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Applicant .. .. THOMAS WALKER FOWLER.
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Classes 81.2; 81.1.

Drawing attached.

COMPLETE SPECIFICATION.

"An improved method of and means for use in erecting concrete structures."

I, THOMAS WALKER FOWLER, of Duncans Road, Werribee, in the State of Victoria, Commonwealth of Australia, Farmer, hereby declare this invention and the manner in which it is to be performed to be fully described and ascertained in and by the following statement:—

This invention relates to an improved method of and means for use in erecting concrete structures and refers especially to a method of and means for forming and erecting concrete wall units or slabs in the construction of buildings, walls, fences and the like.

The object of the invention is to provide a simple and efficient method of and means for forming and handling constructional units or slabs of cement or concrete whereby walls can be erected economically and expeditiously and when erected will have the same or comparatively the same stability as buildings moulded in situ.

I accomplish the abovementioned object by moulding a slab in a shallow tiltable tray or mould having one or more removable sides whereby the tray with the formed slab may be tilted from a horizontal or other convenient moulding position to a vertical position and when the lower side of the tray or mould is removed the slab is placed above a foundation and connected to other slabs similarly formed and erected to form a single or cavity wall structure.

The trays can be employed singly or two or more may be secured within a clamping frame when slabs of large size are to be formed. The tray or group of trays is or are provided with removable sides and ends and one or more of the sides and ends may be unfastened from the tray or trays and be provided with members inserted or moulded into the concrete whereby the formed slabs with one or more of the said side and/or end pieces may be erected adjacent to each other above a foundation and the said sides or end pieces utilised for securing struts, tie beams or like temporary supporting members thereto while the building is in course of erection. The sides of the moulds can be shaped to form longitudinal grooves or recesses in the vertical edges of a slab whereby when the side pieces are removed reinforcing members or tie wires projecting from adjacent slabs can be connected and the spaces therebetween filled with cement or concrete to firmly lock the slabs together.

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A salient feature of the invention resides in the provision of means for supporting the trays or moulds whereby they can be tilted and raised or lowered to facilitate the placing of a slab correctly in position above a foundation.

The moulds can be designed to shape the slabs into a form that will ensure them having a minimum of weight or thickness with a maximum of strength and provision can be made in moulding the said slabs for enabling linings of wood, fibro-cement, plaster or the like to be conveniently attached to the faces thereof.

In order that the invention, the object and nature of which have been set forth, may be readily understood, reference will now be had to the accompanying sheets of explanatory drawings, wherein:—

Figure 1 is a view in perspective illustrating one form of tray or mould and supporting means constructed in accordance with the invention. In this view the tray and supporting means are shown located within a space surrounded by wall foundations upon portions of which slabs are mounted to form wall sections.

Figure 2 is a view in sectional side elevation of a mould or tray and the means for supporting the same.

Figure 3 is a view in sectional elevation of a slab shaped by a mould or tray and placed in position on the foundation.

Figure 4 is a view in elevation of portion of a cradle forming part of the supporting means for a mould viewed in the direction of the arrow **4** shown in Figure 2.

Figure 5 is a view in plan of a mould or tray and cradle, portions of the mould or tray being shown removed to clearly illustrate constructional details thereof.

Figure 6 is a view in section of the mould or tray and one supporting member taken on the dotted line **6—6** of Figure 5.

Figure 7 is a view in section of part of a mould or tray filled with concrete, and clearly illustrates a slight modification which hereinafter is fully described.

Figure 8 is a view in section of the upper part of a mould or tray with portion of a slab therein.

Figure 9 is a view in sectional elevation taken on the dotted line **9—9** of Figure 2.

Figure 10 is a view in plan of portion of a cavity wall and portion of a division wall constructed in accordance with the invention.

Figure 11 is a view in sectional plan showing a detail of the invention which hereinafter will be fully described.

In these drawings the reference numeral **10** designates stands or supports comprising pairs of vertical members **11** and long base members **12**. A pair of jaws or brackets **13** extend upwardly from the vertical members **11** and pivotally supported therebetween is a lever **14** having its long or power arm normally secured as by a pin **15** passing through a hole or holes in standards **16** fitted to the base.

The end of the work arm of the lever is pivotally mounted as at **17** on a supporting cradle. The cradle comprises a pair of longitudinally disposed beams **18** and transverse beams **19**. The transverse beams can be arranged in pairs and the power arms of the levers **14** preferably are pivotally mounted between each pair of transverse beams and at about the centre thereof.

It will be understood from the foregoing description that the cradle is free to pivot on the ends of the levers and in order to maintain the said cradle in a horizontal position when the levers are locked against movement links **20** or like devices are employed to connect one edge of the cradle to the power arm of the levers.

In the drawings the links **20** are shown pivotally connected to the transverse bars **19** of the cradle and the free ends of the links are provided with a series of holes **21** adapted to take pins **22** for securing the links to the levers (see Figures 2 and 9 of the drawings).

The ends of the longitudinal or side beams **18** of the cradle are provided with upwardly extending hook members **23** whereby when a series of trays **24** are placed on the cradle they can be forced closely together by driving wedges **25** between the upwardly projecting hook members on one end of the beams and a batten **26** which forms a detachable side for the mould.

A batten **27** is inserted between the upwardly projecting hooks on the opposite end of the beams **18** and the adjacent tray and the upwardly projecting portion of this batten forms the second detachable side of the mould.

Each tray comprises a pair of side beams or rails **28** approximating in length to the

height of the wall to be formed and connected by cross members 29 situated near the ends thereof.

The bottom of the trays may be covered by boards or metal sheeting 30 fitted to the upper faces of the longitudinal and transverse rails or beams and having transverse grooves or corrugations 31 formed therein. Those portions of the tray which are situated between the transverse members 29 and the ends are made deeper than the intermediate portions and one of the ends of the longitudinal members are provided with upwardly extending hooks or brackets 32, which serve to locate and support a batten 33 closely against the upper ends of the trays to form the top of the mould.

The bottom batten 34 is detachably secured against the lower end of the mould by means of hooks or catches 34[1] and the top batten is retained in position by means of nails 35, screws or like fastening devices which are inserted through holes 36 in the upwardly projecting hook shaped members or brackets 32.

If preferred the trays can be constructed entirely of sheet metal pressed into a desired shape with or without a reinforcing frame.

In proceeding to erect a wall the foundations 37 of the buildings are laid in the usual way and the upper surfaces thereof are made quite level. The stands or supports 10 for the cradle are then placed in position within the room area bounded by a foundation and the levers carrying the cradle are connected thereto. It will be obvious that the stands or supports can be located on the outside or inside of a building as desired or found most convenient in practice.

When the levers have been pivotally mounted on the stands or supports the cradle is connected thereto and retained in a horizontal or other convenient moulding position by connecting the links 20 to the said levers by means of the pins 22.

The trays are then placed on the cradle with the depending hook shaped members 38 thereon engaging the upper longitudinal beam 18. The hook shaped members are disposed on the cradle in such a position as to cause the centre of gravity of the completed mould to be disposed approximately about the pivot connections with the power arms of the levers.

The trays may be spaced apart by intermediately disposed battens or pieces of quatering 39, which are of less depth than the height of the side rails 23 between the transverse members 29 of the trays. The spacing battens may, if desired, be permanently secured to the trays.

When the trays have been placed in position on the cradle the end battens 26 and 27 are inserted between the outmost trays and the upwardly projecting hooks 23 and the top and bottom battens 33 and 34 are placed in position. The trays and spacing battens 39 are drawn tightly together by inserting the wedges 25 between the upwardly extending hooks or like members on the ends of the longitudinal members on the cradle and the adjacent side batten of the mould.

After a layer of concrete has been placed in the trays or mould longitudinal reinforcings rods 40 may be inserted in the corrugations or recesses 31 in the bottom thereof and these reinforcing bars may extend through holes 41 in the battens 26 and 27 forming the sides of the mould.

In addition to or in lieu of the reinforcing bars above described mesh or wire netting reinforcements (indicated at 42 in Figure 7) may be placed on the bottom of the tray prior to filling the mould with concrete or plaster.

After the concrete or other building material has been placed in the mould the upper surface thereof is levelled off and made smooth by means of float bars or other approved devices and the concrete is allowed to set.

When the concrete has partially set the mould can be tilted to such an extent as to enable its lower edge to rest upon a stool or other support whereby excessive strain will be removed from the cradle or moulds, as when large slabs are being formed.

When the concrete has set hard the lower batten 34 is removed by unfastening the hooks 34[1] and forcing it away from the ends of the trays and by releasing the work arms of the levers from the standards 16 the mould after being swung into a vertical position can then be lowered on to the foundation, (see Figure 2 of the drawings).

When the mould has been lowered into position on the foundation and suitably braced the wedges 25 are knocked out to release the sides of the mould and free the cradle. The levers 14 are then raised to

move the cradle downwardly out of engagement with the hooks or brackets **32** on the undersides of the trays when the supports **10** and the cradle are free to be moved away from the erected slab.

After the supports **10** and cradle have been moved away from the slab the nails **35** are withdrawn and the trays and spacing battens **39** are prized away and after being cleaned can be used to form another slab.

It will be understood that the supporting stands **10** are placed in position to support the cradle and mould when reassembled alongside of the erected slab whereby when the second slab is formed it may be tilted into position and erected on the foundation alongside of the first mentioned slab.

When two or more slabs have been erected above the foundation the spaces between the adjacent vertical edges thereof are filled with concrete or grouting and when this concrete or grouting has set the sections of the wall will be securely connected to each other and a water proof joint ensured.

When the reinforcing wires or rods **40** project beyond the sides of the slabs they can be twisted together prior to filling the space with grouting thereby serving to give additional rigidity to the structure.

In some instances the slabs may be placed close together and the joints therebetween may be covered with wood or metal battens which are left permanently in position. The slabs when erected may be connected by temporary struts or ties nailed to the battens **33** secured to the upper edge thereof and these battens also serve as top wall plates to which rafters are easily secured. The top battens **33** are anchored to the tops of the slabs by bent nails **33¹**, pieces of wire or the like which are embedded in the concrete as shown in Figure 8.

If desired battens **43** can be placed in the body of the mould as upon the intermediately disposed spacing battens or pieces of quatering **39** and these battens may be provided with upwardly projecting pieces of wire or nails **44** adapted to anchor them to the face of the concrete slab (see Figure 7) whereby linings of wood or fibro-cement (not shown) can be readily affixed to the walls after the same have been erected. If desired sections of the battens **43** and of the slab at the sides thereof can be removed to provide a free circulation of air in the space between the inner lining and the concrete slab.

Alternatively the ribs on the inside of the slabs can be formed of breeze concrete whereby linings can be readily secured thereto by nails, screws or other fastening devices.

The linings can be secured by bolts, rivets or like members moulded into the slabs and having portions projecting therefrom and adapted to be inserted in holes in the lining or in straps covering the joints thereof.

In the right hand side of Figure 7, a bolt **38¹** is shown having its threaded end supported in a plastic substance in a hole **39¹¹** formed in a spacing batten **39** whereby the head of the bolt is securely anchored in the slab during the moulding operation.

The protruding ends of the bolts **38¹** can pass through holes in the lining or through covering strips or straps and the latter are retained in position on the slab by means of nuts fitted to the bolts.

The ribs on the inside of the formed slab ensures a requisite degree of strength and also facilitate the application of a coat of plaster or other lining to the inside of the wall when this is required.

When doors, windows or other openings are made in the slabs they may be formed by placing frames as **45**, blocks or the like in position on the mould so as to prevent concrete entering the space enclosed thereby. The frames or blocks can be retained in position during moulding operations by any approved means.

In Figures 5 and 6 of the drawings a frame is shown which is adapted to leave a door opening in the slab and this frame may be removed after the slab has set and has been placed in position on the foundation.

The door or window frame may be laid on the bottom of the mould and the slab formed therearound whereby the said frame will be securely anchored in the slab and erected therewith.

The door or window sashes can be mounted in their respective frames before the said frames are placed in the mould.

The bottom of those trays **24** which are adapted to support the door or window frames may be made perfectly flat to ensure an even thickness of concrete around the said frames.

When large slabs are being formed the base of the stands or supporting members 10 for the cradle may be weighted to counterbalance and prevent movement of the same when the slabs are being tilted to be placed in position on the foundation.

Alternatively, the base may be extended through openings in the foundation as illustrated in Figure 1 or they may be located above the foundation and suitable openings provided in the bottom edge of the slabs whereby the openings will fit over the extensions of the base of the supporting members.

When the openings are formed in the bottom or lower edges of the slabs to accommodate the extension on the base of the supporting member they may be filled with concrete after the said supporting members have been removed or these openings may be retained for ventilating purposes.

In adapting the invention to the formation of a hollow wall, that is, walls having an internal cavity, the outer wall sections can be erected first as previously described and the inner wall sections are then erected by placing slabs on the foundation at a suitable distance therefrom. Alternatively the inner wall section can be erected before the outer wall section.

The inner slabs may be of the same thickness or thinner than the outer slabs and the inner and outer wall sections can be connected by wall ties (not shown) secured within the grouting between the two adjoining sections of the slabs or in any other approved way.

If preferred the slabs of the outer wall section 47 can be made quite plain as shown in Figure 10 and their edges can be formed with grooves 46 whereby when two slabs are erected close to each other grouting or cement can be poured into the space therebetween to make a strong joint. The joint between the edges of adjacent slabs can be strengthened by tying or twisting together the projecting ends of reinforcing rods prior to pouring the grouting.

The inner wall section 48 may be made and erected as hereinbefore described and the projecting ends of the reinforcing rods 40 are twisted together as at 49 prior to pouring grouting between the joint. When a division wall 49 is arranged in line with a joint between the slabs of an outer wall the projecting ends of the reinforcing bars can be twisted around the bars connecting the outer wall sections thereby forming tie bars (as 50) which serve to strengthen the connection between the division wall and outer wall and retain the outer and inner wall sections 47 and 48 at a desired distance apart.

In those cases where a division wall is not disposed in line with the joints in an outer wall the reinforcing wires at the joints are connected by wire wall ties as hereinbefore described.

In Figure 1 of the drawings each wall is shown composed of a single slab but it will be obvious that the slabs can be of any desired width and two or more separate slabs can be employed to form a wall.

If desired the longitudinally disposed reinforcing members may be dispensed with and the adjacent slabs of a wall or fence may then be connected by grouting or concrete poured into suitably arranged moulds 51 (see Figure 11 of the drawings).

In order to prevent the grouting uniting with the ends of the slabs, thereby hindering their contraction when setting, the said ends may, prior to the insertion of the concrete or grouting, be given a coating of oil, grease or the like.

When erecting fences or boundary walls in this manner, a hole may be formed in the ground immediately below the gap between adjacent slabs, so that the concrete or grouting, when poured, passes thereinto and serves as a post as well as a connecting member.

It will be obvious that, if desired, the mould 51 may be arranged so that one or both surfaces of the concrete or grouting will be flush with the adjacent faces of the slabs.

Whilst I have described in the foregoing specification certain practical embodiments of the invention and method employed in forming and erecting concrete walls therewith, it will be obvious that various modifications may be made in the construction of the apparatus and method of operation without departing from the spirit and scope of the same and, I therefore, do not wish to be understood as limiting myself by the positive terms employed herein.

Having now fully described and ascertained my said invention and the manner

in which it is to be performed, I declare that what I claim is:—

1. A method of forming and erecting concrete wall structures consisting in moulding slabs in tiltable moulds while the same are in a horizontal or other convenient moulding position and subsequently tilting the moulds from the moulding position to place the formed slabs vertically above a foundation.

2. A method of forming and erecting concrete wall structures consisting in moulding slabs in pivotally supported moulds while the same are in a horizontal or other convenient moulding position, and subsequently tilting the moulds from the moulding position and lowering or raising same to place the formed slabs vertically above a foundation.

3. A method of forming and erecting concrete wall structures consisting in moulding slabs in shallow moulds mounted on pivotal supports, tilting the moulds from the moulding position to a vertical position, and depositing the formed slabs on a foundation.

4. A method of forming and erecting concrete wall structures consisting in moulding slabs in shallow moulds mounted on pivotal supports, removing one or more sides from the moulds, tilting the moulds from a moulding position to a vertical position, and depositing the formed slabs on a foundation.

5. A method of forming and erecting concrete wall structures consisting in moulding slabs in a shallow tiltable tray or mould while the same is in a horizontal position, removing one or more sides from the mould, tilting the mould from a horizontal position and lowering the same to place the formed slab vertically above a foundation, removing the tray or mould from the erected slab, and covering or filling the spaces between the vertical edges of the erected slabs.

6. A method of forming and erecting concrete wall structures consisting in moulding slabs in shallow tiltable moulds having one or more removable sides, supporting the moulds in a horizontal or other convenient position during a moulding operation and until the slabs have set, tilting the moulds to a vertical position and to lower the slabs on to a foundation, removing the moulds from the erected slabs, connecting reinforcing bars projecting from adjacent vertical edges of the slabs, and filling the space between the adjacent edges of the slabs with grouting.

7. Apparatus for forming and erecting slabs for concrete and like wall structures, comprising a mould tiltably mounted on a support and having means whereby it can be maintained in a horizontal or other convenient position for moulding a slab and tilted to place the formed slab in a vertical position above a foundation.

8. Apparatus for forming and erecting slabs for concrete and like wall structures, comprising a shallow mould having removable sides, a pivotal support for the mould, means for retaining the mould in a horizontal position for moulding a slab therein, and means for tilting the mould to place the slab in a vertical position above a foundation.

9. Apparatus for forming and erecting slabs for concrete and like wall structures, comprising a shallow mould, means for detachably securing the sides and one end to the mould, and means for tiltably supporting the mould whereby it can be retained in a horizontal position for moulding a slab and placed in a vertical position to deposit a formed slab on to a foundation.

10. Apparatus for moulding and erecting slabs of concrete in forming wall structures comprising a shallow tiltable mould having removable sides, one or more stands or supports carrying pivoted supporting levers, pivotal connections between the work arms of the levers and the mould, and means for securing the levers and the mould in a fixed position during the moulding operation.

11. Apparatus for moulding and erecting slabs of concrete in forming wall structures, comprising a shallow tiltable mould, removable sides on the mould, levers connected to the mould and pivotally mounted on fixed stands or supports, means for retaining the mould in a position for moulding a slab therein, and means for firmly anchoring one of the sides of the mould to the slab to form a top wall plate.

12. Apparatus for moulding and erecting slabs of concrete in forming wall structures, a plurality of supporting stands having levers pivoted thereto, a cradle pivotally supported on the work arms of the levers, means for securing the levers in fixed positions on the stands, a plurality of trays detachably secured to the cradle, means for detachably securing side battens between the trays and the ends of the cradle and for clamping the trays closely together, means

for securing battens to the upper and lower ends of the trays, and means for retaining the cradle in a horizontal position during moulding operations constructed and arranged whereby the trays can be tilted to place a formed slab in a vertical position above a foundation.

13. Apparatus for moulding and erecting slabs of concrete in forming wall structures consisting of a plurality of stands or supports, levers pivoted to the said stands or supports, a cradle pivotally supported on the work arms of the levers, means for securing the levers in a fixed position on the stands or supports, members for connecting the cradle to the levers or to the supports for retaining it in a horizontal position, trays detachably mounted on the cradle, hook shaped brackets on the cradle and wedges for retaining the trays correctly in position on the cradle, hook shaped brackets on the upper ends of the trays for securing a top plate along the upper edges of the trays, a batten detachably secured to the lower edges of the trays, said trays and battens and top plate constituting a mould for a slab.

14. In apparatus for moulding and erecting slabs of concrete in forming wall structures, a tiltable cradle, a plurality of trays detachably secured to the cradle, detachable ends and sides secured to the tray and forming therewith a shallow mould, transverse grooves or corrugations in the trays and holes in the sides of the trays adapted to accommodate reinforcing bars disposed longitudinally in the recesses or corrugations in the trays.

15. Apparatus for moulding and erecting slabs of concrete in forming wall structures, comprising a plurality of fixed supports adapted to be located adjacent to a wall foundation, levers pivotally mounted on the supports, a cradle pivoted to the work arms of the levers, means for detachably connecting the levers to the cradle whereby it will be retained in a horizontal position, a plurality of trays having depending hook shaped members adapted to engage one side of the cradle, upwardly projecting hook shaped members or brackets on the ends of the cradle, side battens disposed between the hook shaped members and the sides of the trays, wedges for securely clamping the said battens to the trays and for retaining the trays closely together, a batten secured detachably to the lower ends of the trays, a batten or top plate detachably secured to the upper ends of the trays, and means in the bottom of the tray and in the side battens for accommodating longitudinally disposed reinforcing members.

16. Apparatus for moulding and erecting slabs of concrete in forming wall structures according to Claim 14, wherein the tray consists of two side members connected near their ends by transverse bars, boards or metal sheeting covering the bottom of the tray and having grooves or corrugations therein, and means for securing battens to the upper and lower ends of the said tray.

17. Apparatus according to Claim 14, wherein nails or wires project inwardly from the top plate or batten whereby it will be securely anchored to a slab moulded on the tray.

18. Apparatus for moulding and erecting slabs of concrete according to Claim 14, wherein spacing battens are interposed between the trays on the cradle and said battens are of less depth than the sides of the tray.

19. Apparatus for moulding and erecting concrete slabs according to Claim 7 or 14, wherein recesses are formed in the bottom of the trays or moulds and battens are located in the bottom of the recesses and provided with upwardly projecting members whereby they will be securely anchored to the face of a slab formed in the said mould.

20. Concrete slabs for walls or buildings having raised ribs or projections formed thereon and battens secured thereto by members projecting therefrom and moulded into the slab.

21. Concrete slabs for walls of buildings having raised ribs or projections formed thereon, and battens secured to the raised ribs or projections with spaces between the ends thereof providing passages for free circulation of air between linings secured to the battens and the faces of the slabs.

22. A building slab of concrete having ribs or projections on the face thereof formed of breeze concrete, substantially as described.

23. Apparatus for moulding and erecting concrete slabs according to Claim 7 or 14, wherein recesses are formed in the bottom of the trays or moulds, and means are provided for mounting bolts, rivets or like

fastening members in the recesses, in such manner that when a slab is formed, portions of the said fastening members will be left protruding therefrom.

24. In apparatus for moulding and erecting concrete slabs according to Claim 14, recesses in the mould and holes in the moulding faces of the members forming the recesses adapted to temporarily receive the ends of bolts, rivets or the like whereby when a slab is formed in the mould the upwardly extending portions of the bolts or rivets will be anchored therein and the portions temporarily received in the holes will be left projecting from the face of the slab.

25. A slab for use in the erection of concrete buildings having one side thereof of flat formation and the opposite side provided with a series of vertical recesses extending near to the upper and lower ends thereof characterised by the fact that the portions located between the recesses form ribs or projections.

26. In the erection of concrete structures according to Claim 2, coating the ends of adjacent slabs with oil, grease or the like, placing moulds around the gaps between the slabs, and filling the same with grouting or concrete.

27. In the erection of concrete structures according to Claim 2, forming holes in the ground below the gaps disposed between adjacent slabs placing moulds around the gaps and filling the moulds and holes with cement or concrete to form combined posts and connecting members.

28. Apparatus for moulding and erecting slabs of concrete for forming wall structures, consisting of the combination of parts constructed and arranged substantially as hereinbefore described and as illustrated in Figures 1 to 7 of the drawings.

Dated this twenty-fifth day of July, 1927.

THOMAS WALKER FOWLER,
By his Patent Attorney,
CLEM. A. HACK.

Witness—J. W. Mansfield.

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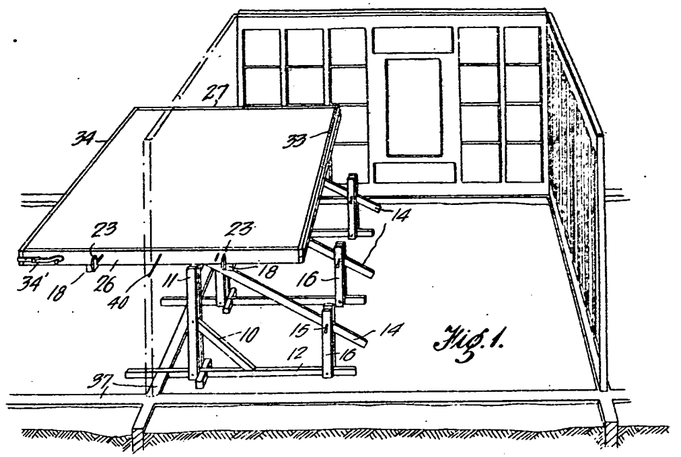

Fig. 1.

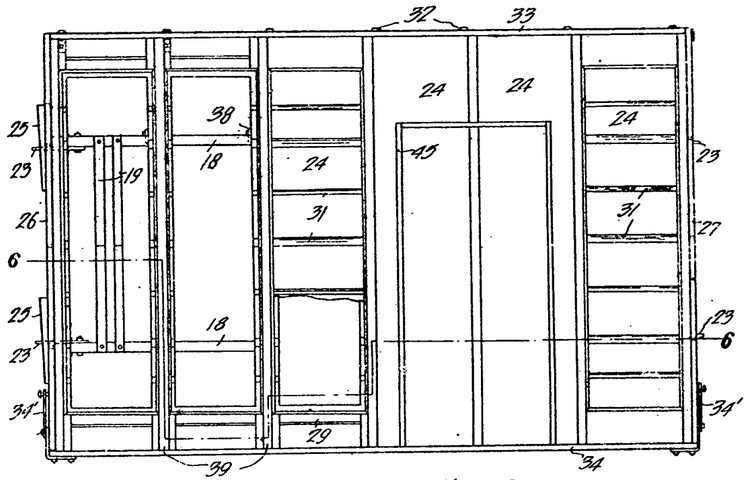

Fig. 5.

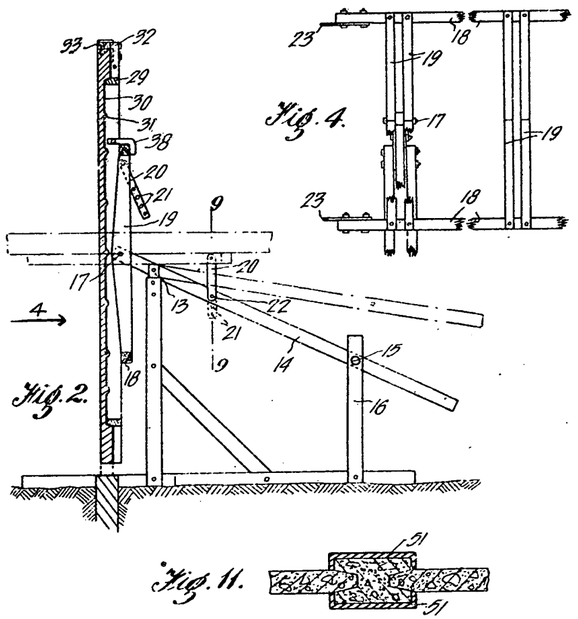

Fig. 2.

Fig. 4.

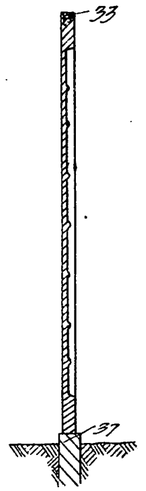

Fig. 3.

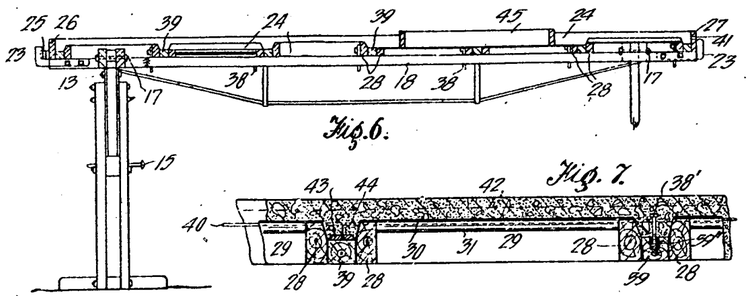

Fig. 6.

Fig. 7.

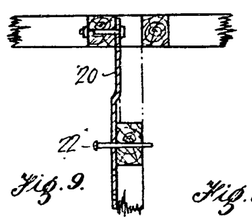

Fig. 9.

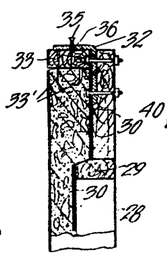

Fig. 8.

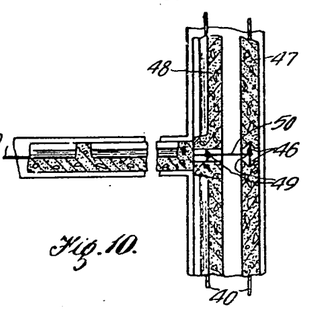

Fig. 10.

Fig. 11.