Sept. 14, 1965 M. C. NOTTINGHAM ETAL 3,206,155

FORMS FOR CASTING CEMENT TANKS

Original Filed June 24, 1963 5 Sheets-Sheet 1

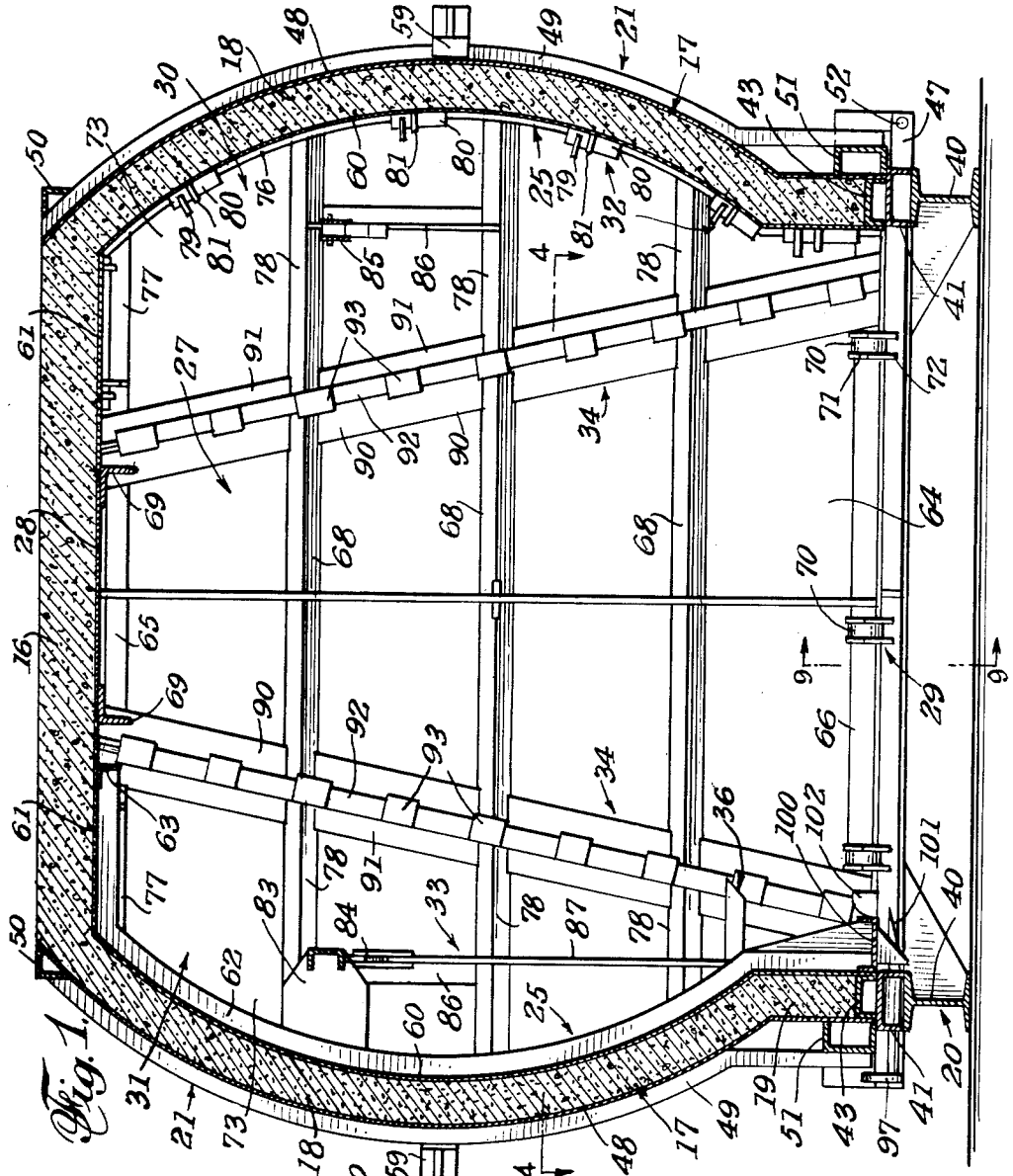


Fig. 1.

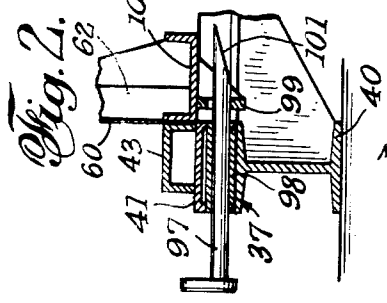


Fig. 2.

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FORMS FOR CASTING CEMENT TANKS

Original Filed June 24, 1963 5 Sheets-Sheet 2

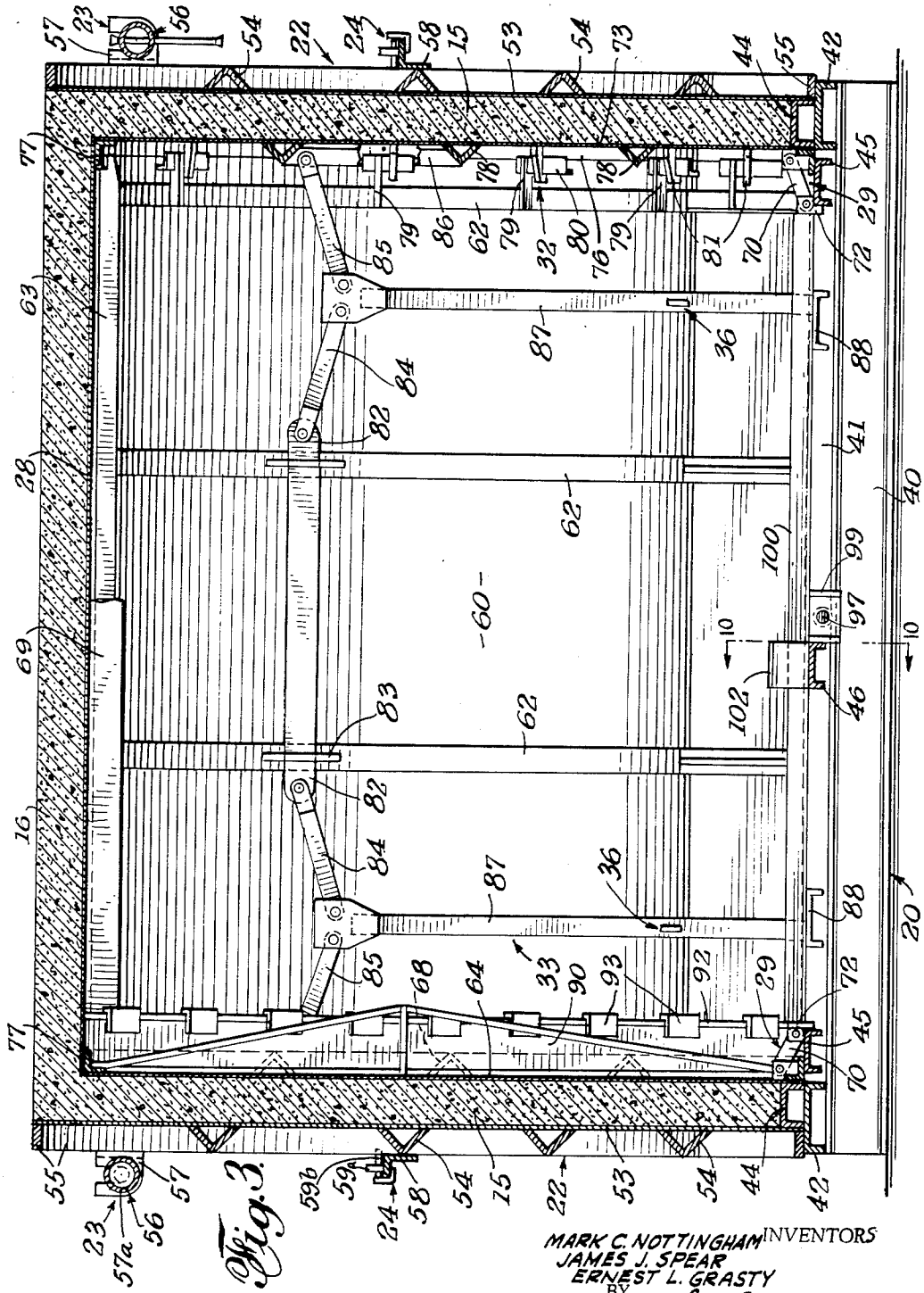


Fig. 3.

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FORMS FOR CASTING CEMENT TANKS

Original Filed June 24, 1963 5 Sheets-Sheet 3

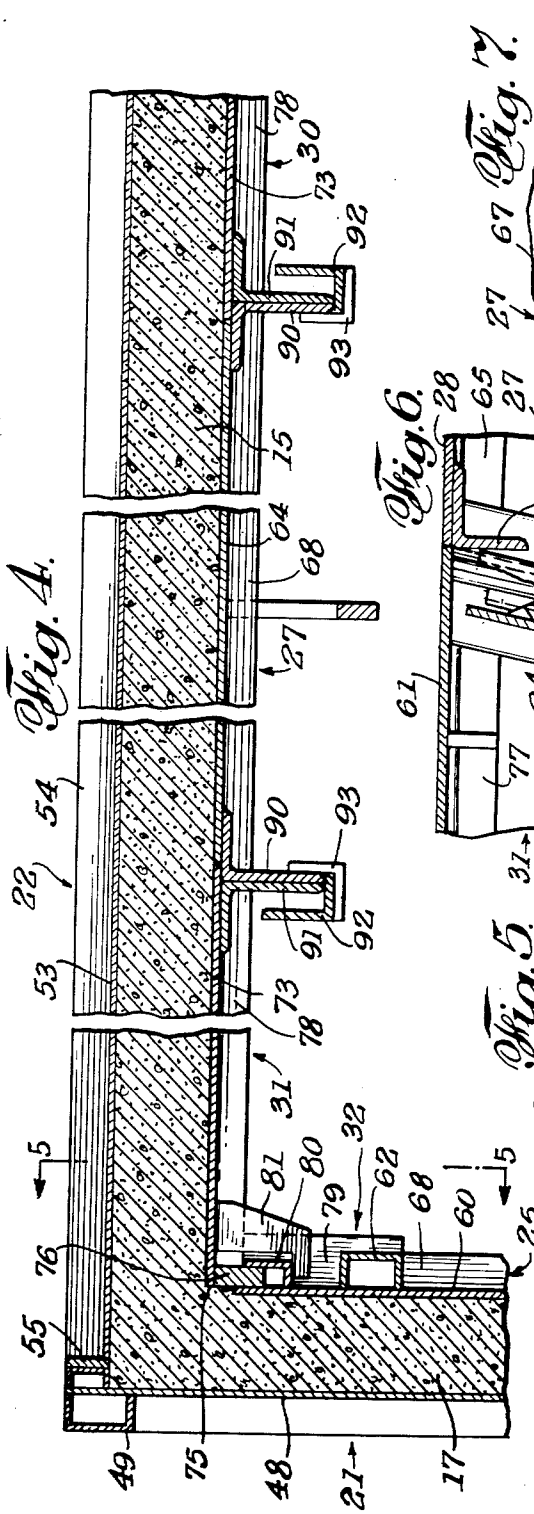


Fig. 4.

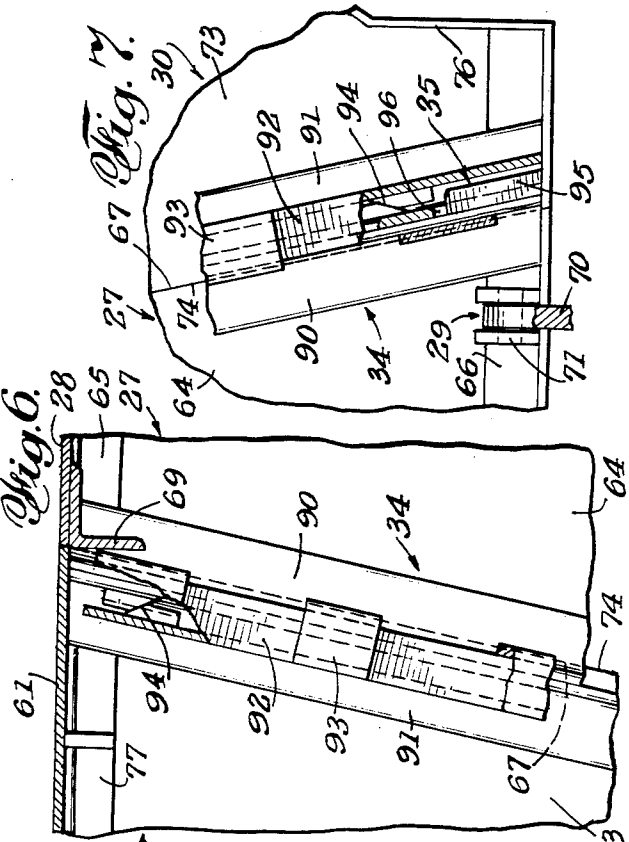


Fig. 6.

Fig. 7.

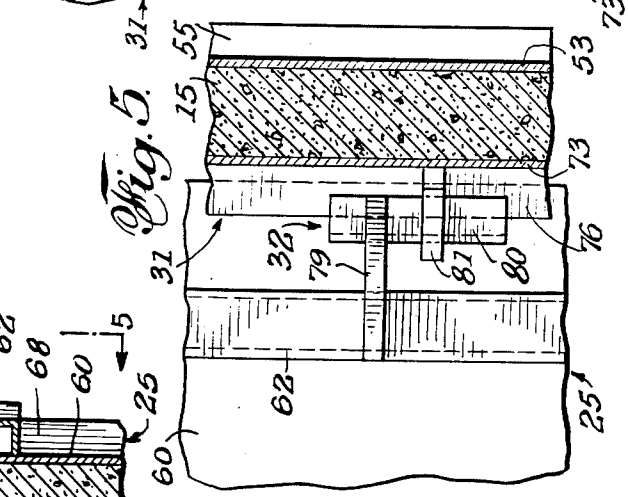


Fig. 5.

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FORMS FOR CASTING CEMENT TANKS

Original Filed June 24, 1963 5 Sheets-Sheet 4

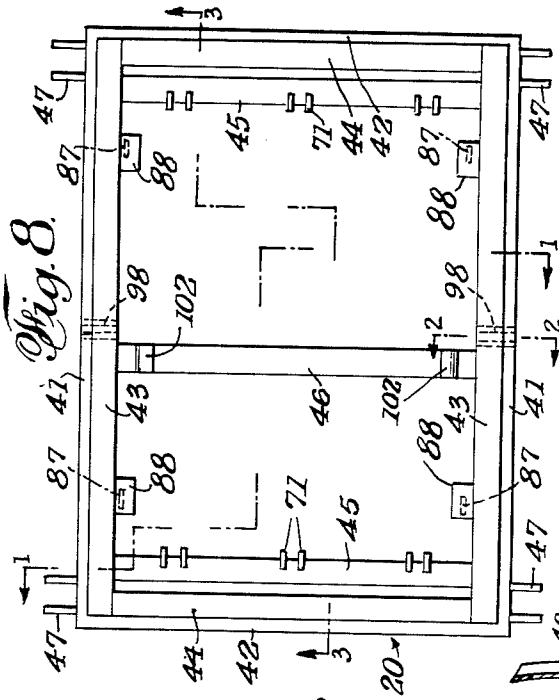


Fig. 8.

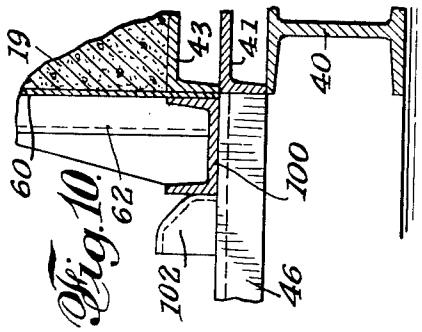


Fig. 10.

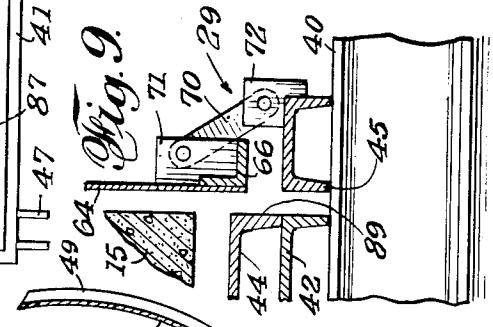


Fig. 9.

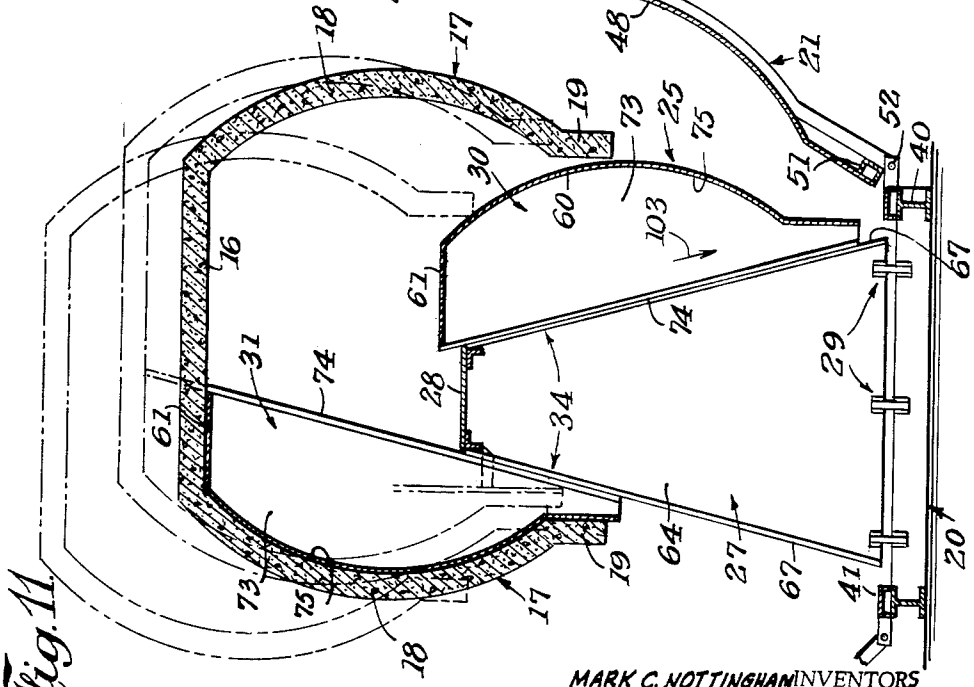


Fig. 11.

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FORMS FOR CASTING CEMENT TANKS

Original Filed June 24, 1963 5 Sheets-Sheet 5

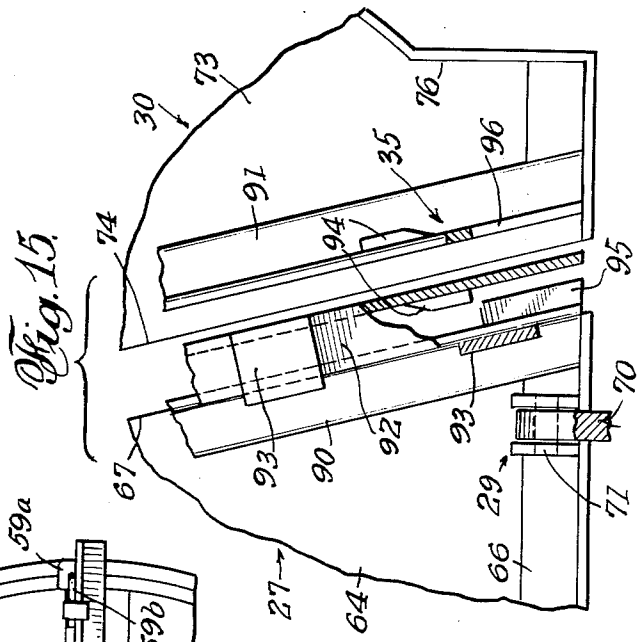


Fig. 15.

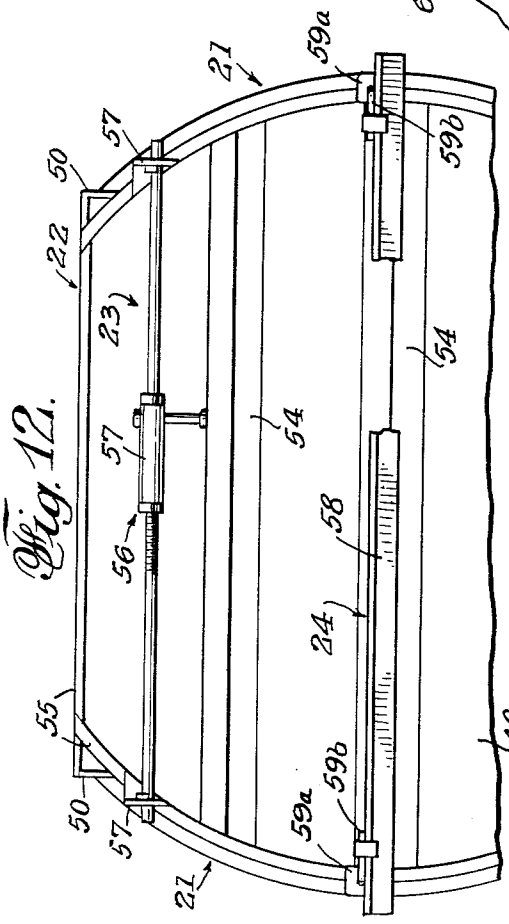


Fig. 12.

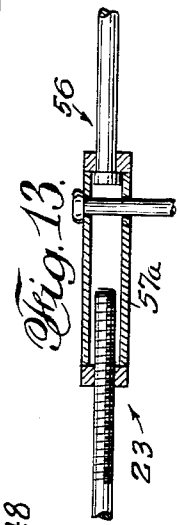


Fig. 13.

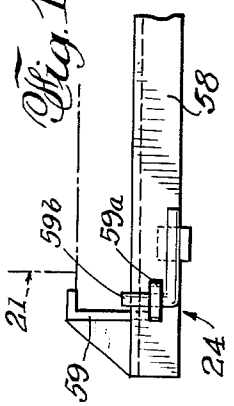


Fig. 14.

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United States Patent Office 3,206,155 Patented Sept. 14, 1965

3,206,155

FORMS FOR CASTING CEMENT TANKS

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Original application June 24, 1963, Ser. No. 289,797. Divided and this application June 1, 1964, Ser. No. 379,063

4 Claims. (Cl. 249—142)

This invention relates to forms and a method for casting concrete receptacles, especially those having outwardly bulging walls. The present form is herein disclosed in connection with a concrete septic tank having flat end walls and outwardly bulged side walls, such a tank being exemplary of a receptacle, as above mentioned.

An object of the present invention is to provide a form embodying novel and improved means for releasing and removing the inner components of the form.

Another object of the invention is to provide a form as above characterized that includes novel and improved means that retain the inner form components operatively connected during the releasing and removing operation, thereby enabling facile and time-saving repositioning of said components to concrete-receiving condition for the next casting operation.

A further object of the invention is to provide a novel and improved method for releasing and slipping the inner form components so the same are released first from one bulging side of the cast tank and then from the other, thereby releasing the bulge-molding portions of the inner form components successively.

A still further object of the invention is to provide a method, as above, in which the inner form components are retained in position for ready return to casting position.

This invention also has for its objects to provide a novel, economical and convenient method or process of superior utility, and to provide apparatus that is positive in operation, convenient in use, easily installed in working position and easily disconnected therefrom, economical of manufacture, relatively simple, and of general superiority and serviceability.

The invention also contemplates novel combination of method steps as well as novel details of construction and novel combinations and arrangements of parts, which will appear more fully in the course of the following description, which is based on the accompanying drawings. However, said drawings merely show and the following description merely describes, the invention with respect to a preferred method and apparatus, the same, nevertheless, being given by way of illustration or example only.

In the drawings, like reference characters designate similar parts in the several views.

FIG. 1 is a cross-sectional view of a form for casting concrete tanks having bulging walls, the view being taken on the planes of line 1—1 of FIG. 8, and a cast tank being shown in the form.

FIG. 2 is a detailed and fragmentary cross-sectional view as taken on the line 2—2 of FIG. 8, the outer form components being omitted.

FIG. 3 is a longitudinal sectional view of the form as in FIG. 1 and taken on the planes of line 3—3 of FIG. 8.

FIG. 4 is an enlarged and broken longitudinal sectional view as taken substantially on the plane of line 4—4 of FIG. 1.

FIG. 5 is a fragmentary vertical sectional view as taken on the line 5—5 of FIG. 4.

FIG. 6 is a fragmentary view, as seen from the inside of the form, of the upper end of slide means that enable the inner form components to slip for release from a cast tank and return to operating position upon such release.

FIG. 7 is a similar view of the lower end of one of the slide means and showing means for releasing the slip components at one inner side of the form.

FIG. 8, to a smaller scale, is a plan view of a base on which the form of the present invention is assembled.

FIG. 9 is an enlarged fragmentary sectional view as taken on the line 9—9 of FIG. 1.

FIG. 10 is a similar view as taken on the line 10—10 of FIG. 3.

FIG. 11 is a semi-schematic cross-sectional view showing the manner of removing the form from the cast tank.

FIG. 12 is a broken end elevational view of the form to a smaller scale than FIG. 1.

FIG. 13 is an enlarged fragmentary longitudinal sectional view for locking the outer form components as shown in the upper portion of FIG. 12.

FIG. 14 is an enlarged fragmentary plan view of one end of spanner means which is shown in FIG. 12, and which controls the locked portion of the outer form components.

FIG. 15 is a view of the means shown in FIG. 7 in separated arrangement to clarify the structural details thereof.

The term "tank" in this disclosure and in the accompanying claims is used to describe a container or vessel that is open at either the top or bottom and has interior portions that are larger than the opening. In the present disclosure, the tank is shown as being made of concrete, the same having end walls **15**, a bottom wall **16** connecting said end walls, and side walls **17** that extend from said end and bottom walls and have bulging portions **18** In this case, the tank opening is opposite to the bottom wall **16**, spans between the end walls **15** and is defined laterally between straight and parallel side wall portions **19**. Hence, said opening is rectangular.

The present form in which said tank is cast comprises, generally, a base **20**, opposite outer side form components **21**, opposite outer end form components **22**, means **23** and **24** for separably locking together the four outer form components **21** and **22** to retain the same in concrete-receiving position opposite inner side form components **25** that, in operative position, are spaced inwardly from and parallel to the outer side form componints **21**, opposite inner end form sections **27** of isosceles trapezoidal form, a longitudinal wall **28** extending between the upper ends of said end form sections **27**, articulated hinge means **29** connecting the lower ends of said end form sections **27** to the respective opposite ends of the base **20**, similar but oppositely formed inner end form sections **30** and **31** constituting complements of the end form sections **27**, means **32** interconnecting the adjoining edges of the inner side components **25** and the end form sections **30** and **31**, spreader mechanism **33** for moving the inner sections **30** and **31** in opposite endwise directions as limited by the interconnecting means **32**, slide means **34** slidingly connecting the sloping edges of each trapezoidal inner form section **27** and the complementary edges of the respective inner end sections **30** and **31**, means **35** interengaging the end form sections **27** and **30** so the same move inward together to effect separation of the latter form sections from the inner surfaces of the concrete walls **15**, means **36** for releasing the form section **31** from said concrete walls **15**, and means **37** to releasably lock the inner form components and sections to the base **20**.

The base **20** is shown as a low rectangular frame that is supported on a pair of longitudinal I beams **40**, said rectangular frame comprising longitudinal channels **41** and transverse end channels **42**. Atop each channel **41**

is provided a narrower channel 43 and atop each channel 42 is provided a narrower channel 44. The channels 43 and 44 are in rectangular arrangement with their webs facing upwardly, the same constituting a rectangular molding wall onto which the open ends of walls 15 and of wall portions 19 bear. Inward of each channel 42, the base is provided with a channel 45, a similar and parallel channel 46 being provided intermediate the ends of the base. On opposite sides of the base frame and at both ends are provided two pairs of hinge brackets 47 which extend oppositely outwardly.

The outer side form components 21 (FIGS. 1 and 4) each comprises a convexly curved wall 48 that is reinforced by channels 49 that follow the curvature of the wall, extending from an upper horizontal channel 50 to a lower horizontal channel 51 that is disposed between said wall 48 and the lower end of the channels 49. The wall 48 is formed to define the outer form of the walls 17 of the cast tank, as above described. Each component 21 is connected, at its lower end, to the brackets 47, by a hinge pin 52 so that the form components 21 may be swung outwardly from their operative position, as in FIG. 1, to an out-of-the-way position, as in FIG. 8.

The outer end form components 22 (FIGS. 3 and 4) each comprises a flat wall 53 that is reinforced on its outer side by horizontally disposed angles 54. A bar-sectioned rim 55 circumscribes the perimeter of each wall 53. Said form components, as shown in FIG. 4, fit within the concave inner sides of the form components 21 to define the outer corners of the tank between the side and end walls of said tank.

The means 23 for locking the form components 21 and 22 together comprises an elongated member 56 that extends along the outside of each component 22, near its upper end, and is connected by its ends to brackets 57 provided on the edges of the form component 21. Said means 23 may be taken up, as by a turnbuckle 57*a*, to draw the components 21 to proper position, as controlled by the spanner means 24 which comprises an angle 58 arranged horizontally about midway between the hinges 52 and the locking member 56, and brackets 59 on the components 21 having lugs 59*a* that extend through slots in the ends of said angle 58. Pins 59*b* extend through said lugs 59*a* and lock the ends of the angle 58 to the brackets 59. Thus, the means 24 locates the components and the means 23 locks the same so as to resist displacement by the weight of concrete being poured into the outer form, as above described.

The inner side form components 25 (FIGS. 1, 3, 4 and 5) each comprises a convexly curved wall 60 spaced from the wall 48 of the mating outer form component 21 and, as shown in FIG. 1, parallel thereto. At the top, said walls 60 extend inwardly toward each other as horizontal wall extensions 61. Each wall 60 is reinforced by channels 62 that follow the curvature of the inner face of said wall and extend along the under side of the extension 61. Near the inner edge of each said extension is provided a longitudinal angle 63 (FIGS. 1 and 3).

Each inner end form section 27 (FIGS. 1, 3, 4, 6 and 7) comprises a flat wall 64 of isosceles trapezoidal form having a horizontal angle 65 at its upper narrower end and a horizontal angle 66 at its lower wider end. The lateral edges 67 of said wall 64 slope divergingly downward from the top. Horizontal angles 68 reinforce said wall 64 as do the mentioned angles 65 and 66.

The wall 28 connects the upper ends of the sections 27, the same being reinforced by two longitudinal angles 69. Said angles render the wall rigid, it being clear that the sections 27 and said wall form an inverted U-shaped unit in which the sections 27 have limited flexure for reasons later apparent.

The hinge means 29 (FIGS. 1, 3, 8 and 9) comprises a plurality of hinge units that connect the lower ends of the sections 27 and the channels 45, at opposite ends of the base 20. As best seen in FIG. 9, each unit comprises a link 70 that extends between brackets 71 on the sections 27 and brackets 72 on the channels 45. Normally, the lower ends of the sections 27 rest upon the channels 45 and laterally against the base channels 44, as in FIG. 3. Upon upward movement of a cast tank with the inner form therein, the links 70 swing upward to a steeper angle, causing the lower ends of the sections 27 to be drawn inwardly toward each other, as can be seen in FIG. 9. It is then that the above-mentioned flexure of the U-shaped unit comprised of sections 27 and wall 28 takes place.

The complementary end form sections 30 and 31 are similar but oppositely formed. Each said section comprises a flat wall 73 that has a sloping edge 74 that abuts one of the edges 67 of the wall 64, and outer edges 75 that are shaped to conform to the shape of the opposite inner form walls 60, so the same have rounded or bulging outer portions opposite to the sloping edges 74 thereof. A rim bar 76 is provided along said edge 75 of each said complementary sections 30 and 31, and an angle 77, at the top edge of each said section at both ends, as well as angles 78, serve the same purpose for these sections as do the angles 65 and 68 of the sections 27.

The means 32 interconnects the edges at the corners where the edges of the side components 25 join the edges of the sections 30 and 31 of the inner end walls of the inner form part of the present apparatus. FIGS. 1, 3, 4 and 5 show the means 32, the same comprising a plurality of hold-down clips 79 that are affixed to the end channel 62 at each end of the wall 60 of the side form component 25, an elongated slide clip 80 in the form of an angle and fixedly carried by each clip 79 and in longitudinally spaced arrangement along the edges of the walls 60, as shown in FIG. 3, and a stop clip 81 affixed to the wall 73 of each section 30 and 31. The clips 81 have hooking engagement with the slide clips 80, such that the walls 73 and 64 of the complementary sections 27, 30 and 31, at each end, may move inwardly, as described in connection with the description of the hinge means 29. Thus, the inner side components 25 and the inner end components formed of sections 27, 30 and 31 remain interconnected both when the latter are drawn inwardly and when the same are spread to operative position, as in FIGS. 3 and 4.

The spreader mechanism 33 is shown as oppositely directed lugs 82 fixedly carried by brackets 83 from the inner sides of the two inner side form components 25, a link 84 pivotally connected to each lug 82, and a link 85 pivotally connected to a brace 86 affixed adjacent each convex edge 75 of the walls 73 of the inner form sections 30 and 31 at both sides. There are four pairs of said links 84 and 85, each pair being pivotally connected to a toggle bar 87 that, when engaged at its end with abutment members 88 (FIGS. 3 and 8), straightens said pairs of links to press the inner end form component sections 30 and 31 oppositely outwardly so the lower ends thereof and of the complementary sections 27 bear against the inner faces of the base channels 44. When the inner form is raised upwardly, as mentioned in connection with the hinge means 29, the link pivots move upwardly with the form, freeing the toggle bar 87 from the abutment members 88 allowing the straightened links to fold and releasing the sections 30 and 31 to move inwardly as shown in FIG. 9.

The slide means 35 is shown in FIGS. 1 and 3 and in detail in FIGS. 4, 6 and 7, one such means being provided along each of the seams formed by the abutting edges 67 and 74 of the two inner end form components that are comprised of sections 27, 30 and 31. Each slide means is shown as a slide angle 90 along each edge 67 of the walls 64 of sections 27, a similar matching slide angle 91 along each edge 74 of each wall 73 of the sections 30 and 31, a guide angle 92 affixed by angle clips 93 to the respective angles 90, and wedge-cam

means **94** at the upper and lower ends of each slide means to draw the backs of the matching slide angles **90** and **91** into firm engagement to, thereby, hold the walls **64** and **73** of each inner end component in alignment, as indicated in FIG. 4. Said cam-wedge means **94** is carried, in part, by the angle **92** and, in part, by the angle **91** of each said means and, by spreading said angles apart, effecting the mentioned firm engagement of the backs of angles **90** and **91**.

The means **35** is shown in FIG. 7 and comprises a lug **95** affixed to the back of the angle **90** at one side of each wall **73**, and a slot **96** in the back of the matching angle **91** and which is provided only on the angle **91** that is provided on the sections **30** at each side. Said lugs **95** are engaged in said slot so that inward movement of the sections **27** will cause similar movement of sections **30** but not of sections **31**, since no such lug and slot connection is provided between the sections **27** and the complementary sections **31**.

The means **36** is shown as a lug extending inwardly from the toggle bars **87** on the side of the structure that is opposite to where the means **35** is provided. Said lugs engage the longitudinal angle **69** or the adjacent edge of wall **28** when the sections **31**, trapped within the cast tank, are moved upwardly during raising of the tank, as the slide angles on that side and at both ends slide relatively. Said engagement between lugs **36** and angles **69** arrests further upward movement of the sections **31** which release themselves from the inner faces of the concrete walls **15**, **16** and **17**.

The means **37**, best shown in FIGS. 2, comprises a pin **97** extending into a tube **98** at each side of the frame **20** and through a hole in a bracket **99** affixed to the under surface of a channel **100** that defines the bottom edge of each inner side component **25**. The pins **97** are provided with wedge ends **101** to serve as means to draw down on the brackets **99** and, therefore, to firmly seat the components **25**.

The means **37** acts in cooperation with locating members **102** (FIG. 10) that, together with the channels **43**, center the channels **100** and thereby releasably locate the lower ends of the form components **25**.

Operation

When the form is closed ready for casting a concrete tank, the pins **97** are applied to hold the inner form components firmly down on the base **20**, and the means **23** and **24** are applied to lock together the outer form components, leaving a space between said inner and outer form components to pour the tank, upside down, as shown.

After the concrete has set (about twenty-four hours) said pins are withdrawn and the means **23** and **24**, at both ends, are removed. Now, the outer side form components **21** are swung down on their hinges (FIG. 11) and the outer end form components **22** are removed, exposing the cast tank. A lifting device is then clamped around the outside of the tank. The first lifting movement of the tank causes the hinges **29** to straighten from the position shown in FIG. 3 to the position of FIG. 9 wherein the tank is raised from the base channel **44**, and the inner form sections **27**, represented by the wall **64** and angle **66**, are both raised and drawn inwardly out of engagement with the inner surfaces of the tank walls **15**. As can be seen from FIG. 4, said sections **27** may move inwardly even though one of the end sections, in this case section **31**, remains engaged with the tank wall **17**. Since the bulging form sections **30** and **31** at both ends and the inner side form components **25** are trapped within the opposite bulges of the portions **18** of the tank, the same move upwardly with the tank. Only the end form sections **30** at both ends, because of the interengaging means **35**, are drawn inwardly by the end sections **27**, the same also becoming loosened out of engagement with said tank walls **15**, The interconnecting means **32** between said sections **30** and their connecting side form components **25**, and freeing of the spreader means **33**, allow such inward movement of sections **30**.

The lifting device continues to raise the tank. Since the end form sections **27** remain connected to the base **20**, the end form sections **30** and **31**, at both ends, as well as the side form sections **25**, move upwardly with the tank, along the sloping slide **34**. Since the sections **31**, and the form side **25** that extends between them, are still "frozen" to the inner surface of the tank, the raising movement of these parts and the tank will follow the line of the slide **34** at the left in FIG. 11. The loosened sections **30** and the form side **25** that extends between them will also move up, but this movement is along the slope of the slide **34** at the right. As the raising of the tank continues, the sections **30** and connecting side **25** are freed from the bulge on that side, and the latter sections and side drop gravitationally, as indicated by the arrow **103**, out of the constricted open end of the tank

The raising of the tank continues until the lug means **36** of the spreader means **33** of the trapped side component **25** encounter the angles **69** or adjacent portions of the wall **28**, as shown in FIG. 11. This stops upward movement of end sections **31** and the connecting side form component **25**. Then, as the tank is raised still further, the same draws away from said end sections **31** and connecting side component **25**, which drop gravitationally along the left side means **34**, the tank being moved toward the left to accommodate such release of the sections **31** and connecting side.

Since all of the inner form components have been released and have dropped to their operative position on the base **20**, the interconnecting means **32** become automatically effective to limit the operative relationship of the components **25** and end sections **27**, **30** and **31** all around the inner form. The spreader means **33**, as the toggle bars **87** engage the members **88** of the bar, return the end sections **27** to said initial position, and the latter, due to the engagement between slide angles **91** and guide angles **92**, return the sections **30** and **31** so the means **32** may re-engage, as explained. The locating members **102** on the base aid this return of the inner form components to the position where the lock pins **97** may be again applied preparatory to casting the next tank.

After the inner form components have been reassembled to operative position, the outer form components are reassembled and the next tank may now be poured.

The cast tank may now be transported to storage and deposited either in its initial upside down position or turned to its position of use.

While the foregoing illustrates and describes what is now contemplated to be the best mode of carrying out the invention with respect to both the method and apparatus, the same is, of course, subject to modification without departing from the spirit and scope of the invention. Therefore, it is not desired to restrict the invention to the particular method steps or combination or sequence of steps described, nor to the particular form of construction illustrated and described, but to cover all equivalents or modifications of method and apparatus that may fall within the scope of the appended claims.

Having thus described the invention, what is claimed and desired to be secured by Letters Patent is:

1. An inner form for casting a concrete tank having bulging sides and generally flat ends, said form being adhered to the tank and comprising:

(a) a base,

(b) opposite sectional ends, each comprising a central trapezoidal section and oppositely formed end sections that have convex edges residing in the bulges of a tank cast around said form,

(c) opposite convex sides conforming to the inner concave faces of the tank sides,

(d) means loosely connecting the convex edges of the oppositely formed end sections with the edges of the convex sides,

(e) hinge means connecting the trapezoidal end sections to the base to draw said sections inwardly to release the same from engagement with the inner faces of the flat ends of the tank upon raising of the tank away from the base,

(f) means interconnecting the trapezoidal section, at each end, with one of the oppositely formed end sections to inwardly move and release the latter also,

(g) converging slide means connecting each sloping edge of the two trapezoidal sections with the adjacent edges of the oppositely formed end sections,

(h) the slide means that connect the non-released oppositely formed sections being sloped in a direction to move the convex side connected to said non-released sections and the tank adhered thereto laterally to free the released oppositely formed sections and the connected convex side from the bulge of the tank so the same may gravitationally slide on the slide means to initial position during continued upward movement of the tank, and

(i) means to arrest the upwardly sliding movement of the non-released sections to release the same and the connected convex side during continued upward movement of the tank, the latter sections and side gravitationally returning to initial position.

2. A form according to claim 1 provided with means, interconnecting the oppositely formed end sections and the base, releasable upon upward movement of the trapezoidal sections on the hinge means, to free said end sections for release movement from the tank.

3. A form according to claim 1 in which the base, the end sections, and the convex sides retain loose connection one with the other through the hinge, interconnecting and slide means, during all operative movements of the form.

4. A form according to claim 1 in which

(a) a longitudinal wall part connects the ends of the trapezoidal sections opposite the end engaged with the base, and

(b) the convex sides are each provided with an extension cooperating with said wall to form a form closure on which concrete is poured.

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