

Dec. 5, 1967

C. T. MULLEN, JR
METHOD AND APPARATUS FOR MONOLITHIC CASTING
OF SWIMMING POOLS OR TANKS

3,355,897

Filed April 17, 1963

7 Sheets-Sheet 1

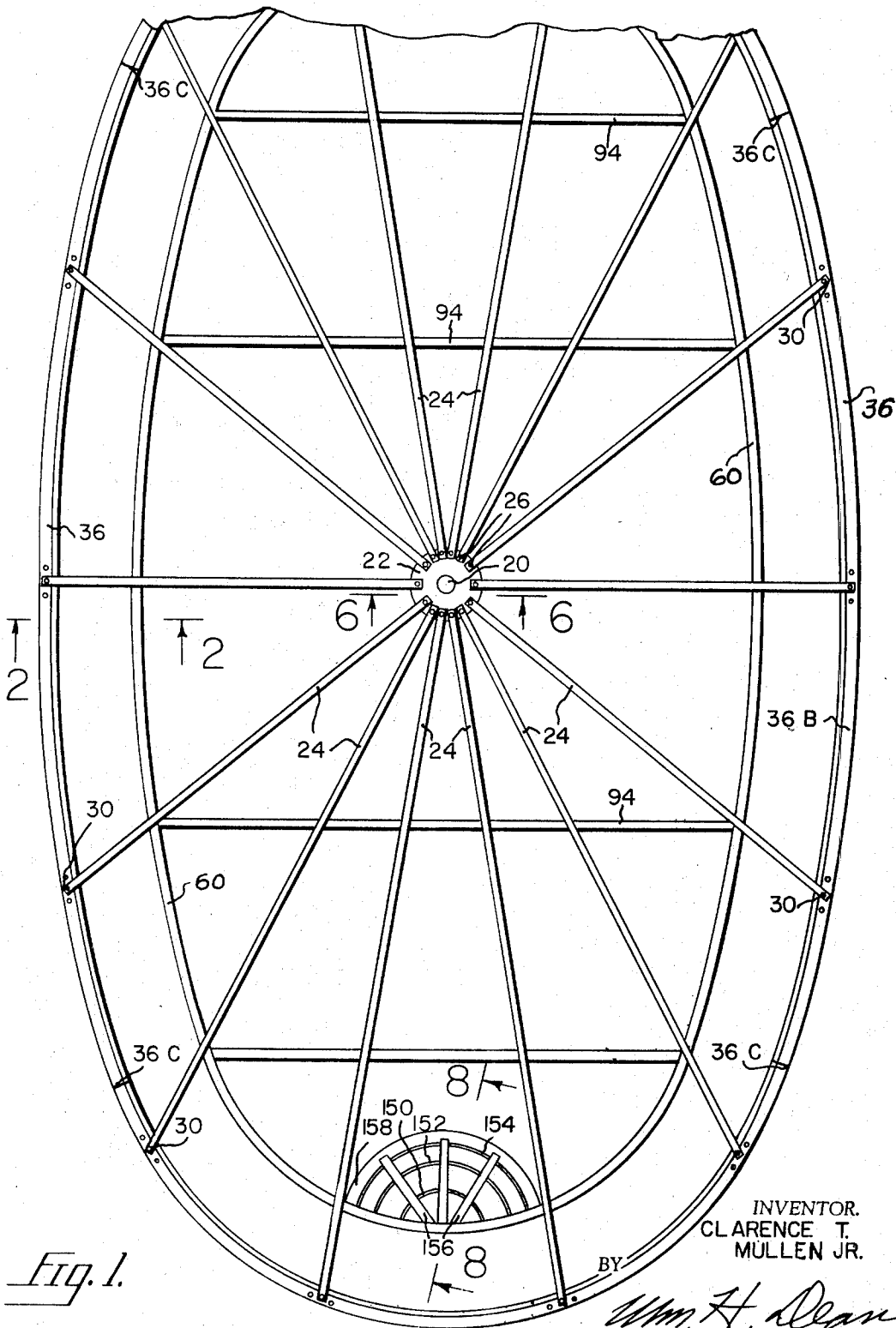


Fig. 1.

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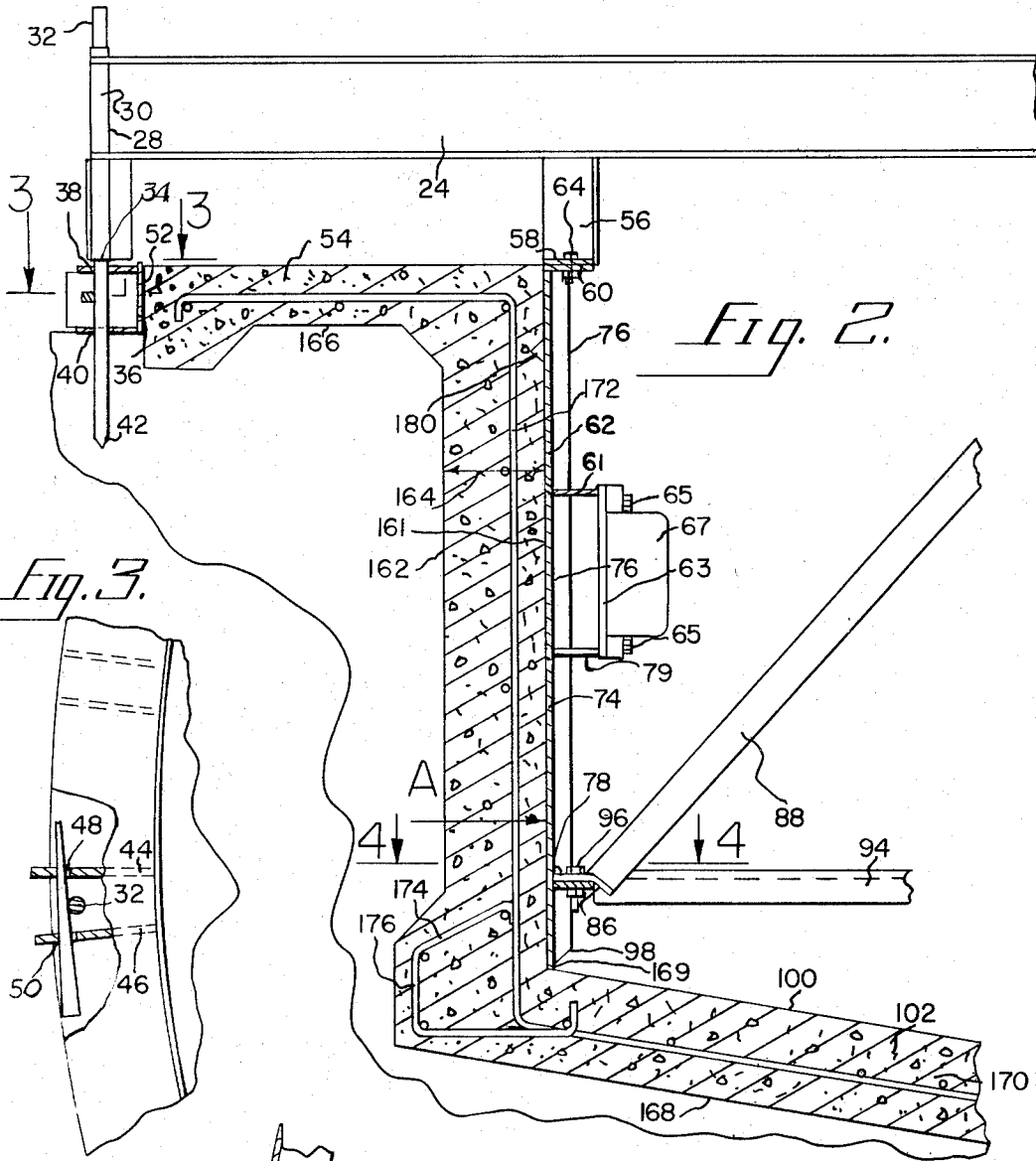


Fig. 2.

Fig. 3.

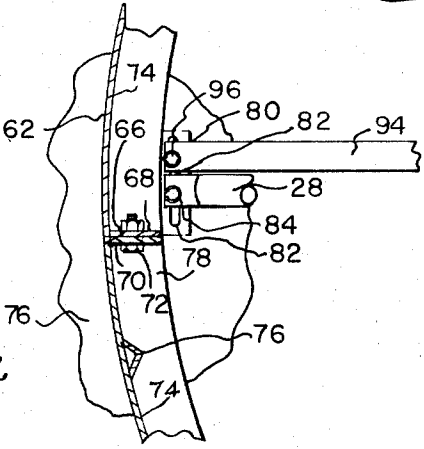
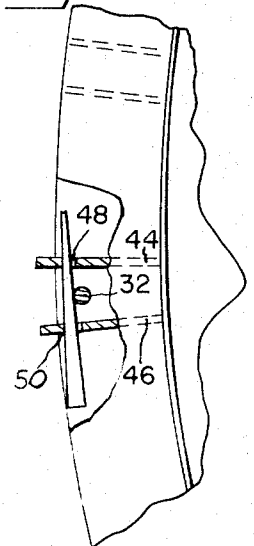


Fig. 4.

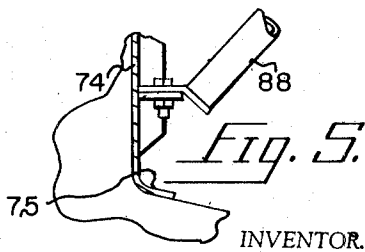


Fig. 5.

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Fig. 6.

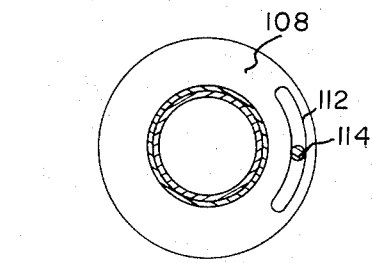
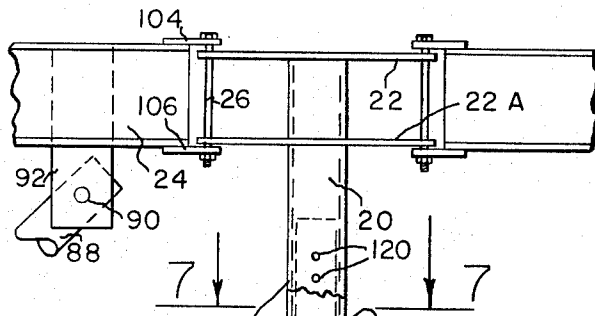
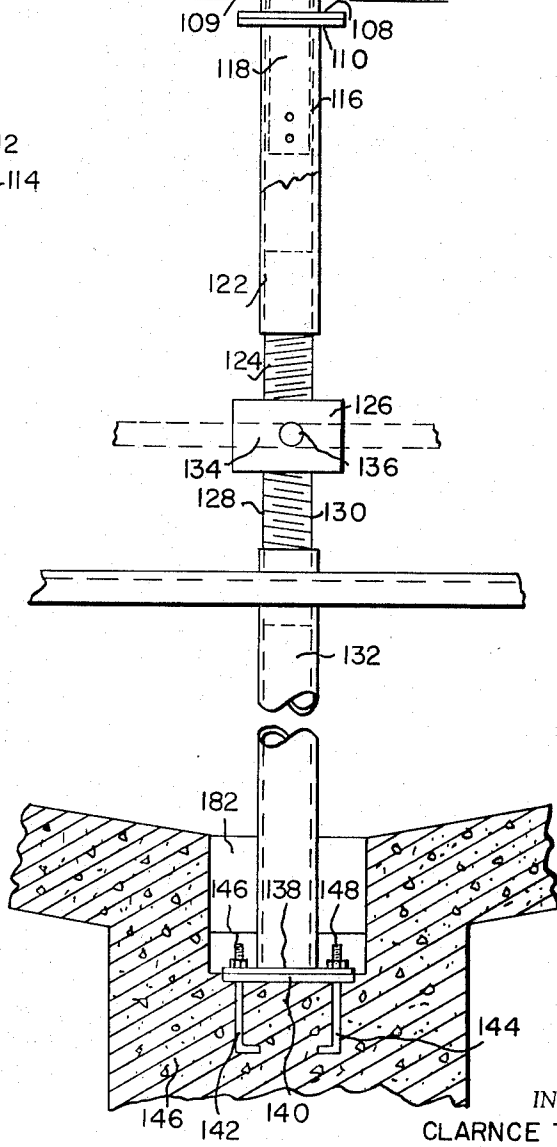


Fig. 7.



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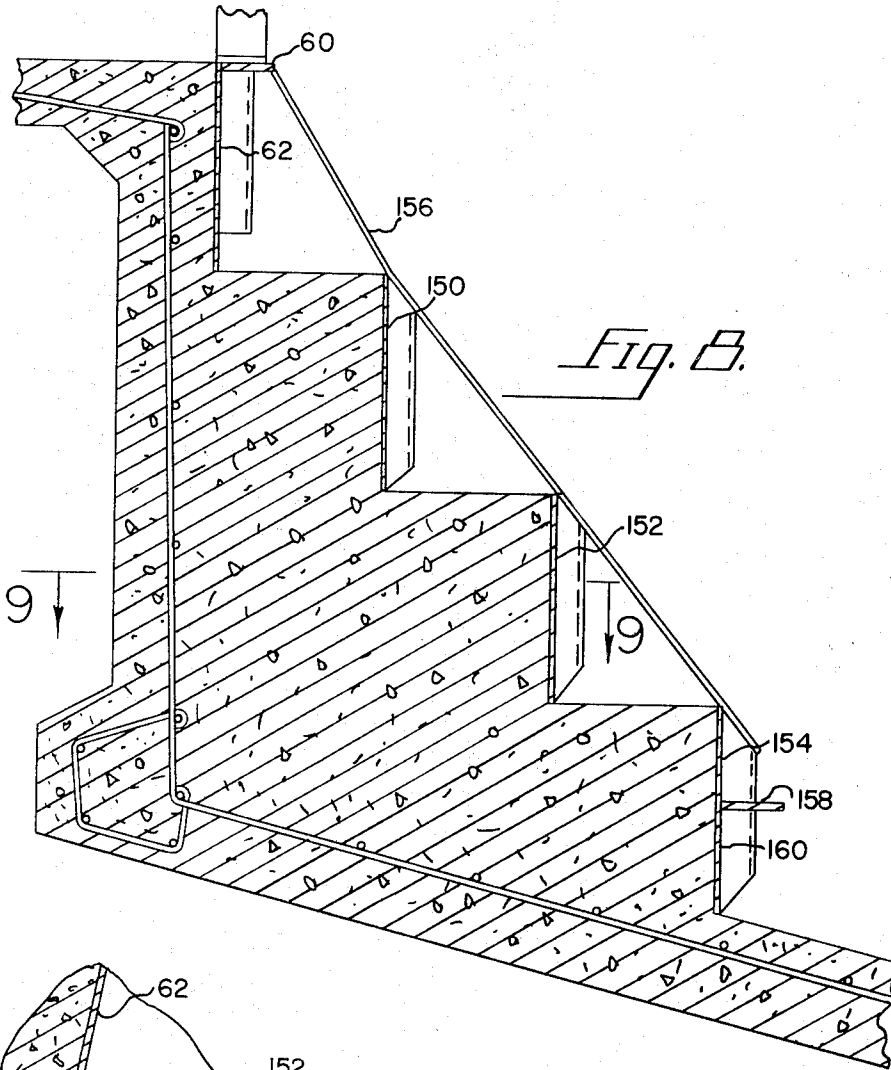


Fig. 8.

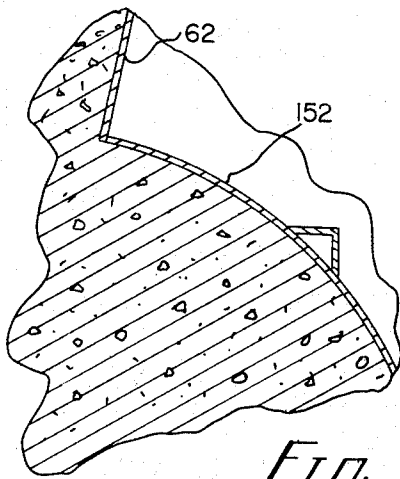


Fig. 9.

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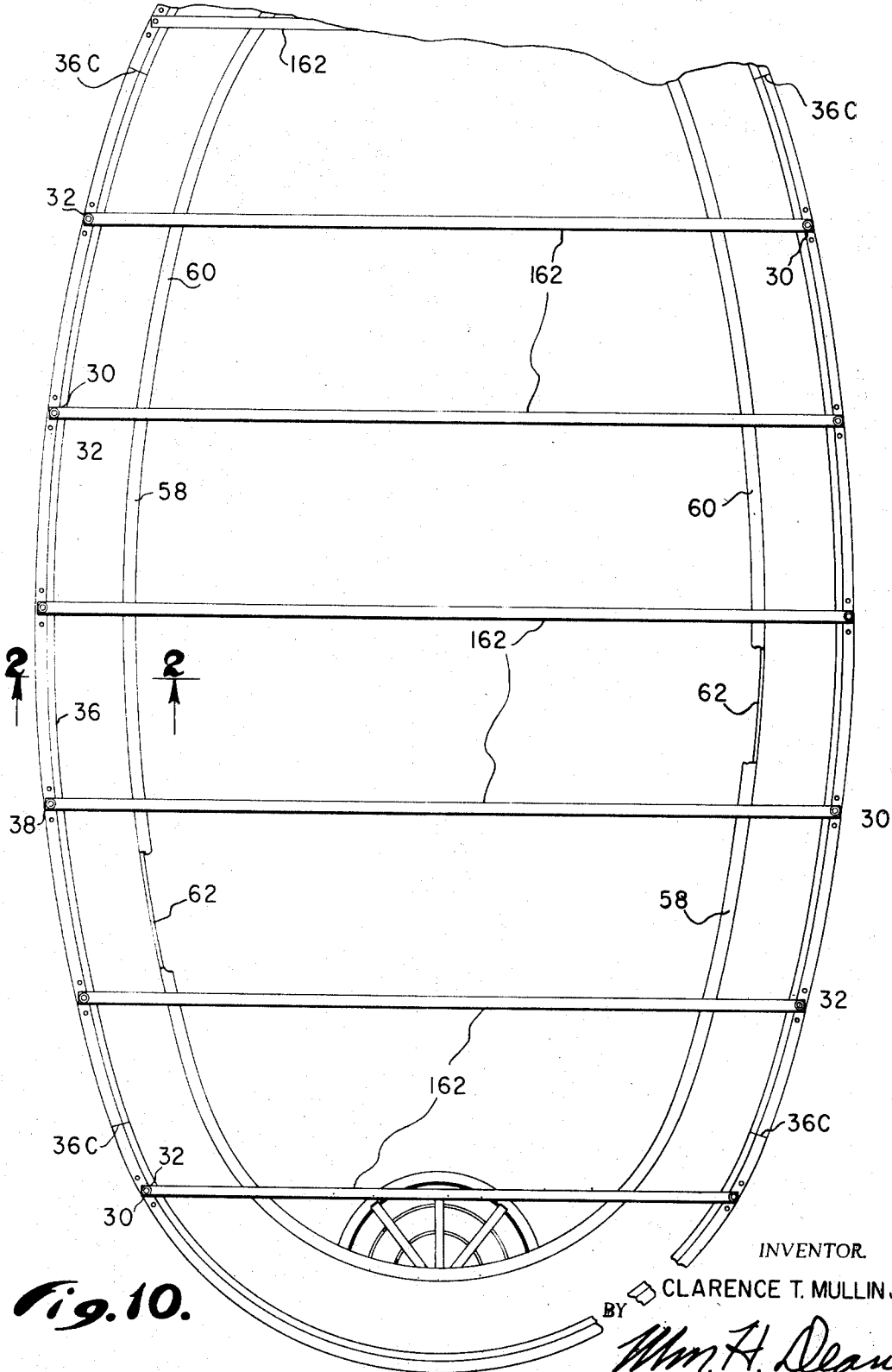
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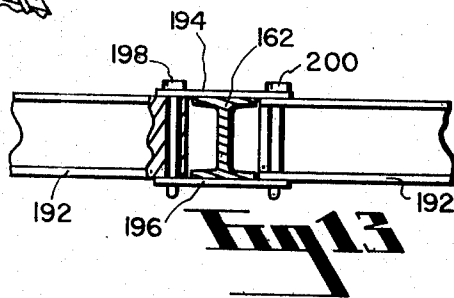
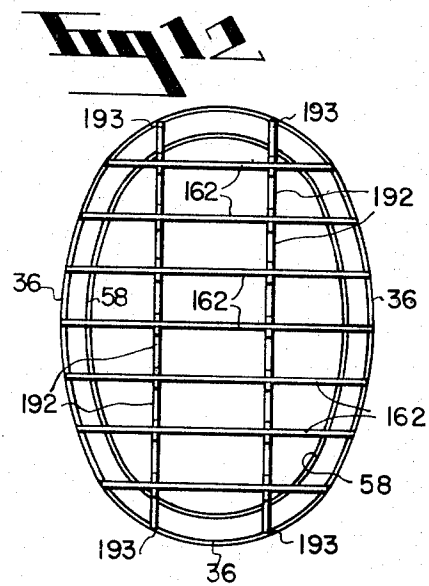
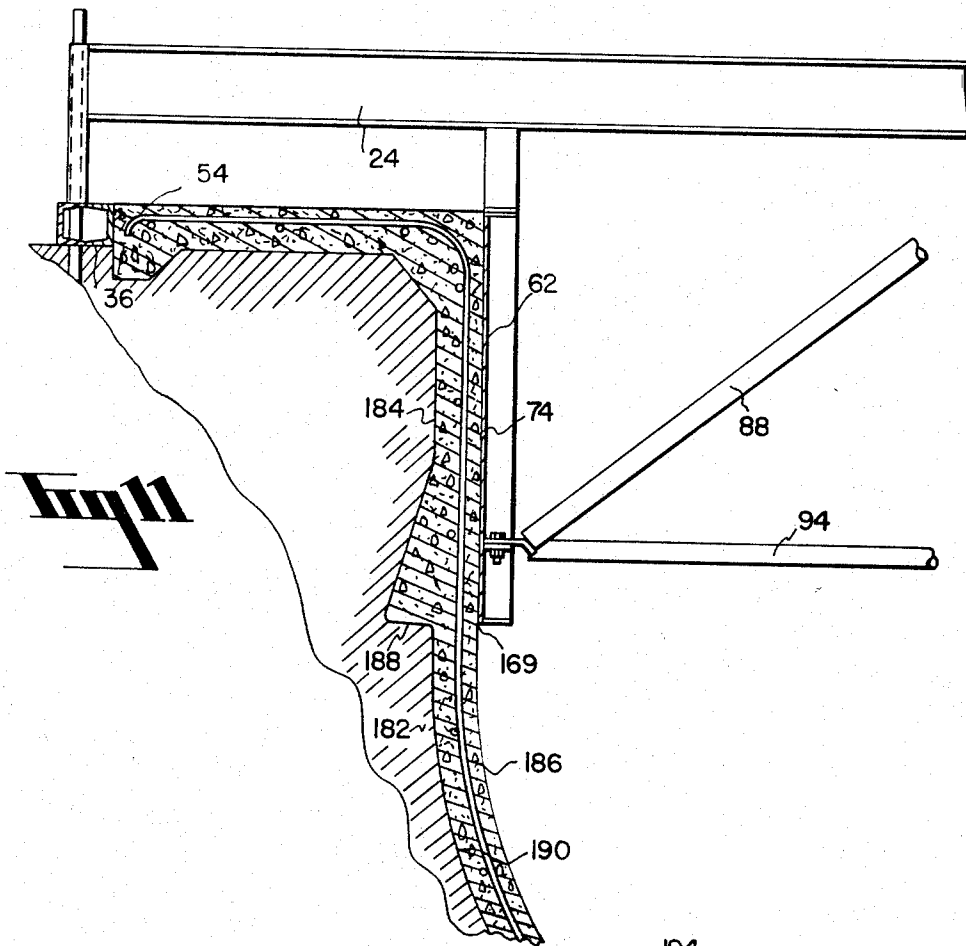
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Fig 14

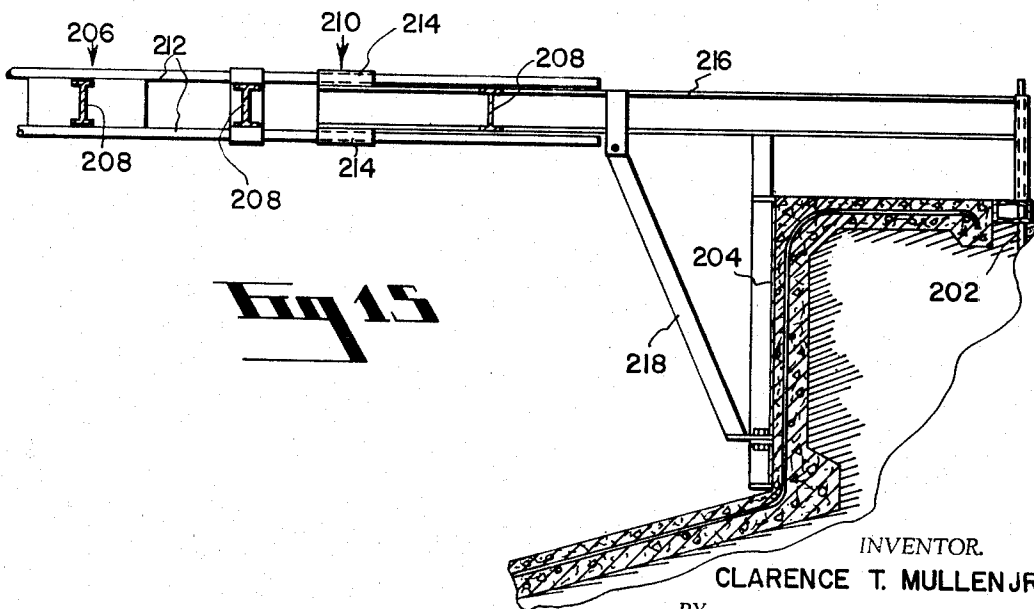
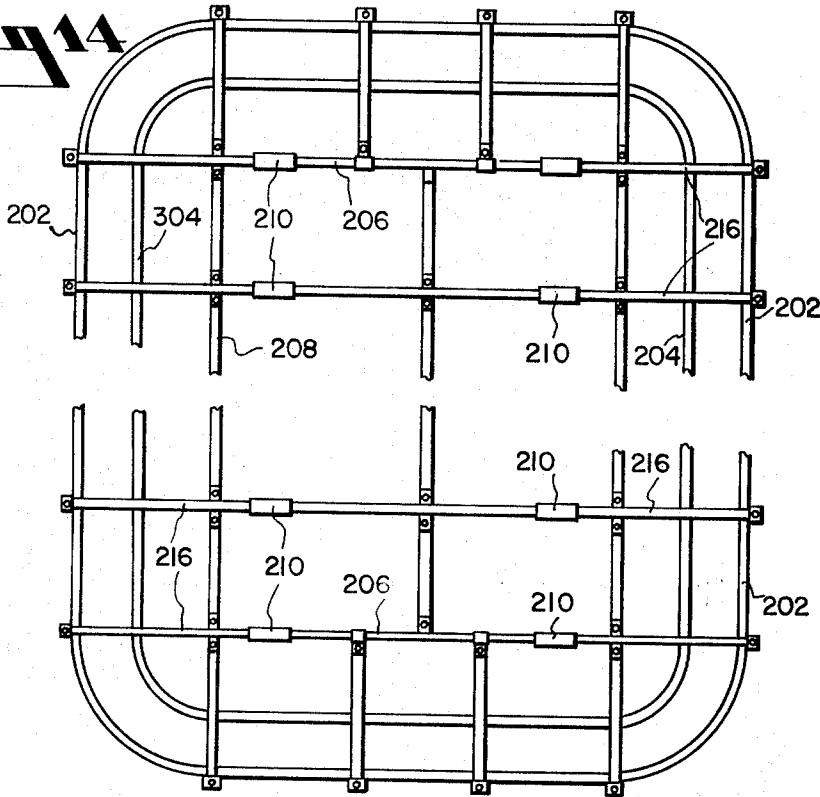


Fig 15

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METHOD AND APPARATUS FOR MONOLITHIC CASTING OF SWIMMING POOLS OR TANKS

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26 Claims. (Cl. 61-35)

This invention relates to a suspension form means for the monolithic casting of swimming pools or tanks, and more particularly to such a form means, which may readily be assembled in an excavation and which provides surfaces, adjacent to which the inner wall surfaces of a swimming pool or tank, as well as the coping thereof, may be cast.

This application is a continuation in part of my co-pending application, Ser. No. 156,174, filed Nov. 30, 1961.

Conventional methods of constructing tanks or swimming pools are quite costly and generally include either expensive custom forms or expensive equipment for the placement of concrete in an excavation.

The prior art casting of monolithic concrete swimming pools or tanks has involved forms which are very expensive from the standpoint of assembly and labor cost, as well as the expenditure of short-lived lumber or other materials.

The conventional Guniting method of producing swimming pools involves very expensive equipment which sprays concrete to form a wall layer over reinforcing steel placed adjacent fine graded walls of an excavation.

Additionally, conventional prior art form structures are sometimes very bulky and will not lie within the peripheral limits of a swimming pool and coping structure. Accordingly, some of these forms cannot be used in confined places where it is desired to construct a swimming pool.

The custom construction of wooden forms for the monolithic casting of swimming pools is very expensive, not only in design but labor cost of building the forms preliminary to the casting of the concrete, but also due to rapid deterioration of such forms. Additionally, a great amount of time is required for the custom building of the forms and the final completion of a pool, according to such conventional methods.

Accordingly, it is an object of the present invention to provide a suspension form means for monolithic casting of swimming pools which are very compact, easy to handle, economical to assemble and disassemble, and which, thereby, greatly reduces the cost of producing swimming pools.

Another object of the invention is to provide a suspension form means for monolithic casting of swimming pools, wherein a complete inner swimming pool wall form and coping form structure is supported from beams connected to a center pole, whereby the overall area of the form structure is limited to the area of a swimming pool and coping to be cast adjacent thereto.

Another object of the invention is to provide a suspension form means for monolithic casting of swimming pools which may be used in confined areas, due to the fact that said form means does not extend beyond the area of the swimming pool and coping to be produced.

Another object of the invention is to provide a suspension form means for monolithic casting of swimming pools which very accurately and very simply establishes a grade level for the upper structure of a swimming pool.

Another object of the invention is to provide a suspension form means for monolithic casting of a swimming pool which is very durable and very accurate in the production of swimming pools of a desired geometrical shape.

Another object of the invention is to provide a suspension form means for monolithic casting of swimming pools which permits swimming pools to be cast in excavations, whereby a minimum of finishing labor is required after the forms are removed.

Another object of the invention is to provide a suspension form means for monolithic casting of swimming pools wherein a center pole structure is located in an excavation and is provided with adjustable radiating beams and brace means for holding swimming pool wall forms, and also coping forms, spaced outwardly thereof, whereby the coping forms and swimming pool side wall forms are precisely held in relation to each other, and whereby a minimum of assembly and set-up time is required to prepare the forms for monolithic pouring of the side walls and the coping of a swimming pool.

Another object of the invention is to provide a suspension form means for monolithic casting of swimming pools wherein a center pole and radiating beam structures are disposed to support side wall forms which are braced relative to the radiating beams by inclined, diagonal braces which are considerably elevated above the bottom of the pool, thereby permitting the bottom of the pool to be trowel-finished without having the brace structure interfere with actions of the laborers during the finishing operations on the bottom of the pool.

Another object of the invention is to provide a suspension form means for monolithic casting of swimming pools wherein a center pole is anchored in a central location of an excavation in order, rigidly and accurately, to support radiating beams, which support side wall and coping forms, and whereby the anchoring of the center pole resists forces on the forms during the pouring of the swimming pool side walls around the forms.

Another object of the invention is to provide a suspension form means for monolithic casting of swimming pools wherein a side wall form member contains inwardly directed arcuate sections in vertically stepped relationship to each other to thereby provide for the casting of steps inwardly of the pool and integral with the monolithic side wall and bottom structure of a pool.

Another object of the invention is to provide a suspension form means for monolithic casting of quite large swimming pools wherein a center pole and radiating beam structures support a generally elliptical assembly of side wall and coping forms, which due to their particular geometry, resist inward pressure of concrete being poured against the forms, thereby the overall assembly of form structures may be light enough so that the individual parts, thereof, may readily be handled by laborers during the assembly of said form means.

Another object of the invention is to provide a suspension form means for monolithic casting of swimming pools wherein a generally elliptical assembly of side wall forms is composed of individual curved sections which are readily interchangeable at opposite ends of the elliptical assembly, and wherein a center pole supports radiating beams connected to said elliptical assembly at the upper portions and brace support the lower portions of the sections whereby various parts of the form means are interchangeable at opposite ends of the elliptical assembly thereof.

Another object of the invention is to provide a novel suspension form means and method for producing swimming pools whereby forms are supported in spaced relation to walls of an excavation and the surfaces of the forms are vibrated by means attached to the form which causes the fines, of concrete poured between the excavation walls and the form surfaces, to concentrate at the surfaces of the forms whereby inner surfaces of the cast pool are so smooth they do not require plaster, or the like, but may immediately be painted with any suitable

paint, such as a concrete base paint or equivalent material.

Further objects and advantages of the invention may be apparent from the following specifications, appended claims, and accompanying drawings, in which:

FIG. 1 is a fragmentary top or plan view of a suspension form means for monolithic casting of swimming pools, in accordance with the present invention;

FIG. 2 is an enlarged fragmentary sectional view taken from the line 2—2 of FIG. 1 and line 2—2 of FIG. 10;

FIG. 3 is an enlarged fragmentary sectional view taken from the line 3—3 of FIG. 2;

FIG. 4 is an enlarged fragmentary sectional view taken from the line 4—4 of FIG. 2;

FIG. 5 is a fragmentary sectional view of a modified side wall form member taken on a plane similar to that of FIG. 2 of the drawings;

FIG. 6 is an enlarged fragmentary sectional view taken from the line 6—6 of FIG. 1;

FIG. 7 is an enlarged sectional view taken from the line 7—7 of FIG. 2;

FIG. 8 is an enlarged fragmentary sectional view taken from the line 8—8 of FIG. 1;

FIG. 9 is a fragmentary sectional view taken from the line 9—9 of FIG. 8;

FIG. 10 is a fragmentary top or plan view similar to FIG. 1 showing a modification of the suspension from system of the invention;

FIG. 11 is a view similar to FIG. 2 showing a modification of the invention;

FIG. 12 is a reduced view similar to FIG. 10 showing a further modification of the invention,

FIG. 13 is an enlarged sectional view taken from line 13—13 of FIG. 12;

FIG. 14 is a fragmentary plan view similar to FIG. 10 showing another modification of the invention; and

FIG. 15 is an enlarged sectional view taken from the line 15—15 of FIG. 14.

As shown in FIG. 1 of the drawings, the suspension form means for monolithic casting of swimming pools may consist of a substantially elliptical assembly. However, it will be obvious to those skilled in the art, that this suspension form means for swimming pools may readily be adapted to other configurations, such as circular or rectangular shapes, as desired.

The elliptical, or other curved assemblies or forms, will be advantageous, in accordance with the invention, for the production of lightweight form assemblies. The curved structures tend to promote rigidity of these forms, and accordingly, economize on the thickness of the structures and, consequently, provide for lightweight form sections. Such lightweight sections may readily be handled by laborers, during the assembly of the forms, preliminary to the monolithic pouring of the swimming pool coping, side walls, and floor structures.

As shown in FIG. 1 of the drawings, a preferred embodiment of the invention comprises a substantially elliptical suspension form assembly including a center pole 20.

This center pole 20 may be constructed of steel pipe, or the like, as will be hereinafter described, and secured, to the upper portion thereof, is a plate 22 to which radiating beams 24 are secured pivotally by bolts 26, as will be hereinafter described in detail. In the particular substantially elliptical assembly of forms, as shown, some of the beams 24 are longer than others, however, the extending ends of all of these beams terminate at locations substantially coinciding with the outermost limits of the coping of a swimming pool to be formed.

In this manner, the present suspension form system may be utilized in confined spaces adjacent buildings or other features of a residence, for example.

As shown in FIG. 2 of the drawings, each beam 24, at its outer end 28, is provided with vertically disposed tubular member 30 welded or otherwise secured thereto. This tubular member 30 is disposed to receive a stake 32,

which extends downwardly therethrough, and projects beyond a lower end 34, of the tubular section 30.

Coping form members 36, which are generally channel-shaped in cross-section, are provided with openings 38 and 40, in the upper and lower legs of the channel section, through which the stakes 32 project. As shown in FIG. 2, each stake 32 projects through the openings 38 and 40 and is provided with a sharp lower end portion 42, which is driven into the ground and thereby embedded in the ground a considerable distance below the grade on which the lower leg 40 of the coping form 36 is located.

Welded, or otherwise secured, between the legs 38 and 40, of the coping forms 36, are spaced plates 44 and 46, which straddle the openings 38 and 40, and which are disposed on opposite sides of the stake 32.

These plates 44 and 46 are provided with wedge-receiving openings 48 and 50, through which tapered wedges may be driven into engagement with one of the sides of the stake 32 for wedging the same in place, relative to the coping form member 36.

It will be understood that the coping form 36 may be made of conventional structural steel channels and formed in several sections to complete the generally elliptical assembly thereof, as shown in FIG. 1 of the drawings.

These coping form members 36, as shown, are preferably formed in four sections, including two substantially identical end sections 36a and two substantially identical side sections 36b. The side sections 36b abut the end sections 36a, at locations 36c.

As shown in FIG. 2 of the drawings, each coping form channel section 36, at its main web section 52, provides a form surface adjacent to which the outer extremities of swimming pool coping 54 may be cast.

Spaced from the tubular section 30, in connection with the beams 24, are wall form connection clips 56 having bolt-receiving plates 58 disposed to rest upon curved frame members 60 at the upper portions of wall form sections 62. The plates 58 are bolted, or otherwise secured, to the frame members 60, by means of bolts 64, when the forms are assembled, as will be hereinafter described. Each wall form section 62 extends between the adjacent beams 24 and terminates at an abutted location 66, as shown in FIG. 4 of the drawings, which substantially coincides with the position below each beam 24. Thus, the wall forms 62 are made up in short sections and, as shown in FIG. 4 of the drawings, are provided with adjacent vertical flanges or angle legs, 68 and 70, secured together by bolts 72. These wall forms 62 are provided with sheet metal wall sections 74, reinforced by vertical angle members 76, which extend between the curved frame sections 60 and similar curved frame sections 78, near the lower portions of the wall forms 62.

As shown in FIG. 2 of the drawings, each form 62 is provided with horizontal curved frame sections 61 and 79, which are similar to the hereinbefore described curved frame sections 60 and 78, respectively. These curved frame sections 60, 61, 78 and 79 are secured between the vertical flanges 68 and 70 by welding or otherwise, as desired. The curved frame members 61 and 79 are disposed to straddle a median portion of each respective wall form 62. Plates 63 are welded, or otherwise secured, to the curved form members 61 and 79. Secured on several of the plates 62, by bolts 65, are vibrators 67. These vibrators may be powered by any suitable means, such as electromechanical or eccentric weight motors.

Secured to each wall form 62, at its curved frame member 78 and adjacent to its connection flange 68, is an outwardly directed clip portion 80 having a bolt-receiving slot 82 therein. This slot 82 is disposed to receive a bolt 84, which extends through a clip 86, connected to an inclined brace 88, which may be made of pipe or any other suitable structural member.

The opposite end of the brace 88, in connection with each beam 24, is secured thereto by a pin 90 extending

through a pair of downwardly directed spaced plates 92 secured to the respective beam 24.

Lateral, horizontally disposed braces 94 interconnect respective clips 80, at opposite sides of the pool forms, by means of pins 96, which extend through the slots 82, in the clips 80.

As shown in FIG. 2 of the drawings, the lower ends of the vertical stiffener angles 76 are beveled at 98 to provide clearance for the troweling of the upper surface 100, of the pool bottom structure 102, as will be hereinafter described.

Referring now to FIG. 6 of the drawings, it will be seen that the center pole 20 is provided with a second plate 22a, similar to the hereinbefore described plate 22, and that these plates 22 and 22a are fixed on the center pole 20, so that bolts 26, as hereinbefore described, are extended through the plates 22 and 22a for holding the beams 24, by means of clip portions 104 and 106, which are welded, or otherwise secured, to beams 24 and through which said bolts 26 extend.

The center pole 20 comprises a rotary location flange 108, fixed to the uppermost section 109 thereof. This flange 108 bears upon a similar flange 110, of identical configuration, as shown in FIG. 7 of the drawings. The flange 108 is provided with an arcuate slot 112, through which a bolt 114 extends for fixing the flange 108 to the flange 110, subsequently, to prevent rotation thereof.

The flange 110 is provided with an arcuate slot similar to the slot 112, so that the upper section 109, of the center pole, may be preliminarily rotated relative to the next lower sections 116, on which the flange 110 is fixed.

A short pipe section is fixed to the uppermost section 109, of the center pole, by means of bolts 120, and this pipe section 118 extends downwardly into the pipe section 110, of the center pole 20, to provide stability thereof during rotational adjustment of the uppermost section 109, relative to the lower section 116, as permitted by the bolt 114 extending through the arcuate slotted portions 112, in the plates 108 and 110.

The pipe section 116, of the center pole 20, is provided with an internally screwthreaded portion 112 engaged by an externally screwthreaded portion 124, of a right and left hand screw member 126. The opposite end of this member 126 is provided with an externally screwthreaded portion 128 screwthreadably engaged with an internally screwthreaded portion 130 in a lowermost pipe section 132, of the center pole 20.

An intermediate portion 134, of the right and left hand screw member 126, is provided with openings 136 there-through, disposed to receive a bar for rotatably and screwthreadably actuating the right and left hand screwthreaded member, in order to cause retraction or extension of the pipe sections 118 and 132, relative to each other.

The lower portion of the lowermost pipe sections 132, of the center pole 20, is provided with a base plate 138, welded, or otherwise secured thereto.

The plate 138 is adapted to rest on a plate 140, connected to anchor bolts 142 and 144, which are cast into a base 146, as will be hereinafter described. The bolts 142 and 144 extend upwardly through the plates 138 and 140, and nuts 146 and 148, on these bolts, hold the plate 138 securely down on the plate 140, in its bedded relationship with a previously cast footing 146. The anchor plate 140 is located in a central position, in an excavation, as will be hereinafter described, with respect to the operation of the suspension form means for monolithic casting of swimming pools, in accordance with the invention.

As shown in FIGS. 1 and 9 of the drawings, one of the side wall form members 62, at one end of the elliptical assembly of forms, is provided with means for casting steps integral with side wall structure of a swimming pool.

As shown in FIG. 1, a series of substantially concentric arcuate wall portions are connected to a respective side wall form member 62, there arcuate sections 150, 152, and

154, being shown in detail in FIG. 8 of the drawings. These arcuate wall sections 150, 152 and 154 are connected to the respective curved frame portion 60, by means of a plurality of angular disposed brace members 156.

An arcuate brace 158 is secured to the inner side 160, of the arcuate step forming section 154. This brace 158 conforms with the arcuate structure, of the step forming section 154, and is welded to extending end portions, of the respective form sections 62, in coincidence with a respective curved frame member 78.

Operation of the suspension form means for monolithic casting of swimming pools is substantially as follows:

As shown in FIGS. 1 and 2 of the drawings, excavation is first prepared, having a shape substantially elliptical in form, and the excavation is provided with graded side walls 163, spaced apart a distance considerably greater than the spacing of the opposite side wall form sections 62, whereby a space 164 is provided outwardly of all the side wall form sections 62, for the receiving of a poured concrete wall section of a swimming pool to be cast around the wall form sections 62, in their assembled condition. Communicating with the side walls 162, of the excavation, is a graded, excavated channel 166 disposed to receive a poured coping integral with wall sections to be poured in the space 164. Additionally, a graded bottom surface 168 is provided to receive the bottom of a floor section 170, of a cast swimming pool, all as shown best in FIG. 2 of the drawings. Reinforcing steel 172 is laid in the channel 166, in the area in which the coping is to be cast, and this steel extends downwardly through the wall receiving space 164 and into the floor area 170. Additionally, a loop of reinforcing steel 174 is provided to reinforce a laterally extended portion of the excavation, wherein a side wall footing 176 is cast. This footing is cast around the steel 174 and it is preferably connected to the steel 172, so that the entire coping, wall, and floor structure, of the swimming pool, may be cast in one monolithic structure outwardly of and below the side wall form members 62.

When the excavation is completed and the steel is fixed in place, the footing 146, hereinbefore described, may be poured together with the anchoring of the bolts 142 and 144 therein, and the placement of the base plate 140 is thus accomplished. It will be seen that the footing 146 is a downwardly diverging footing disposed to resist vertical upward force, which may be exerted on the center pole 20.

After the footing 146 has set, the suspension form means of the invention, in disassembled form, is removed from a truck, or other carrier, and the suspension form means is assembled in the excavation, as shown in FIG. 1 of the drawings.

First of all, the center pole 20, at its plate 138, is set upon the base plate 140 and the nuts 146 and 148 are tightened on the anchor bolts 142 and 144, to anchor the center pole in a central position in the excavation, previously prepared. The beams 24 are then bolted or pinned by means of the bolts 26, onto the plates 22 and 22a, at the upper portion of the center pole 20. These beams are then arranged in substantially radiating disposition, as shown in FIG. 1 of the drawings, and are coupled by bolts, as hereinbefore described, to the upper edges of the form sections 62, which are located in positions, as shown in FIG. 2 of the drawings, and are bolted in edge to edge relationship by means of the bolts 72, hereinbefore described. In this position, lower edges 169, of the form sections, are suspended above the graded floor surface 168, a distance which is substantially equal to the thickness of the pool floor to be cast. The braces 88 are then bolted to the clips 80 and to the fixtures 92, hereinbefore described, so that they provide angular bracing from the lower portions, of these form sections 62, to the beams 24. The stakes 32 are driven through the tubular sections 30, at the outer end of the beams 24, and down-

wardly through the openings 38 and 40 of the coping form members 36. These stakes 32 are further driven and embedded in the ground, outwardly of the channel 166, prepared for the casting of the swimming pool coping. Thus, the surface 52, of each coping form member 36, is aligned, with its respective sections, at the joints 36c and the stakes 32 thus hold the coping form sections 36 in juxtaposition with respect to the beams 24 and the wall forming sections 62 of the suspension form means. Accordingly, the stakes, embedded in the ground hold the complete form structure in juxtaposition with respect to the excavation in the ground and that the horizontal plan structures interconnect the wall forms near opposite sides and ends of the excavation.

The braces 88 and 94 resist inwardly directed forces indicated by an arrow A, in FIG. 2 of the drawings, which are imposed by the concrete as it is poured downwardly around the outer surfaces of the form sections 62. As the concrete applies forces in the direction of the arrow A, the braces 88 and 94 resist these forces and maintain the concrete in proper position, so that the symmetry of the swimming pool walls will be attained. It will be appreciated by those skilled in the art that the short form sections, extending between the beams 24 and the braces 88 and 94, provide for individual lightweight sections, all of which may readily and easily be handled by laborers. For example, the beams 24 may each be easily handled by one laborer and all of the individual form sections 62 are light enough to be readily handled by an individual laborer. Thus, the entire suspension form system of the invention may be quickly and easily assembled, around the center pole 20, and the vertical grade may be attained by leveling each individual beam 24, while the center pole may be adjusted vertically by the right and left hand screw member 126, hereinbefore described. For example, if it is desired to raise the elevation of the beams 24, the screw 126 may be rotated in one direction by positioning a lever bar through the openings 136, or this screw-threaded member 126 may be rotated in the opposite direction for lowering the beams 24, if desired.

When the concrete is being poured externally of the form sections 62, the vibrators 67 may be energized, whereby the smooth outer surfaces 161 of the form sections 62 are vibrated relative to the concrete adjacent thereto. The fines of the concrete will collect contiguous with the surfaces 161 ultimately to provide a smooth inner wall surface of the pool being produced. Additionally, the vibrations provided by the vibrator 67 causes overall compaction of the concrete in the wall forming spaces 164, shown in FIG. 2 of the drawings.

It will be seen that the braces 88 are inclined relative to the floor 102 of the swimming pool, so that a laborer may readily finish the upper surface 100, of the floor, and that the spacing of the braces 94 is such that sufficient room is provided for the worker, therebetween. Due to the inclination of the braces 88, from the outer edge of the floor, the worker may readily trowel the upper surface 100, of the swimming pool floor, below the tapered edge portions 98, of the stiffeners 76, connected to the side form members 62.

On the outer sides of the form section 62, are horizontal indented section 180, which project into the space 164 and form a water line groove, in the inner walls of the swimming pool, adjacent the form sections 62, all as shown best in FIG. 2 of the drawings.

When the poured concrete, of the monolithic swimming pool, has set sufficiently, the suspension form means, of the present invention, may be disassembled by pulling the stakes 32 and disconnecting all the bolted structures, hereinbefore described, whereupon, the beams and center pole structures are finally removed from the finished concrete structure of the swimming pool. Additionally, the form sections 62 are disassembled and removed and subsequently the recess 182, above the base plate 140, may

be filled with concrete to a level coinciding with the upper surface 100, of the bottom of the pool.

The pool may then be finish painted on the inside and subsequently filled with water, as desired.

The method for monolithic casting of swimming pools, according to the present invention is substantially as follows:

An excavation is first prepared; then wall forms are suspended therein. These forms are spaced from the side walls of the excavation and their lower edges are disposed considerably below the surface of the ground and are spaced from the bottom, thereof, distances equal to the desired wall and floor thickness of the swimming pool to be cast; then concrete is poured on said bottom to form a floor and between said wall forms and vertical walls of said excavation to form sides of the pool; the material poured to form said sides being permitted to flow into and become integral with the material poured to form said floor below the lower edges of said wall forms. The method of the invention also includes the vibration of the wall forms during the pouring and placement of said concrete material in said excavation and around said wall forms; said vibration being employed to concentrate concrete fines adjacent said wall forms so that the inner surfaces of the pool being cast will have a smooth, fine finish when the forms are removed from the cast pool. Further, the wall forms are held level and are braced from a center pole and radiating beams connected thereto.

In the modification, as shown in FIG. 10 of the drawings, the coping forms 36 are similar to those hereinbefore described and the wall form sections 62 are similar to those hereinbefore described. Additionally, the brackets 56, as shown in FIG. 2 of the drawings, are also included in the structure shown in FIG. 10 of the drawings. These brackets 56 suspend the wall forms 62 from transverse beams 162. These transverse beams structures 162 abridge and span the excavation A and interconnect support the wall forms 62 by means of the brackets 56. Additionally, it will be seen that the tubes 30, at the ends of the beams 162, are similar to the tubes 30, as shown in FIG. 2 of the drawings, and that the stakes 32 are positioned therein and extend through the coping form flanges 38 and 40 and are driven into and embedded in the ground.

The beams 162, extending transversely of the elongated excavation, completely span it and are supported on the coping forms 36 and suspend the wall forms 62 in a manner as hereinbefore described wherein the lower edges 169 thereof are disposed considerably below the surface of the ground and are spaced from the bottom 168 of the excavation.

The braces 88, shown in FIGS. 2 and 6 of the drawings, are connected to the wall forms 62 and to the beam members 162 in a similar manner to that as shown in FIGS. 2 and 6 of the drawings. Thus, the braces 88 function in the modified structure, as shown in FIG. 10 of the drawings, in substantially identical manner as that shown in FIGS. 2 and 6 of the drawings. These braces 88; however, are directly below the beams 162, as shown in FIG. 10, and cross-braces 94, as shown in FIGS. 2 and 6 of the drawings, may be positioned directly below the beams 162, if desired, and connected intermediate the wall forms 62, as shown in FIGS. 1 and 2 of the drawings.

The transverse abridging and spanning relationship of the beam structures 162 relative to the excavation and in supported relationship on the coping forms 36, provides a very simple means of supporting the coping forms together with the braces 88, and permits sections of the wall forms 62 readily to be added at the sides of the excavation so that a longer excavation may be accommodated which results in the forming of a longer pool simply by adding side wall form sections 62, as desired.

The embedded stake structures hold the entire form system of the present invention, including the horizontal beams and the suspended wall forms in juxtaposition in

the excavation and the beams interconnect the wall forms near opposite sides and opposite ends of the excavation.

Operation of the modified structure, as shown in FIG. 10 is otherwise similar to that hereinbefore described in connection with the structure shown in FIGS. 1 and 2 of the drawings.

As shown in FIGS. 6, the modified form side plates 74 are provided with a curved lower portion 75, to form a curved transition between the wall and the floor of the pool.

In the modification as shown in FIG. 11 of the drawings, an excavation 182 is prepared and this excavation is provided with graded side walls 184 similar to the graded side walls shown in FIG. 2 of the drawings. Lower edges 169 of the wall forms 74 are similar to the structure shown in FIG. 2 of the drawings and the braces 88, 94 and the beams 24 are all structurally similar to the means disclosed in FIG. 2 of the drawings. Additionally, the curbing form 52 is similar to that shown in FIG. 2 of the drawings.

In the modification of the invention as shown in FIG. 11, an approved method is practiced in the forming of the excavation 182 and the subsequent pouring of concrete 186 therein, the method comprises the step of providing a ledge 188 in the side wall of the excavation 182 to support a column of concrete above the lower edge 169 of the form 74 and located between the form 174 and the side wall 184 of the excavation. So that concrete may be manually trowled into a further downwardly extending portion 190 of the excavation 182, said portion extending downwardly to provide a deep portion of the excavation considerably beyond and below the lower edge 169 of the wall form 74. This downwardly extending excavation portion 190 may be the deep end of a swimming pool in order to provide a deep diving bowl area and the method involved in constructing this deep bowl with the forms as disclosed in FIG. 11 comprises the pouring of the concrete between the form and the graded wall and supporting some of the concrete on the earthen ledge in the side wall of the excavation whereby concrete bridges between the ledge and the wall form and further trowling and hand finishing a concrete wall section below the lower edge of the form extending downwardly into a deepened portion of the excavation.

It will be understood that the step of the method forming the ledge 188 and the supporting of freshly poured concrete thereon, while continuing to hand place poured concrete in the lower and downwardly extending portion of the excavation below the edge 169 of the wall form 174 comprises a novel method which greatly helps in supporting freshly poured concrete on the side wall of the excavation when the concrete is to be formed into a wall section adjacent the side of the excavation considerably below the lower edge of the wall forms 74.

In the modification as shown in FIG. 12 of the drawings, the lateral beams 162 are braced by connecting beams 192, the beams 162 extend across the excavation in one direction as hereinbefore described and shown in FIG. 10 of the drawings; connected to these beams 162 are lap plates 194 and 196 through which pins 198 and 200 extend. These pins also extend outwardly through the adjacent end of the beams 192 thereby removably locking them to the beams 162. Accordingly, it will be appreciated that these short beams 192 interconnecting the beams 162 provide lateral support therefore and extend into connection with the coping forms 36 and the wall forms 58 so that outer ends 193 of the beams 192 are secured to the coping forms 36 in a manner similar to the connection of the beams 24 with the coping forms 36 as hereinbefore described.

In the modification as shown in FIGS. 14 and 15, an adjustable form version of the invention is disclosed wherein a set of forms similar to those hereinbefore described may be retracted or extended to produce rectangular pools of varying dimensions.

As shown in FIG. 14, coping forms 202 are similar to the coping forms 36 hereinbefore described and wall forms 204 are similar to the wall forms 62 hereinbefore described. Lateral beams 206 are similar to the beams 24 and longitudinal beams 208 are similar to the beams 192 hereinbefore described and are connected to the beams 206 in a manner similar to the connection of the beams 192 with the beams 162 shown in FIG. 13.

The beams 206 are provided with longitudinally adjustable sections 210 which permits lateral extension of the forms so that they may be adjusted laterally of the excavation or longitudinally of themselves so that the addition of wall panels may readily be accommodated, as for example, the wall panel 62 may be added to either the longitudinal or lateral side walls of the form structure in order that pools of various lengths and widths may be constructed. The slidable adjustable structures 210 permit lateral adjustment of the forms in order to provide in complementary adjustment laterally of the forms and their spacing from each other at opposite sides of an excavation and thus, by adding wall forms and curb forms of varying lengths and ends the forms of the present invention may be extended to form rectangular shaped pools of varying longitudinal and lateral dimensions.

As shown in FIG. 15 of the drawings, the extendable structure of the beams 206, namely, the sliding bearing structure 210, involves beam structures 206 formed of spaced parallel pipes 212 which are telescopically mounted in tubular members 214 of sections 216 of the beams 206. These sections 216 are similar to the beam structures 24 hereinbefore described in FIG. 2 of the drawings and the curb forms 36 and wall forms 62 are also similar to structures hereinbefore described. Diagonal braces 218 are similar to the braces 88 hereinbefore described and connect to the beam sections 216.

It will be seen that the beam section 216 may slide relative to the beam section 206 and provide for lateral extension of the opposite side wall form 62 toward or away from each other and that the end wall forms may be made in sections as hereinbefore described, varying in length to construct pools of various widths, likewise the wall form sections as hereinbefore described are connected together similarly to that structure shown in FIG. 4 of the drawings and also in the plan view of FIG. 1. Thus, the wall forms are bolted together and various combinations of various lengths of these wall forms provide for different lengths and widths of the overall wall forms coupled together by the beam structures 206 and 208 and the telescopic structures 210 permit lateral extension of the beams 206 and their outward beam portions 216. It will be appreciated by those skilled in the art, that the beams 208 may be constructed in different lengths and while they are fixed between the beam structures 206, that these lateral extensions of the beam structures 206 provided by their telescopic connections 210 provides for a very versatile and adjustable form arrangement which permits the adaptation of the forms to excavations of various lengths and widths and thus, makes applicant's invention very versatile in the construction of various size swimming pools or other concrete lined excavations.

It will be obvious to those skilled in the art that various modifications of the present invention may be resorted to in a manner limited only by a just interpretation of the following claims.

I claim:

1. In a means for monolithic casting of swimming pools or tanks the combination of: an excavated earthen structure in and below the surface of the earth said excavated earthen structure having earthen side walls and an earthen bottom; an assembly of wall forms disposed inwardly of and spaced relative to said walls of said excavated earthen structure in the ground; said assembly of wall forms comprising; a plurality of form sections; and means removably connecting said sections together whereby they may be disconnected from each other and:

removed from cast concrete swimming pool walls subsequent to hardening of the concrete thereof; support members supported on the ground and disposed above said excavated earthen structure and said wall forms; said wall forms suspended from said support members; and lower edges of said wall forms being thus suspended in spaced relation with said side walls and said bottom of said excavated earthen structure; said lower edges of said wall forms being considerably below the surface of the earth adjacent said excavated earthen structure.

2. In a means for monolithic casting of swimming pools or tanks the combination of: an excavated earthen structure in and below the surface of the earth said excavated earthen structure having earthen side walls and an earthen bottom; an assembly of wall forms disposed inwardly of and spaced relative to said wall forms of said excavated earthen structure in the ground; said assembly of wall forms comprising; a plurality of form sections; and means removably connecting said sections together whereby they may be disconnected from each other and removed from cast concrete swimming pool walls subsequent to hardening of the concrete thereof; support members disposed above said wall forms and said excavated earthen structure and extending to a location beyond said wall forms and said excavated earthen structure; means engaging the earth and supporting said support members at said location said wall forms suspended from said support members; and lower edges of said wall forms being thus suspended in spaced relation with said bottom of said excavated earthen structure; said lower edges of said wall forms being considerably below the surface of the earth adjacent said excavated earthen structure.

3. In a means for monolithic casting of swimming pools or tanks the combination of: an excavated earthen structure in and below the surface of the earth said excavated earthen structure having earthen side walls and an earthen bottom; an assembly of wall forms disposed inwardly of and spaced relative to said walls of said excavated earthen structure in the ground; said assembly of wall forms comprising; a plurality of form sections; and means removably connecting said sections together whereby they may be disconnected from each other and removed from cast concrete swimming pool walls subsequent to hardening of the concrete thereof; support members disposed above and extending horizontally beyond said wall forms; said wall forms suspended from said support members; lower edges of said wall forms being thus suspended in spaced relation with said bottom of said excavated earthen structure; said lower edges of said wall forms being considerably below the surface of the earth adjacent said excavated earthen structure portions of said support members extending beyond said wall forms; and coping forms disposed outwardly beyond said excavated earthen structure in spaced relation therewith said support members supported on said coping.

4. In a means for monolithic casting of swimming pools or tanks the combination of: an excavated earthen structure in and below the surface of the earth said excavated earthen structure having earthen side walls and an earthen bottom; an assembly of wall forms disposed inwardly of and spaced relative to said walls of said excavated earthen structure in the ground; said assembly of wall forms comprising; a plurality of form sections; and means removably connecting said sections together whereby they may be disconnected from each other and removed from cast concrete swimming pool walls subsequent to hardening of the concrete thereof; support members spanning and abridging said excavated earthen structure and extending horizontally beyond said wall forms; means removably connecting and suspending said wall forms from said beams; lower edges of said wall forms being thus suspended in spaced relation with said bottom of said excavated earthen structure; said lower edges of said wall forms being considerably below the surface of

the earth adjacent said excavation portions of said beams extending beyond said wall forms; and coping forms disposed outwardly beyond said excavated earthen structure in spaced relation therewith and coupled to said extending portions of said support members; and means supporting opposite ends of said beams on said coping forms.

5. In a means for monolithic casting of swimming pools or tanks the combination of: an excavated earthen structure in and below the surface of the earth said excavated earthen structure having earthen side walls and an earthen bottom; an assembly of wall forms inwardly of and spaced from the walls of said excavated earthen structure; said assembly of wall forms comprising; a plurality of form sections; and means removably connecting said sections together whereby they may be disconnected from each other and removed from cast concrete swimming pool walls subsequent to hardening of the concrete thereof; support members extending horizontally above said wall forms; said wall forms suspended from said support members; lower edges of said wall forms being thus suspended in spaced relation with said bottom of said excavated earthen structure; said lower edges of said wall forms being considerably below the surface of the earth adjacent said excavated earthen structure; coping forms connected to said support members outwardly of said wall forms, whereby coping may be cast integral with wall structures in said excavated earthen structure outwardly of said wall forms; and a plurality of stakes driven into the ground and holding said support members and said coping forms.

6. In a means for monolithic casting of swimming pools or tanks the combination of: an excavated earthen structure in and below the surface of the earth said excavated earthen structure having earthen side walls and an earthen bottom; an assembly of wall forms inwardly of and spaced from the walls of said excavated earthen structure; said assembly of wall forms comprising; a plurality of form sections; and means removably connecting said sections together whereby they may be disconnected from each other and removed from cast concrete swimming pool walls subsequent to hardening of the concrete thereof; support members extending horizontally above said wall forms; said wall forms suspended from said support members; lower edges of said wall forms being thus suspended in spaced relation with said bottom of said excavated earthen structure; said lower edges of said wall forms being considerably below the surface of the earth adjacent said excavated earthen structure; coping forms connected to said support members outwardly of said wall forms, whereby coping may be cast integral with wall structures in said excavated earthen structure outwardly of said wall forms; and a plurality of stakes driven into the ground and holding said coping forms; and a means of said coping forms and said support members for engaging stakes are driven and disposed in the ground against said support members for connecting and holding said coping forms and said support members in position relative to said excavated earthen structure in the ground.

7. In a means for monolithic casting of swimming pools or tanks the combination of: an excavated earthen structure in and below the surface of the earth said excavated earthen structure having earthen side walls and an earthen bottom; an assembly of wall forms disposed inwardly of and spaced relative to said walls of said excavated earthen structure in the ground; said assembly of wall forms comprising; a plurality of form sections; and means removably connecting said sections together whereby they may be disconnected from each other and removed from cast concrete swimming pool walls subsequent to hardening of the concrete thereof; support members supported on the ground and above said excavated earthen structure and said wall forms; said wall forms suspended from said support members; means embedded in the ground

outwardly of said excavated earthen structure and holding said support members in juxtaposition relative to said excavated earthen structure; and lower edges of said wall forms being thus suspended in spaced relation with said bottom of said excavated earthen structure; said lower edges of said wall forms being considerably below the surface of the earth adjacent said excavated earthen structure; and means laterally bracing said side wall forms to resist movement thereof away from the side walls of said excavated earthen structure when concrete material is poured between said side walls and said wall forms.

8. In a means for monolithic casting of swimming pools or tanks the combination of: an excavated earthen structure in and below the surface of the earth said excavated earthen structure having earthen side walls and an earthen bottom; an assembly of wall forms disposed inwardly of and spaced relative to said walls of said excavated earthen structure in the ground; said assembly of wall forms comprising; a plurality of form sections; and means removably connecting said sections together whereby they may be disconnected from each other and removed from cast concrete swimming pool walls subsequent to hardening of the concrete thereof; horizontally disposed support members above said excavated earthen structure and said wall forms; and means removably connecting and suspending said wall forms from said support members; means embedded in the ground outwardly of said excavated earthen structure and holding said support members in juxtaposition relative to said excavated earthen structure; and lower edges of said wall forms being thus suspended in spaced relation with said bottom of said excavated earthen structure; said lower edges of said wall forms being considerably below the surface of the earth adjacent said excavated earthen structure; and means laterally bracing said side wall forms to resist movement thereof away from the side walls of said excavated earthen structure when concrete material is poured between said side walls and said wall forms; said last mentioned means comprising braces disposed between said wall forms and said support members and extending on an incline relative to said side wall forms.

9. In a means for monolithic casting of swimming pools or tanks the combination of: an excavated earthen structure in and below the surface of the earth said excavated earthen structure having earthen side walls and an earthen bottom; an assembly of wall forms disposed inwardly of the walls of said excavated earthen structure in the ground; said assembly of wall forms comprising; a plurality of form sections; and means removably connecting said sections together whereby they may be disconnected from each other and removed from cast concrete swimming pool walls subsequent to hardening of the concrete thereof; a center pole having a base supported in said bottom portion of said excavated earthen structure; support members connected with said center pole and extending horizontally beyond said wall forms; means supported by the earth and embedded therein outwardly of said excavated earthen structure, said means supporting said extending portions of said support members; means removably connecting and suspending said wall forms from said support members; and lower edges of said wall forms being thus suspended in spaced relation with the bottom of said excavated earthen structure; said lower edges of said wall forms being considerably below the surface of the earth adjacent said excavated earthen structure.

10. In a means for monolithic casting of swimming pools or tanks the combination of: an excavated earthen structure in and below the surface of the earth said excavated earthen structure having earthen side walls and an earthen bottom; an assembly of wall forms disposed inwardly of and spaced relative to said wall forms of said excavated earthen structure in the ground; said assembly of wall forms comprising; a plurality of form sections; and means removably connecting said sections

together whereby they may be disconnected from each other and removed from cast concrete swimming pool walls subsequent to hardening of the concrete thereof; horizontal beams disposed above said wall forms and said excavated earthen structure and extending beyond said wall forms and said excavated earthen structure; means supporting said beams in horizontal position; means embedded in the earth outwardly beyond said excavated earthen structure and holding said beams in juxtaposition relative thereto; means removably connecting and suspending said wall forms from said beams; and lower edges of said wall forms being thus suspended in spaced relation with said bottom of said excavated earthen structure; said lower edges of said wall forms being considerably below the surface of the earth adjacent said excavated earthen structure; said means supporting said beams in horizontal position comprising structure engaging the ground outwardly beyond said excavated earthen structure.

11. In a means for monolithic casting of swimming pools or tanks the combination of: an excavated earthen structure in and below the surface of the earth said excavated earthen structure having earthen side walls and an earthen bottom; an assembly of wall forms disposed inwardly of the walls of said excavated earthen structure in the ground and spaced therefrom; said assembly of wall forms comprising; a plurality of form sections; and means removably connecting said sections together whereby they may be disconnected from each other and removed from cast concrete swimming pool walls subsequent to hardening of the concrete thereof; a center pole having a base supported in said excavated earthen structure on the bottom thereof; beams connected with said center pole and having extending portions disposed beyond the walls of said excavated earthen structure; means supported by the earth and embedded therein outwardly of said excavated earthen structure, said means supporting said extending portions of said beams; means removably connecting and suspending said wall forms from said beams; lower edges of said wall forms being thus suspended in spaced relation with said bottom of said excavated earthen structure; said lower edges of said wall forms being considerably below the surface of the earth adjacent said excavated earthen structure; and means for vertically adjusting and elongating said center pole to dispose said beams at a desired grade level.

12. In a means for monolithic casting of swimming pools or tanks the combination of: an excavated earthen structure in and below the surface of the earth said excavated earthen structure having earthen side walls and an earthen bottom; an assembly of wall forms disposed inwardly of the walls of said excavated earthen structure in the ground and spaced therefrom; said assembly of wall forms comprising; a plurality of form sections; and means removably connecting said sections together whereby they may be disconnected from each other and removed from cast concrete swimming pool walls subsequent to hardening of the concrete thereof; a center pole having a base supported in said excavated earthen structure on the bottom thereof; beams connected with said center pole and having extending portions disposed beyond the walls of said excavated earthen structure; means supported by the earth outwardly of said excavated earthen structure, said means supporting said extending portions of said beams; means removably connecting and suspending said wall forms from said beams; lower edges of said wall forms being thus suspended in spaced relation with said bottom of said excavated earthen structure; said lower edges of said wall forms being considerably below the surface of the earth adjacent said excavated earthen structure; and means for vertically adjusting and elongating said center pole to dispose said beams at a desired grade level; said last mentioned means having right and left hand screwthreaded members for extending said center pole.

13. In a means for monolithic casting of swimming pools or tanks the combination of: an excavated earthen structure in and below the surface of the earth said excavated earthen structure having earthen side walls and an earthen bottom; an assembly of wall forms disposed inwardly of and spaced relative to said walls of said excavated earthen structure in the ground; said assembly of wall forms comprising; a plurality of form sections; and means removably connecting said sections together whereby they may be disconnected from each other and removed from cast concrete swimming pool walls subsequent to hardening of the concrete thereof; beams disposed above and extending horizontally beyond said wall forms; means removably connecting and suspending said wall forms from said beams; lower edges of said wall forms being thus suspended in spaced relation with said bottom of said excavated earthen structure; said lower edges of said wall forms being considerably below the surface of the earth adjacent said excavated earthen structure; portions of said beams extending beyond said wall forms; and coping forms disposed outwardly beyond said excavated earthen structure in spaced relation therewith and coupled to said extending portions of said beams; means at the ends of said beams and on said coping forms having openings therethrough; and stakes driven through the openings in said means on said beams and said coping forms whereby said stakes extend through said means and into the ground for holding said beams and said coping form in juxtaposition relative to said excavated earthen structure.

14. A method for monolithic casting of swimming pools or tanks comprising the preparation of an excavation in and below the surface of the ground thereby having earthen side walls and an earthen bottom; the placement of an assembly of substantially vertical wall forms in said excavation in spaced relation with the side walls thereof; suspending said wall forms so that their lower edges are in spaced relation with the bottom of said excavation and a considerable distance below the surface of the ground; pouring concrete in the bottom of said excavation and between the side walls of said excavation and said wall forms and directly in contact with said earthen side walls and bottom whereby the material between said wall forms and the side walls of said excavation flows monolithically into the material on the bottom thereof; then permitting said concrete to harden and then removing said beam structures and said wall forms from the area of said excavation.

15. A method for monolithic casting of swimming pools or tanks comprising the preparation of an excavation in and below the surface of the ground thereby having earthen side walls and an earthen bottom; the placement of an assembly of reinforcing members in said excavation near the bottom and side thereof; the placing of wall forms in said excavation in spaced relationship with the side walls thereof and inwardly of said reinforcing members; suspending said wall forms so that their lower edges are in spaced relation with the bottom of said excavation; and a considerable distance below the surface of the ground; pouring concrete in the bottom of said excavation and between the side walls of said excavation and said wall forms and around said reinforcing members whereby the material between said wall forms and the side walls of said excavation flows monolithically into the material on the bottom thereof; then permitting said concrete to harden and then removing said beam structures and said wall forms from the area of said excavation.

16. A method for monolithic casting of swimming pools or tanks comprising the preparation of an excavation in and below the surface of the ground thereby having earthen side walls and an earthen bottom; the placement of an assembly of reinforcing members in said excavation near the bottom and side thereof; the placing of wall forms in said excavation in spaced relationship with the side walls thereof and inwardly of said reinforcing

members; suspending said wall forms so that their lower edges are in spaced relation with the bottom of said excavation; and a considerable distance below the surface of the ground; pouring concrete in the bottom of said excavation and between the side walls of said excavation and said wall forms and around said reinforcing members whereby the material between said wall forms and the side walls of said excavation flows monolithically into the material on the bottom thereof; and vibrating said wall forms during the placement of said concrete material in said excavation; then permitting said concrete to harden and then removing said beam structures and said wall forms from the area of said excavation.

17. A method for monolithic casting of swimming pools or tanks comprising a preparation of an excavation in and below the surface of the ground thereby having earthen side walls and an earthen bottom; the placement of an assembly of reinforcing members in said excavation near the bottom and side walls thereof; the placing of wall forms in said excavation in spaced relationship with the side walls thereof and inwardly of said reinforcing members; suspending said wall forms so that their lower edges are in spaced relation with the bottom of said excavation; and a considerable distance below the surface of the ground; pouring concrete in the bottom of said excavation and between the side walls of said excavation and said wall forms and around said reinforcing members whereby the material between the wall forms and the side walls of said excavation flows monolithically into the material on the bottom thereof and then vibrating the concrete material between said wall forms and said side walls of said excavation; then permitting said concrete to harden and then removing said beam structures and said wall forms from the area of said excavation.

18. In a means for monolithic casting of swimming pools or tanks the combination of: an excavated earthen structure in and below the surface of the earth said excavated earthen structure having earthen side walls and an earthen bottom; an assembly of wall forms disposed inwardly of and spaced relative to said walls of said excavated earthen structure on the ground; said assembly of wall forms comprising; a plurality of form sections; and means removably connecting said sections together whereby they may be disconnected from each other and removed from cast concrete swimming pool walls subsequent to hardening of the concrete thereof; horizontally disposed beams above said excavated earthen structure and said wall forms; and means removably connecting and suspending said wall forms from said beams; and lower edges of said wall forms being thus suspended in spaced relation with said bottom of said excavated earthen structure; said lower edges of said wall forms being considerably below the surface of the earth adjacent said excavated earthen structure; arcuate vertically stepped curved step form walls coupled to one of said first mentioned wall forms, the concave sides of said curved step forming form sections communicating directly with the outer sides of said wall forms and disposed to face and communicate with the wall of said excavated earthen structure.

19. In a means for monolithic casting of swimming pools or concrete liners in an excavated earthen structure the combination of: an excavated earthen structure having an earthen bottom and substantially vertical earthen side walls; beam structures extending across and above said excavated earthen structure; ends of said beam structures extending beyond the sides of said excavated earthen structure; second structures embedded in the earth outwardly of and beyond the sides of said excavated earthen structure, said second structures connected to said beam structures for holding them in juxtaposition relative to said excavated earthen structure; wall forms fixed to said beam structures and extending downwardly into said excavated earthen structure in spaced relation with the earthen side walls thereof; said assembly of wall forms

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comprising; a plurality of form sections; and means removably connecting said sections together whereby they may be disconnected from each other and removed from cast concrete swimming pool walls subsequent to hardening of the concrete thereof; lower edges of said wall forms being considerably below said second structures and the upper surface of the ground and in spaced relation with the bottom of said excavated earthen structure said wall forms disposed near opposite sides of said excavated earthen structure and interconnected by said beam structures for holding them in juxtaposition relative to each other and to the side walls and bottom of said excavated earthen structure.

20. In a means for monolithic casting of swimming pools or concrete liners in an excavated earthen structure the combination of: an excavated earthen structure having an earthen bottom and substantially vertical earthen side walls; beam structures extending across and above said excavated earthen structure; ends of said beam structures extending beyond the sides of said excavated earthen structure; stakes embedded in the soil outwardly of and beyond the sides of said excavation, said stakes connected to said beam structures for holding them in juxtaposition relative to said excavated earthen structure; wall forms fixed to said beam structures and extending downwardly into said excavated earthen structure in spaced relation with the earthen side walls thereof; said assembly of wall forms comprising; a plurality of form sections; and means removably connecting said sections together whereby they may be disconnected from each other and removed from cast concrete swimming pool walls subsequent to hardening of the concrete thereof; lower edges of said wall forms being considerably below said stakes and the upper surface of the ground and in spaced relation with the bottom of said excavated earthen structure; said wall forms disposed near opposite sides of said excavated earthen structure and interconnected by said beam structures for holding them in juxtaposition relative to each other and to the side walls and bottom of said excavated earthen structure.

21. A method for monolithic casting of swimming pools or concrete liners in an excavation consisting of: the preparation of an excavation having an earthen bottom and substantially vertical earthen side walls; the placement of beam structures across and above said excavation with ends of said structures extending beyond the sides of said excavation; embedding stake structures in the earth beyond the sides of said excavation and connecting said ends of said beam structures to said stake structures embedded in the earth to hold said beam structures in place and in juxtaposition relative to said excavation; fixedly suspending wall forms in downwardly extending disposition from said beam structures near opposite side walls of said excavation to interconnect and brace said wall forms by said beam structures thereby locating sides of said wall forms in spaced relation to the sides of said excavation and thereby locating the lower edges of said wall forms a distance considerably below the ground surface and in spaced relation with the bottom of said excavation; and then pouring and vibrating concrete between the sides of said excavation and said forms and in the bottom of said excavation whereby said concrete flows together at the sides and bottom of said excavation below the lower edges of said wall forms; then permitting said concrete to harden and then removing said beam structures and said wall forms from the area of said excavation.

22. A method for monolithic casting of swimming pools or concrete liners in an excavation consisting of: the preparation of an excavation having an earthen bottom and substantially vertical earthen side walls; the placement of beam structures across and above said excavation with ends of said structures extending beyond the sides of said excavation; embedding second structures in the earth beyond the sides of said excavation and connecting

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said ends of said beam structures to said second structures embedded in the earth to hold said beam structures in place and in juxtaposition relative to said excavation; fixedly suspending wall forms in downwardly extending disposition from said beam structures near opposite side walls of said excavation to interconnect and brace said wall forms by said beam structures, thereby locating sides of said wall forms in spaced relation to the sides of said excavation and thereby locating lower edges of said wall forms a distance considerably below the ground surface and in spaced relation with the bottom of said excavation; and then pouring concrete between the sides of said excavation and said forms and in the bottom of said excavation whereby said concrete flows together at the sides and bottom of said excavation below the lower edges of said wall forms; then permitting said concrete to harden and then removing said beam structures and said wall forms from the area of said excavation.

23. A method for monolithic casting of swimming pools or concrete liners in an excavation consisting of: the preparation of an excavation having an earthen bottom and substantially vertical earthen side walls; lining said excavation with reinforcing bars; the placement of beam structures across and above said excavation with ends of said structures extending beyond the sides of said excavation; embedding second structures in the earth beyond the sides of said excavation and connecting said ends of said beam structures to said second structures embedded in the earth to hold said beam structures in place and in juxtaposition relative to said excavation; fixedly suspending wall forms in downwardly extending disposition from said beam structures near opposite side walls of said excavation to interconnect and brace said wall forms by said beam structures, thereby locating sides of said wall forms in spaced relation to the sides of said excavation and thereby locating the lower edges of said wall forms a distance considerably below the ground surface and in spaced relation with the bottom of said excavation; and then pouring concrete between the sides of said excavation and said forms and in the bottom of said excavation whereby said concrete flows together at the sides and bottom of said excavation below the lower edges of said wall forms; then permitting said concrete to harden and then removing said beam structures and said wall forms from the area of said excavation.

24. In a means for monolithic casting of swimming pools or concrete liners in an excavated earthen structure the combination of: an excavated earthen structure having an earthen bottom and substantially vertical earthen side walls; first beam structures extending across and above said excavated earthen structure; ends of said beam structures extending beyond the sides of said excavated earthen structure; second beam structures interconnecting said first beam structures and disposed laterally thereof; third structures embedded in the earth outwardly of and beyond the sides of said excavated earthen structure, said third structures connected to said first and second beam structures for holding them in juxtaposition relative to said excavated earthen structure; wall form structure fixed to said beam structures and extending downwardly into said excavated earthen structure in spaced relation with the earthen side walls thereof; said assembly of wall forms comprising; a plurality of form sections; and means removably connecting said sections together whereby they may be disconnected from each other and removed from cast concrete swimming pool walls subsequent to hardening of the concrete thereof; lower edges of said wall form structure being considerably below said third structures and the upper surface of the ground and in spaced relation with the bottom of said excavated earthen structure; said wall form structure disposed near opposite sides of said excavated earthen structure and interconnected by said beam structures for holding them in juxtaposition relative to each other and to the side walls and bottom of said excavated earthen structure.

25. In a means for monolithic casting of swimming pools or concrete liners in an excavated earthen structure the combination of: an excavated earthen structure having an earthen bottom and substantially vertical earthen side walls; first beam structures extending across and above said excavated earthen structure; ends of said beam structures extending beyond the sides of said excavated earthen structure; second beam structures interconnecting said first beam structures and disposed laterally thereof; third structures embedded in the earth outwardly of and beyond the sides of said excavated earthen structure, said third structures connected to said first and second beam structures for holding them in juxtaposition relative to said excavated earthen structure; wall form structure fixed to said beam structures and extending downwardly into said excavated earthen structure in spaced relation with the earthen side walls thereof; said assembly of wall forms comprising; a plurality of form sections; and means removably connecting said sections together whereby they may be disconnected from each other and removed from cast concrete swimming pool walls subsequent to hardening of the concrete thereof; lower edges of said wall form structure being considerably below said third structures and the upper surface of the ground and in spaced relation with the bottom of said excavated earthen structure; said wall form structure disposed near opposite sides of said excavated earthen structure and interconnected by said beam structures for holding them in juxtaposition relative to each other and to the side walls and bottom of said excavated earthen structure; and telescopic extension means of said beam structures disposed to permit variation in the length thereof to accommodate addition or subtraction of said wall form structure.

26. A method for monolithic casting of swimming pools or concrete liners in an excavation consisting of: the preparation of an excavation having an earthen bottom and substantially vertical earthen side walls; forming a substantially horizontal recessed ledge in said side walls;

placing beam structures across and above said excavation with ends of said structures extending beyond the sides of said excavation; embedding stake structures in the earth beyond the sides of said excavation and connecting said ends of said beam structures to said stake structures embedded in the earth to hold said beam structures in place and in juxtaposition relative to said excavation; fixedly suspending wall forms in downwardly extending disposition from said beam structures near opposite side walls of said excavation to interconnect and brace said wall forms by said beam structures thereby locating sides of said wall forms in spaced relation to the sides of said excavation and thereby locating the lower edges of said wall forms a distance considerably below the ground surface and in spaced relation with the bottom of said excavation; and then pouring, vibrating and placing concrete between the sides of said excavation and said forms and placing said concrete on said ledge and causing it vertically to support concrete, and then packing concrete on said excavation side walls below said ledge and said forms and onto the bottom of said excavation; then permitting said concrete to harden and then removing said beam structures and said wall forms from the area of said excavation.

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