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3,016,595

MOVABLE ARC FORM AND BUILDING METHOD

Filed Feb. 4, 1957

2 Sheets-Sheet 1

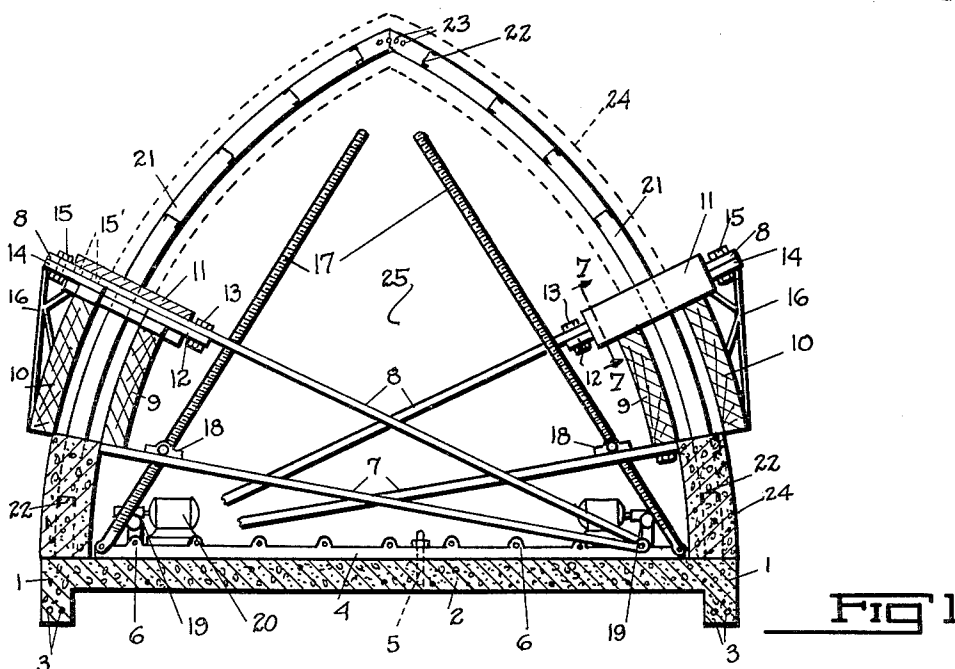
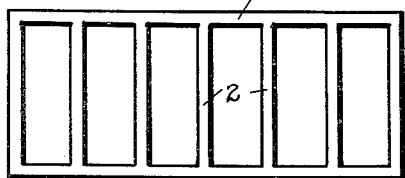
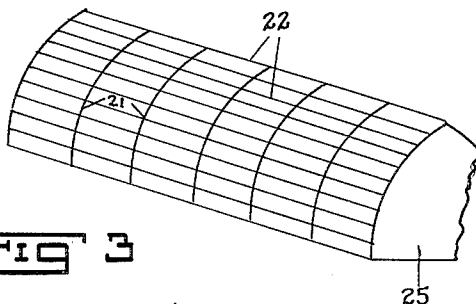
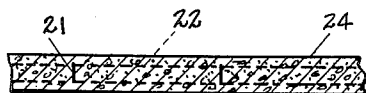
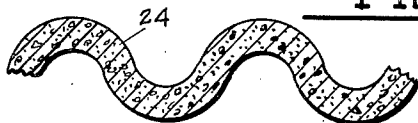
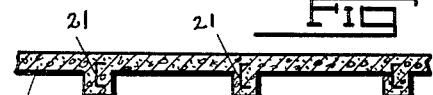
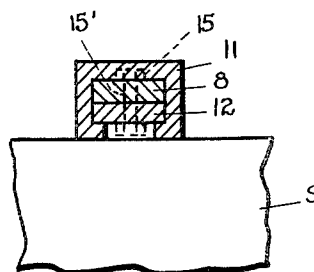


FIG 2

FIG 3

FIG 4

FIG 5

FIG 6

FIG 7

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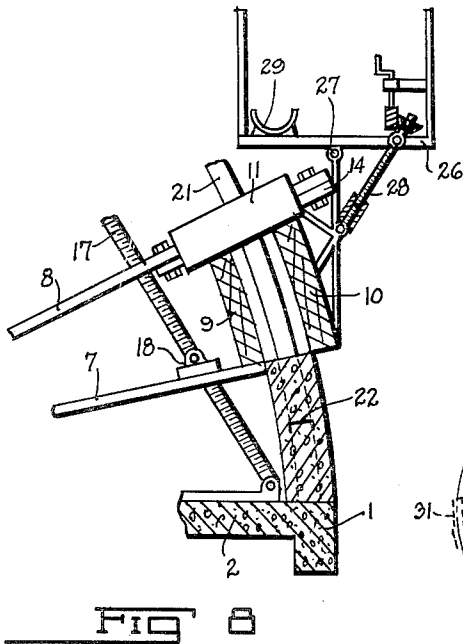
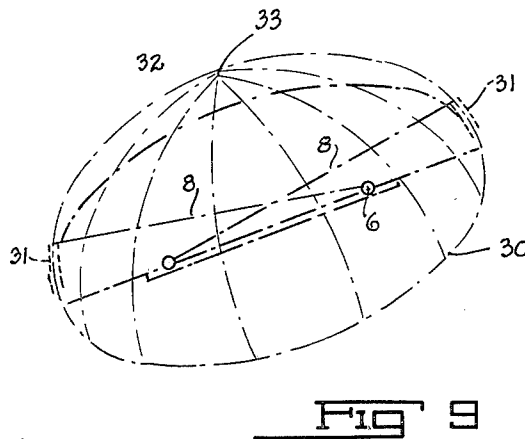
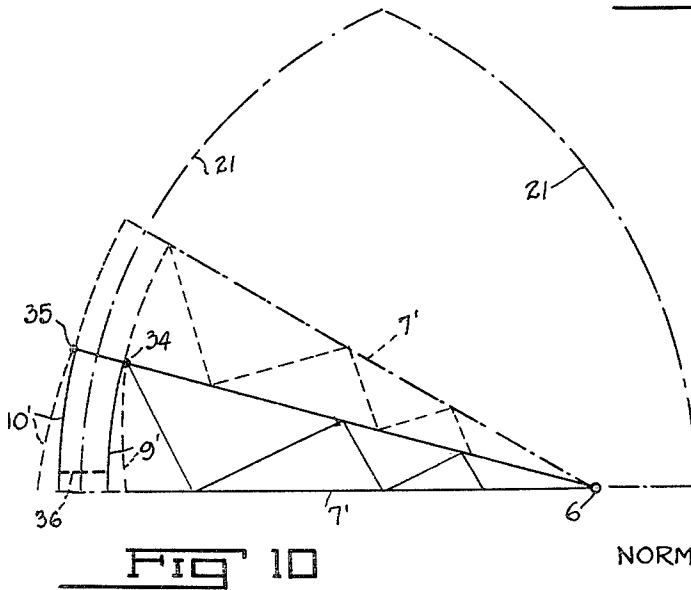
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2 Sheets-Sheet 2



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MOVABLE ARC FORM AND BUILDING METHOD

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11 Claims. (Cl. 25—131)

This invention relates in general to forms for poured concrete structures and in particular to collapsible movable arc forms and method of using same.

Movable forms in themselves are not new, and the prior art shows them used in a horizontal plane operating from a fixed central pivot to erect a cylindrical structure; and also, pivoted above the base to swing through horizontal and vertical planes to form a substantially spherical structure.

However, nothing has been found in the prior art which shows movable arc forms on both sides of a structure, both being raised at the same time until they meet at the center to complete the main body of the structure, the forms being easily removable for reuse.

The removable arcuate movable forms may be of any desired radius and may be used for building structures of various types including gymnasiums, underground bomb and fallout shelters, field houses, hangars, factories and the like, as well as for structures such as overpasses, bridges and the like. It can be used for arched concrete roofs on walls of conventional construction. The forms may be changed after a portion of a structure is erected for forming a structure with a composite arc.

The objects of my invention are, first; to provide in a building construction, a plurality of collapsible movable arc forms each carried on raisable beams pivoted to a base at predetermined spaced points.

Second; to provide oppositely disposed movable arc forms arcuately raisable in predetermined increments toward each other to meet at the apex and form a building structure.

Third; to employ the movable arc forms for raising the framework and then for forms for the pouring of the arcuate wall and roof structure, the forms being carried by pivoted beams for both steps or by the erected framework for the wall pouring operation.

Fourth; to provide a beam casing in the movable arc form, said casing remaining after the concrete is poured to form a ventilator.

Fifth; to provide a movable arc form structure mounted on crossing pivoted arms carried at predetermined spaced pivot points on a base member.

Sixth; to provide elongated movable arc forms carried by a plurality of beams arcuately movable by means of spaced jacks, whereby an entire wall can be formed in predetermined vertical increments.

Seventh; to provide a base with a plurality of pivot points for adjustment of beams for forming a building of desired width.

Eighth; to provide a building structure formed by movable arc forms carried by a plurality of beams radiating from centrally located pivot points to form structural arches terminating at a common apex, the base points of the arches forming any desired pattern.

Ninth; to provide movable arc forms arcuately raisable to form an arched structure and working platforms raisable with the movable arc forms from which concrete may be poured, means being provided to maintain the platform on a horizontal plane as the forms are raised.

Tenth; to provide a modified form of beam with inner and outer movable arc forms hinged at the upper edge to the beam with lower tie wires or bolts holding the forms together and being rupturable or removable after the concrete has set.

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Other objects and advantages as well as the construction and use of my invention will be better understood by reference to the following description in connection with the accompanying drawings in which:

FIG. 1 is a vertical cross sectional view of the movable arc form assembly in use, parts being shown in elevation.

FIG. 2 is a reduced plan view of a foundation or footing prepared for a building to be constructed in accordance with my invention.

FIG. 3 is a reduced, isometric, diagrammatic view of the framework of a building constructed with my invention.

FIGS. 4, 5 and 6 show some of the contours possible with my movable arc forms.

FIG. 7 is an enlarged fragmentary sectional view on the line 7—7 of FIG. 1.

FIG. 8 is a fragmentary view of one of the movable arc forms with a working platform attached.

FIG. 9 is an isometric view of a modified form of construction in which my invention is employed to form concrete arches for a circular building.

FIG. 10 is a vertical cross sectional, diagrammatic view of a modified form of movable arc form assembly.

Referring now to the drawings by numerals of reference, 1 designates concrete footings with suitable cross footings 2, any suitable reinforcing means such as bars 3 or the like being employed in a well known manner.

Paralleling each cross footing 2 is a pivot base 4 suitably secured to the footing by anchor bolts 5 embedded in the footing 2. The pivot base 4 has a plurality of spaced upstanding lugs 6 to certain of which beams 7 and 8 are pivotally secured, the precise lugs depending on the width and height of building desired.

The beams 7 and 8, while they meet at the pivot point at lugs 6 at one end diverge and carry movable arc forms 9 and 10, the length of the forms being equivalent to the distance between the cross footings 2 or any multiple thereof depending on physical limitations of the material from which the forms are made and the total length of the building. The movable arc forms can be joined or spliced to form any desired length.

Lower beam 7 extends to but not beyond the outer edge of the inner form 9, whereas upper beam 8 extends beyond the outer form 10 and slidably passes through a casing 11 (see FIGS. 1 and 7). The inner form 9 has transverse arm 12 which also slidably rests in casing 11 and is secured to the upper beam 8 by suitable securing means 13. The outer form 10 has transverse arm 14 which is slidably received by casing 11 and is secured to upper beam 8 by suitable securing means 15, suitable truss reinforcement 16 being provided between the outer form and the transverse arm 14.

The movable arc forms may be of any desired contour to form walls 24 such as shown in FIGS. 4, 5 and 6. They may be made of wood, metal or any other suitable material and may be used time and again without the necessity of making new forms.

Raising and lowering of the beams and forms may be accomplished by any suitable means and I have shown one form in which screw jacks 17 are pivotally and rotatably carried by the pivot base 4 in any suitable manner, the screw jack threadedly engaging the lower beam 7 at pivoted collar 18, suitable jack rotating means 19 including driving means 20 being provided.

In using the movable arc forms and method comprising my invention, after the footings 1 and 2 are poured with anchor bolts 5 in place, pivot bases 4 are properly secured in place at each cross footing 2.

Each oppositely disposed set of beams 7 and 8 may be offset or angularly disposed so as to clear each other as they are raised and lowered. With beams 7 assembled

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to the pivot bases the inner forms 9 are assembled in place after which the upper beams 8 may be inserted from the inside or outside of the building frame depending on physical limitations, after which the casing 11 and outer forms 10 may be assembled and secured to the beams 8. A plurality of apertures 15' at the outer end of upper beams 8 are provided for the securing of outer forms 10 in proper spaced relation to the inner forms to give the proper thickness to the wall being poured.

My invention can be used for the raising of the framework prior to the pouring of the concrete and when so used is assembled in the same manner as just described. The arched structural members 21 are set in place in the movable arc forms which may be at their lowest position or may be partially elevated if the outer footings are raised. After the arched beams 21 are initially placed the forms may be raised by operation of the screw jacks and a plurality of cross beams 22 may be assembled and as the forms are lowered in desired increments additional cross beams 22 are assembled temporarily forming a complete skeleton ready to receive the concrete walls. With the forms in proper alignment at their lowermost point the concrete is poured on both sides of the building and permitted to set sufficiently for the next pouring. Reinforcing rods 23 may be inserted at any time before the concrete is poured. Door and window openings may be framed out prior to pouring and will not interfere with the operation of the forms.

With the jacks power operated and synchronized it is a simple matter to raise all the forms simultaneously a predetermined amount. Individual power or manual operation of each jack may be provided for small aligning adjustments when necessary. When the forms have reached the top of the structure and the concrete has set, the outer forms 10 are disassembled from the upper beams 8 and lowered to the ground in any convenient manner, the inner forms are disassembled from the upper beams 8 for removal of said beams through the casing 11 the latter being left in place for use as ventilators, any suitable weatherproofing capping means being applied to said casings. The jacks are then operated to lower the inner forms 9 and beams 7 after which they are disassembled and moved to the next building site.

The end walls 25 may be finished in any suitable manner or poured at the same time as the arcuate walls.

In the modification shown in FIG. 8, a working platform 26 with suitable hand rails may be pivotally secured at 27 to projection from transverse arms 14, a leveling screw 28 being provided to keep the platform level during raising and lowering thereof. A concrete conveyor 29 may run along the platform to direct concrete into the forms.

In the modification shown in FIG. 9, a circular foundation 30 is used, the movable arc forms 31 being of predetermined size and shape to form concrete arches 32 meeting at common apex 33, the beams and forms being pivotally moved in a horizontal plane to a new position for pouring new arches. When the arches are poured and set they will form a skeleton structure for reception of any desired covering.

In the modification shown in FIG. 10 truss beams 7' may be used with forms 9' and 10' hinged at 34 and 35 to the beam, a tie wire or bolt 36 being used adjacent the bottom of the forms to hold them at the proper spacing while the concrete is being poured and during setting. When the concrete has set the tie wire 36 is cut, or if a bolt is used it is removed and the hinged forms spread to separate them from the concrete for easy movement to the next position in the same manner as described earlier in this specification.

From the foregoing it will be apparent that I have provided a new and novel movable arc form and method for constructing a concrete structure in which both sides or opposite frames of a structure may be simultaneously formed and poured in desired increments, the forms being

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moved from one position to the next until they meet at the apex after which they are disassembled and lowered for reuse. I have also provided a work platform movable with the forms to facilitate pouring of the concrete.

It is obvious that changes in form, proportion and details of construction may be resorted to without departing from the spirit of my invention, and I reserve all rights to such changes as come within the scope of these specifications and the claims which follow.

What I claim as new and desire to secure by Letters Patent is:

1. An apparatus for erecting a metal framework and molding an arched concrete wall structure on said erected framework, comprising a set of form members along each of two opposite sides of the structure, each set of form members comprising an inner and an outer form member, a casing for each set of form members extending transversely of its respective set of form members, the casings being located adjacent the upper edge of the form members, a transverse pivot base, an upper beam for each set of form members, said upper beams having one end slidably received in its respective casing, the other end of each upper beam being pivotally and adjustably connected to the transverse pivot base, a lower beam for each set of form members, one end of each lower beam being secured to the lower edge of its respective inner form member, the other end of each lower beam being pivotally and adjustably connected to the transverse pivot base at the same point as its respective upper beam, and means connected to each lower beam for raising the beams and form members in desired increments.

2. An apparatus for molding arched concrete structures employing a movable arc form, comprising an inner and an outer form member, one form member being spaced from the other form member, a casing in which both form members are supported, a lower support member pivotally supported at one end thereof, the other end of the lower support member being secured to the inner form member, an upper support member operating on the same pivot point as the lower support member and received by the casing, and means for raising and lowering the form members.

3. The structure as specified in claim 2, the inner and outer form members being slidably supported by the casing, the upper supporting member being slidably received by the casing, the inner and outer form members being detachably secured to the upper supporting member.

4. The structure as specified in claim 2, the inner and outer form members being slidably supported by the casing at the upper edge of the inner and outer form members, the form members being removably and adjustably secured to the upper support member.

5. An apparatus for molding arched concrete structures employing a movable arc form, said movable arc form comprising parallel, longitudinally and oppositely disposed sets of inner and outer form members, elongated base members transversely disposed between each opposite set of form members, form supporting means each pivotally secured at one end to a selected pivot point on its respective base member, and form actuating means arcuately moving each set of form members toward a common apex at desired increments, said form supporting means comprising pairs of angularly related beams, each pair of beams meeting at common pivoted ends, one beam of each pair of beams being secured to its respective inner form member, the other beam of each pair of beams being removably secured to both form members of its respective set of form members.

6. The structure as specified in claim 5, the form actuating means being operatively related to the first mentioned beam which is secured only to its respective inner form member.

7. An apparatus for molding arched concrete structures employing a movable arc form, said movable arc form comprising parallel, longitudinally and oppositely

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disposed sets of inner and outer form members, elongated base members transversely disposed between each opposite set of form members, form supporting means each pivotally secured at one end to a selected pivot on its respective base member, and form actuating means arcuately moving each set of form members toward a common apex at desired increments, and casings each engaging its respective set of form members and form supporting means, said casings being releasable from the form members and the form supporting means for retention in the poured concrete structure when pouring is completed.

8. A method of forming a curved wall structure on a precast foundation which comprises the placing of base members in removable securable relation to the foundation, pivotally securing oppositely disposed support members to each of the base members, removably mounting spaced forms on the free end of each support member, swinging the supports and forms arcuately in steps, and pouring concrete into the forms and permitting the concrete to set before swinging the forms from step to step to form abutting arcuate wall sections until they meet at an elevated central junction.

9. A method of forming a curved wall structure on a precast foundation which comprises the placing of base members in removable securable relation to the foundation, pivotally securing oppositely disposed support members to each of the base members, removably mounting spaced form members hinged to the free end of each support member, temporarily securing the free end of each hinged form member in definite spaced relation during the pouring and setting of the concrete, pouring the concrete into the forms and permitting the concrete to set, swinging the supports and form members arcuately in steps to form abutting arcuate wall sections until they meet at an elevated central junction, releasing the free ends of the hinged form members after each section of wall has set, and swinging each form member away from the wall prior to movement of the form members arcuately upward to a new position.

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10. A method of forming a structure with curved opposite walls on a precast foundation, which comprises the placing of removable base members having a plurality of pivot points, placing sets of spaced form members along opposite sides of the foundation, pivotally securing oppositely disposed support members between the form members and one of a plurality of pivot points on the base members, pouring concrete into the forms and permitting the concrete to set, swinging the supports and form members arcuately upward in steps to form abutting arcuate wall sections meeting at the apex, lowering and removing the forms and support members, and removing the base members.

11. A method of forming a structure with a plurality of arches rising from a circular foundation and terminating at a common apex, which comprises the placing of a base member centrally pivoted on the foundation, pivotally securing oppositely disposed support members to one of a plurality of pivot points on the base member, securing a form on the free end of each support member, pouring concrete into the forms and permitting the concrete to set, swinging each support member and form arcuately in steps to form arches meeting at a common apex, and pivoting the base member to a new location to provide a second arch meeting at a common apex, and repeating the process until all the arches have been formed.

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