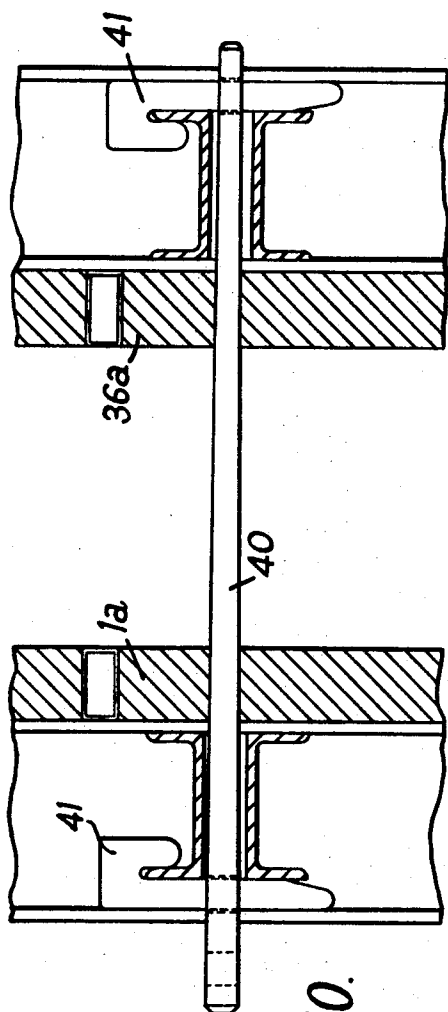


Fig. 10.

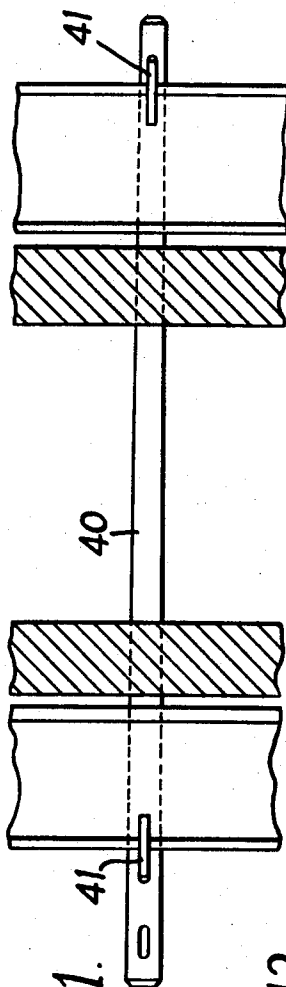


Fig. 11.

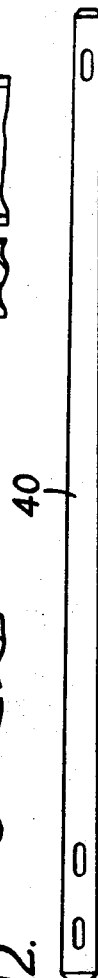


Fig. 12.

INVENTOR.
JOSEPH W. FERENC
BY *McGraw and Toren*
Attorneys

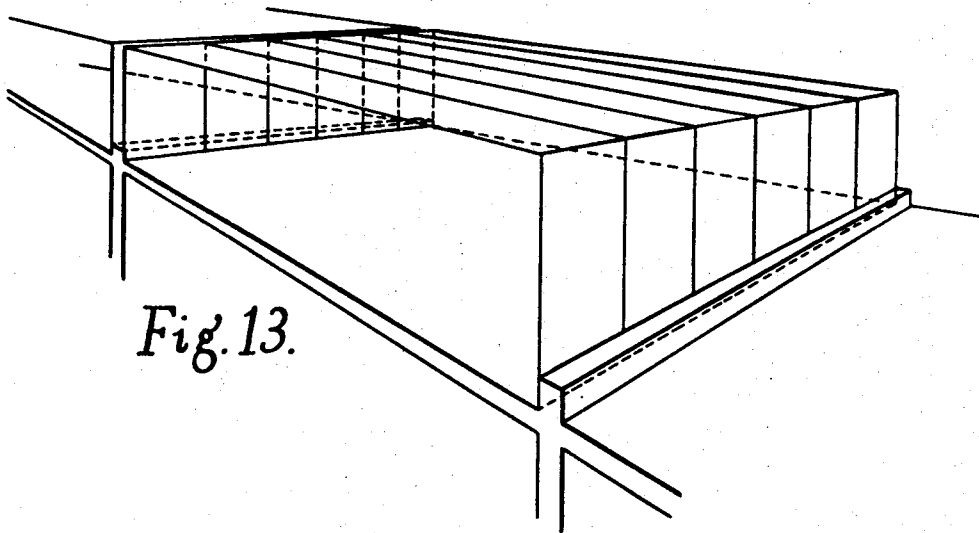


Fig. 13.

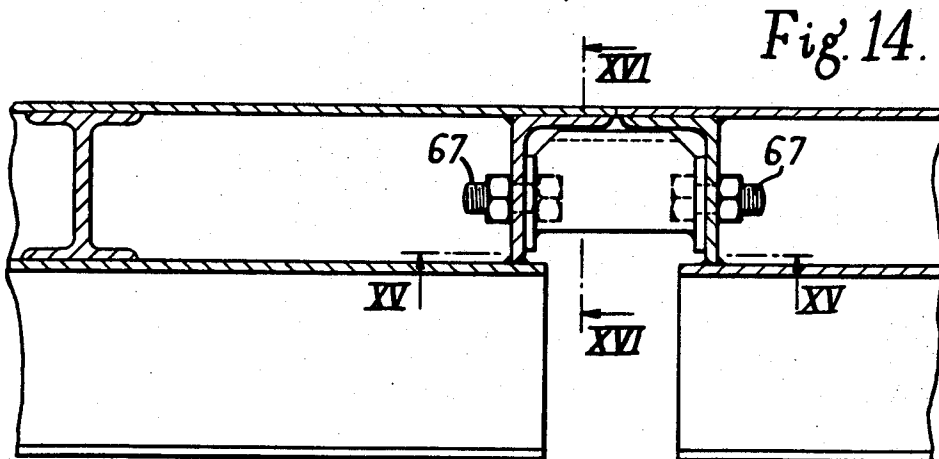


Fig. 14.

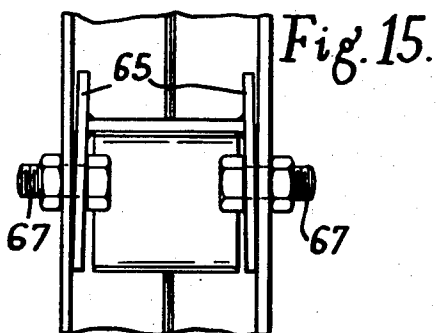


Fig. 15.

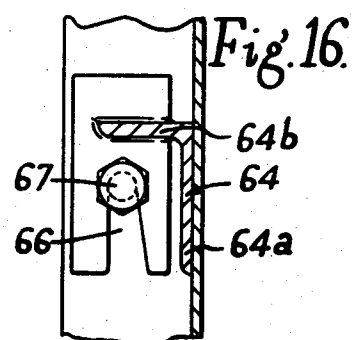
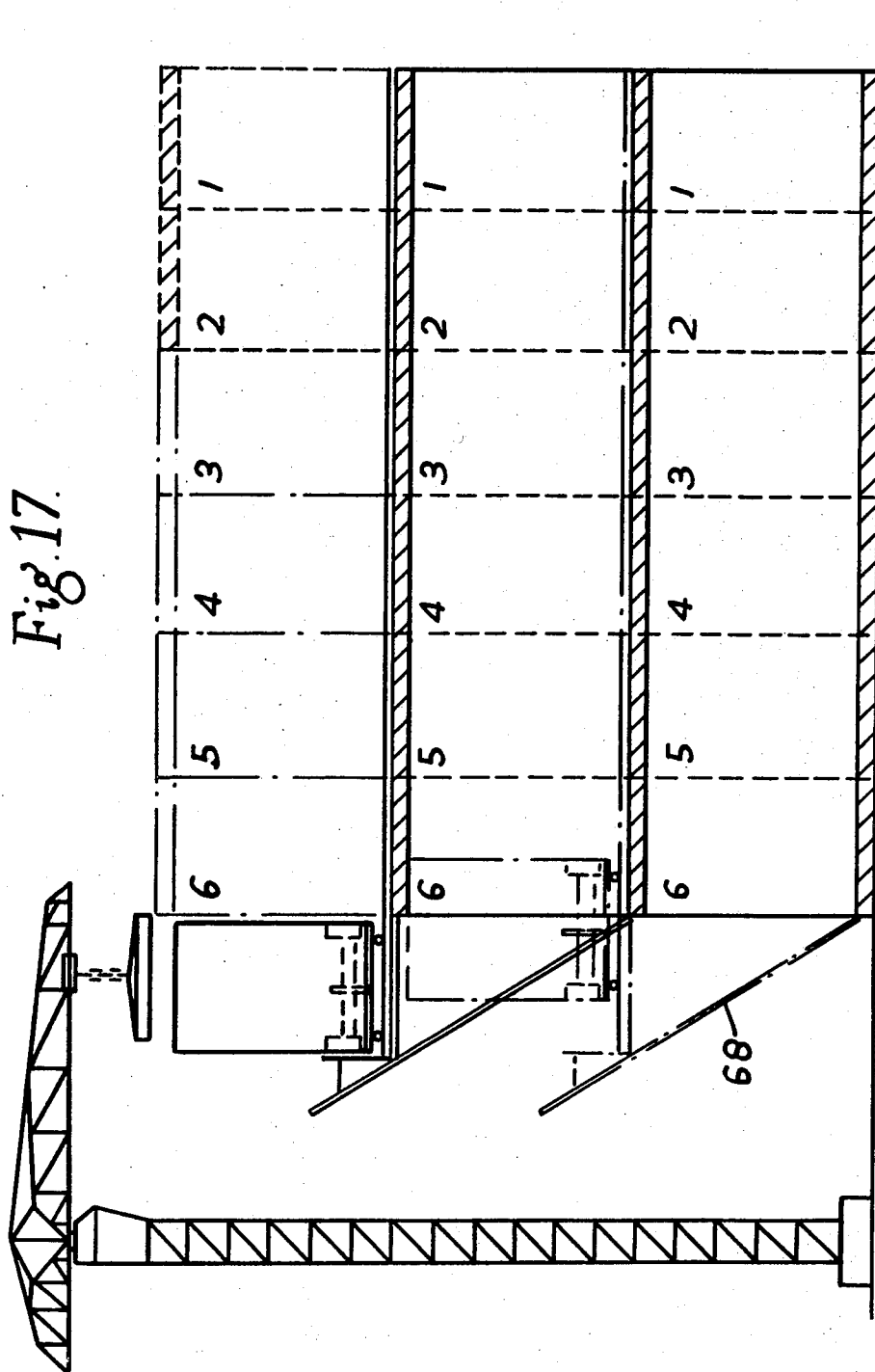


Fig. 16.

INVENTOR.
JOSEPH W. FERENC
BY *McGraw and Toren*
Attorneys



INVENTOR.
JOSEPH W. FERENC
BY *M. Glen and Toren*
Attorneys

APPARATUS FOR SHUTTERING POURED CONCRETE STRUCTURES

This invention relates to shuttering for poured concrete structures, its object being to provide an improved method, and apparatus suitable for use in carrying out the method.

According to the present invention, a method of forming a poured concrete structure comprises in combination the steps of:

- i. mounting an internal shuttering member on a wheeled carriage;
- ii. running the assembly of carriage and internal shuttering member on rails into alignment with a desired shuttering location;
- iii. operating control means on the carriage so as to raise the internal shuttering member into a desired position;
- iv. supporting it in the raised position;
- v. securing other associated external shuttering members in position;
- vi. pouring the concrete and allowing it to set;
- vii. releasing the other associated external shuttering members;
- viii. adjusting the internal shuttering so as to cause it to contract laterally and be lowered;
- ix. running the contracted internal shuttering member on a carriage away from the shuttering location.

Where the method is to be used for the successive formation of a plurality of superposed structures, it is advantageous to form during each pouring operation a raised rim which can serve, during the next pouring operation, as a guide for positioning of the internal shuttering member and an external shuttering member.

Apparatus suitable for use in carrying out this method comprises a wheeled carriage, a contractible inverted U-shaped internal shuttering member, means on the carriage for supporting the internal shuttering member, and means on the carriage for adjusting the height and width of the internal shuttering member.

Preferably the internal shuttering member comprises a plurality of portions, for example two or three portions, which can be secured together to provide a desired adjustable width for the internal shuttering member.

An embodiment of building method, and apparatus for carrying out the method, are described with reference to the accompanying drawings, wherein:

FIG. 1 is a front elevation of an internal shuttering member mounted on a carriage;

FIG. 1a is a partial front elevation of a modification of the shuttering member of FIG. 1;

FIG. 2 is a partial perspective elevation of a carriage for the shuttering members;

FIG. 3 is a partial front elevation showing a shuttering member mounted in position together with external shuttering;

FIG. 4a and 4b are elevations, to a larger scale, to show respectively details of the accurate vertical adjustment of a shuttering member, and the manner in which it can be lowered to bring it away from the set concrete;

FIG. 5 is a perspective view of a building with internal and external shuttering members in position;

FIG. 6 is a perspective view of the building to show the manner of removal of the internal shuttering member;

FIG. 7 is a perspective view of the building to show the internal shuttering member positioned on the top of a completed portion of the building, ready for the next pouring operation;

FIG. 8 is an end elevation of means for obtaining simultaneously the shuttering of a raised rim portion of the concrete, and for providing a set of rails to receive carriages for (i) the installation of various services, and (ii) the pouring of fresh concrete for a new floor level;

FIG. 9a and 9b are partial elevations, to a larger scale, to show the manner of locking and unlocking of the shuttering member of FIG. 1.

FIG. 10 is a vertical section through a portion of the shuttering, to show polyurethane insulating sheets;

FIG. 11 is a plan view corresponding to FIG. 10;

FIG. 12 is an elevation of a shuttering pin;

FIG. 13 is a perspective view of a plurality of shuttering elements placed side by side.

FIG. 14 is an end elevation of an anchoring and wedging device serving to adjust the adjacent shuttering elements into exactly aligned condition;

FIG. 15 is a section taken on the line XV—XV of FIG. 14;

FIG. 16 is a section taken on the line XVI—XVI of FIG. 14.

FIG. 17 is a schematic view to illustrate the manner in which shuttering elements could be used for the building of a structure.

Referring to FIGS. 1 and 1a, the shuttering member is of the shape of an inverted "U", and comprises side wall plates 1 and a top wall plate 2. The side wall plates 1 are reinforced against bending by longitudinal girders 3 and vertical girders 4, and the top wall plate is reinforced against bending by longitudinal girders 5 and horizontal transverse girders 6. Inclined struts 7 are welded to the side wall girders 4 and the top wall girders 5 as reinforcements. On the struts 7 there are welded seatings 8 and guides 9, the operation of which is explained below in relation to FIG. 3.

The shuttering member of FIG. 1 is composed of two portions "A" and "B" which are coupled together at 10, in the manner described in detail in relation to FIGS. 9a and 9b, to form the complete unit. The shuttering member of FIG. 1a is composed of three portions "A", "B" and "C" which are similarly coupled together at 11 and 12 to form the complete unit. Central portions "C" of various widths may be used in conjunction with the portions "A" and "B" to provide shuttering members of different overall widths.

Referring to FIG. 2 there is shown a portion of a carriage comprising longitudinal girders 13 and transverse girders 14 welded to form a rectangular frame which can run by means of wheels 15 on rails 16. Onto the transverse girders 14 there are welded short uprights 17 braced by inclined struts 18. On the girders 14 there is disposed a fixed cross-member 19 which carries a bearing block 20 on which there is seated the lower end of an adjusting screw 21 threaded into a cross-member 21a which can slide vertically on the uprights 17 acting as guides. The screw carries a pinion 23 operable, when desired, by a motor drive (not shown) mounted on the carriage, or by hand. The cross-member 21a carries a cross-bar 22 on which are fixed parallel support arms 24, 24 which serve to receive and carry the seatings 8 of the shuttering members. On the cross-member 21a there is provided a horizontal screw 21b which is en-

gaged in a threaded block 21c coupled to the cross-bar 22. The screw 21b can be rotated, when desired, by the same motor drive (not shown). Thus the arms, 24, 24 can be adjusted both vertically and horizontally. At the upper end of the uprights 17 there is secured a guide plate 15 which is contacted by the guides 9 of the shuttering members. It will be seen that, in lowered position of the cross-bar 22, (FIG. 3) the shuttering member rests on the carriage by means of the two guides 9 on the guide plates 25, whereas for moving the shuttering into raised position the cross-bar 22 is raised to lift the shuttering member, the latter then being supported by the seatings 8 on the support arms 24. When the shuttering member has been secured in its raised position, the carriage support arms can be lowered to permit removal of the carriage.

Referring now to FIGS. 3, 4a and 4b, the internal shuttering member is seen in its operative position. The floor 26 of the building has already been cast in concrete, and it includes a raised rim 27. To position the internal shuttering member at exactly the correct height, there is provided a removable rail member 28 which consists of two U-shaped girders 29 and 30 and an L-shaped girder 31 all welded in side-by-side position to form an assembly. The girder 31 is pushed up to the rim 27, and the plate 32 of a foot on the lower end of the shuttering member is then seated on the girder 30. The threaded rod 33 is engaged through two nuts 34 welded to the shuttering member, and has a squared end 35 to receive a key for rotating it to adjust the height. The girder 29 can act as the rail for the wheeled carriage.

The shuttering member is arranged in the position shown in FIG. 3, i.e. with its lower edge just overlapping and sealing against the side wall of the rim 27, and an outer shuttering member, consisting of a plate 36 reinforced by vertical girders 37 and horizontal girders 38, is secured in position with its lower end also overlapping the rim 27. The outer shuttering member is supported in position by bars 39 engaged through holes bored in the rim 27, and is prevented from lateral movement, with respect to the inner shuttering member, by conical pins 40 (FIG. 12) engaged through the two shuttering members and through polyurethane insulating sheets 1a and 36a and locked by pegs 41 engaged through slots in the pins 40 and hooked over the flanges of horizontal girders forming part of the two shuttering members.

It is desirable, for the formation of the next higher stage of the building, to provide a further rim 27a at the top end of the cast concrete wall to be formed. For this purpose, the outer shuttering member carries pins 42 supporting an internal girder 43 and locked by pegs 44. When the shuttering members have been assembled in the manner shown (and other suitable end shutterings "S" (see FIG. 6) have been bolted in position at each end, the concrete can be poured in to form the side wall 45 and the top wall 46 and the rim 27a.

When it is desired to remove the shuttering from the set concrete structure, it is necessary to permit the shuttering member (FIG. 1) to contract both laterally away from the concrete walls, and downwardly, away from the concrete roof. The downward movement is achieved by rotation of the foot 32 (see FIG. 4a) into a position in which it is substantially aligned with the girder 30, and can pass into the girder, see FIG. 4b.

For lateral contraction of the shuttering member, and referring to FIGS. 9a and 9b, the two portions "A" and "B" are coupled by means of a pivot 49 on one portion movable in a slotted hole 50 in a plate 51 on the other portion. On the portion "A" there is provided a pivot 52 for an intermediate plate 53. To the plate there is connected a handle 54 which can be used to swing the plate 53 from the raised position of FIG. 9a to the lowered position of FIG. 9b. In the raised position (FIG. 9a) the plate 53 fills the gap between the two portions "A" and "B" and the shuttering member is accordingly of its maximum width. In the lowered position of FIG. 9b, the plate 53 is withdrawn downwardly, and the two portions "A" and "B" have moved towards each other to permit the shuttering member to contract laterally.

Referring to FIG. 5, two of the internal shuttering members would be arranged end to end, so that the front-to-back depth of the building is twice the length of each shuttering member. The rear shuttering member is omitted, for clarity, in FIG. 5.

When the concrete has set, the pins 40 and 42 are released, and the outer shuttering member and the shutterings S are removed. The foot 32 (see FIGS. 4a, 4b) of each internal shuttering member is turned through 90° to permit the shuttering member to be lowered slightly away from the concrete roof. At the same time, the handle 54 is operated to permit the shuttering member to contract laterally, away from the side walls. This contracting movement, downwardly and inwardly, causes the shuttering member to drop slightly on the carriage until the struts 7 contact the guide plates 25. The shuttering member is now spaced from both the roof and the walls, and can be run out, on the carriage on rails, to the front of the building. Similarly, when the shuttering member is being placed in position, it is run into the correct position while in contracted position, it is run into the correct position while in contracted position on the carriage, and the vertical and horizontal adjustments of the support arms 24 are used for adjusting the shuttering member into exactly the correct position, whereupon the shuttering member is locked in that position, by the feet 32 and the intermediate plate 53, and the carriage can be re-adjusted and disengaged from the shuttering member and withdrawn on its rails. When the concrete has set the assembly of carriage and shuttering member is then run out of the building on the rails 16, which would be supported by any convenient bracing (not shown), into the position of FIG. 6. A cradle 47 suspended from a crane hook 48 is then positioned over and engaged with the shuttering member and is used to lift each shuttering member off the carriage, and raise it onto another carriage positioned one stage higher. The shuttering member is lowered onto the new carriage, and the cradle 47 is disengaged. The entire operation of moulding the side walls and a roof span can then be repeated, as often as is required.

To permit both the formation of a new raised rim 27 and the provision of a new rail system for the support of carriages at the next higher stage, there is used the assembly shown in FIG. 8. Onto the top edges of two adjacent shuttering members 1, 2, there is placed an assembly consisting of a plate 55 to which there are welded two longitudinal girders 56 each in an inclined position and having placed through them a series of

spikes 57 each held in position by a key 58 passed through a slotted hole in the spike and engaged about a flange of the girder. Below the plate 55, at each side, there is provided a girder 59 having at its lower edge a beading 60. The girder 59 acts as a shuttering for the raised rim 27, and the beading 60 serves to provide an undercutting which facilitates accurate formation of corners when a covering material is laid on the floor span.

The girders 59 also have welded to them a rail 61 serving to carry wheels 62 of carriages 63. The left-hand carriage in FIG. 8 could be used for the laying and positioning of service pipes, wiring, etc. which must be placed in position before the concrete is poured. The right-hand carriage in FIG. 8 could be used to support (i) a hopper for pouring concrete, and (ii) a vibrator, and (iii) means for accurate determination of the level of the poured concrete, i.e., a screed. Thus, whilst one team of workmen is using the left-hand carriage for laying services, another team of workmen is pouring the next roof or floor span, with accurately determined levels of pouring, and vibration of the poured concrete. Where a large number of internal shuttering members need to be placed end-to-end, a suitable long length of rails may be provided and the same carriage used to carry each of the internal shuttering members in turn. During placing in position and removal the carriage also serves to raise and lower the internal shuttering member. More than two of the shuttering members may be placed end-to-end so as to form an elongated internal shuttering, e.g. for a tunnel.

The internal shuttering member can also be made of different widths, so that any length and any desired width of concrete structure can be made.

If necessary, any convenient heating means such as steam pipes or electrical elements may be used in conjunction with the shuttering elements, for rapid setting of the concrete.

Referring to FIG. 13 there is seen a plurality of the shuttering units disposed side by side for the formation of a relatively elongated structure. It is important that all of the elements shall be exactly aligned with the neighboring elements, so that the surface of the eventual concrete is flat. To obtain this adjustment there is utilized an anchoring and wedging device illustrated in FIGS. 14, 15 and 16. The device comprises an angle member 64 the arm 64a of which lies beneath the edges of two shuttering members disposed edge to edge, thereby ensuring that the surface of the shuttering members are level with each other. On the other arm 64b there are welded two spaced plates 65 each having a tapered slot 66 in which is received a bolt 67 serving to anchor the device to the respective shuttering member.

Referring to FIG. 17 there is seen an illustration of the manner in which a plurality of the shuttering members could be used for producing a building with several floors. To commence the operation, shuttering members would be fixed in position at ground level, in the order shown by the numbers thereon. When the side walls and roof have been formed with those shut-

tering elements, they would be released, and removed one by one from within the structure by running them out on the carriage. As each shuttering element is removed, it is lifted by a crane to the level of the next floor up, and is then run on a carriage into a new position in the sequence shown by the numbers. To facilitate the running of the shuttering members, on a carriage, into this second position, there is used a removable staging 68 which projects beyond the end of the structure. When the shuttering means has again been used for formation of the concrete structure, the shuttering elements are run out again, on a carriage, onto the staging 68 and are there picked up again by the crane and lifted up to the next higher level, and are run on the carriage into a new position in the order indicated by the numbering.

I claim:

1. Apparatus for forming a poured concrete structure comprising a wheeled carriage arranged to travel on a support surface, an inverted U-shaped internal shuttering member comprising a pair of laterally spaced side wall plates and a top wall plate extending between the upper ends of said side wall plates, said shuttering member being removable supportable on said wheeled carriage for movement into position for forming the poured concrete structure, means associated with said carriage for displacing said shuttering member from a first position for movement while supported on said carriage and a second position for locating said side wall plates and said top wall plate in position for providing a form or surface for a poured concrete structure, means associated with said shuttering member for securing said side wall plates and said top wall plate in position for providing the form-work surface for the poured concrete structure so that said carriage can be movably displaced whereby it no longer forms a support for said shuttering member, wall means for forming a raised rim wall being spaced upwardly from and supported on at least one said internal shuttering member, and said wall means including at least one rail for supporting auxiliary tools and equipment for use in pouring the concrete into the form provided at least in part by said shuttering member.

2. Apparatus, as set forth in claim 1, wherein said wall means comprising a wall member extending along the lower end of the surface forming the juncture of the raised rim wall and the subjacent concrete structure, said wall member forming a beading projecting inwardly into the surface of the raised rim wall and forming an undercutting therein which facilitates accurate formation of corners.

3. Apparatus, as set forth in claim 1, characterized in that a vibrating device is supported on said wall means and is movable on said rail thereof for vibrating the concrete poured into the form work provided at least in part by said shuttering member.

4. Apparatus, as set forth in claim 1, characterized in that means is movably supported on said rail of said wall means for affording an accurate determination of the level of the concrete poured into the form work provided at least in part by said shuttering member.

* * * * *