Sept. 14, 1965 M. C. NOTTINGHAM ETAL 3,206,532

METHOD FOR CASTING CEMENT TANKS

Filed June 24, 1963

4 Sheets-Sheet 1

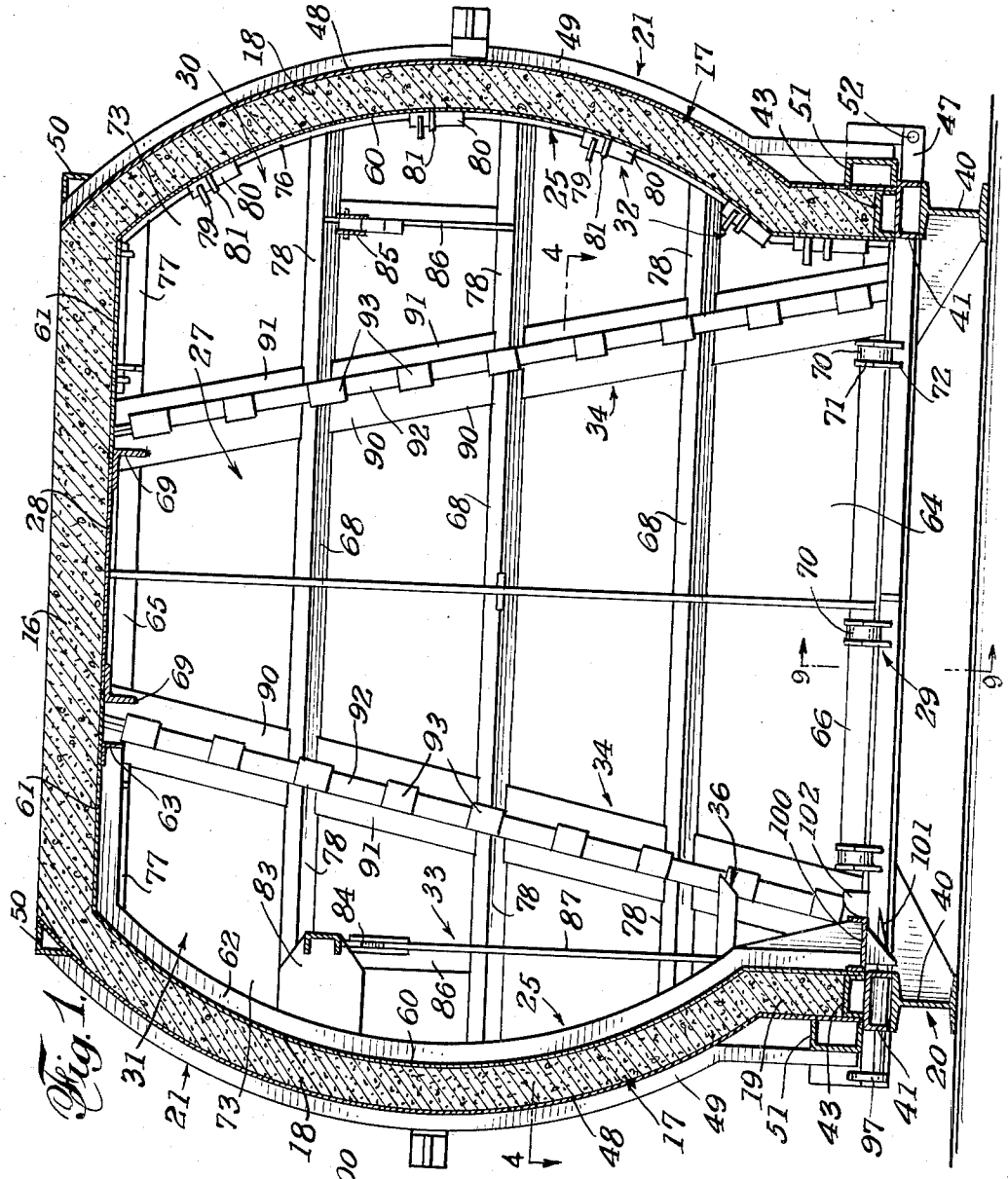

Fig. 1.

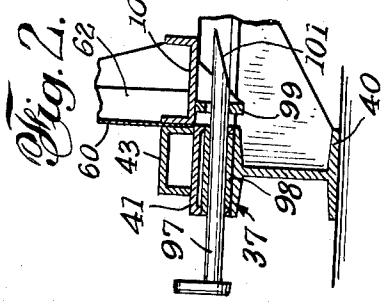

Fig. 2.

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METHOD FOR CASTING CEMENT TANKS

Filed June 24, 1963 4 Sheets-Sheet 2

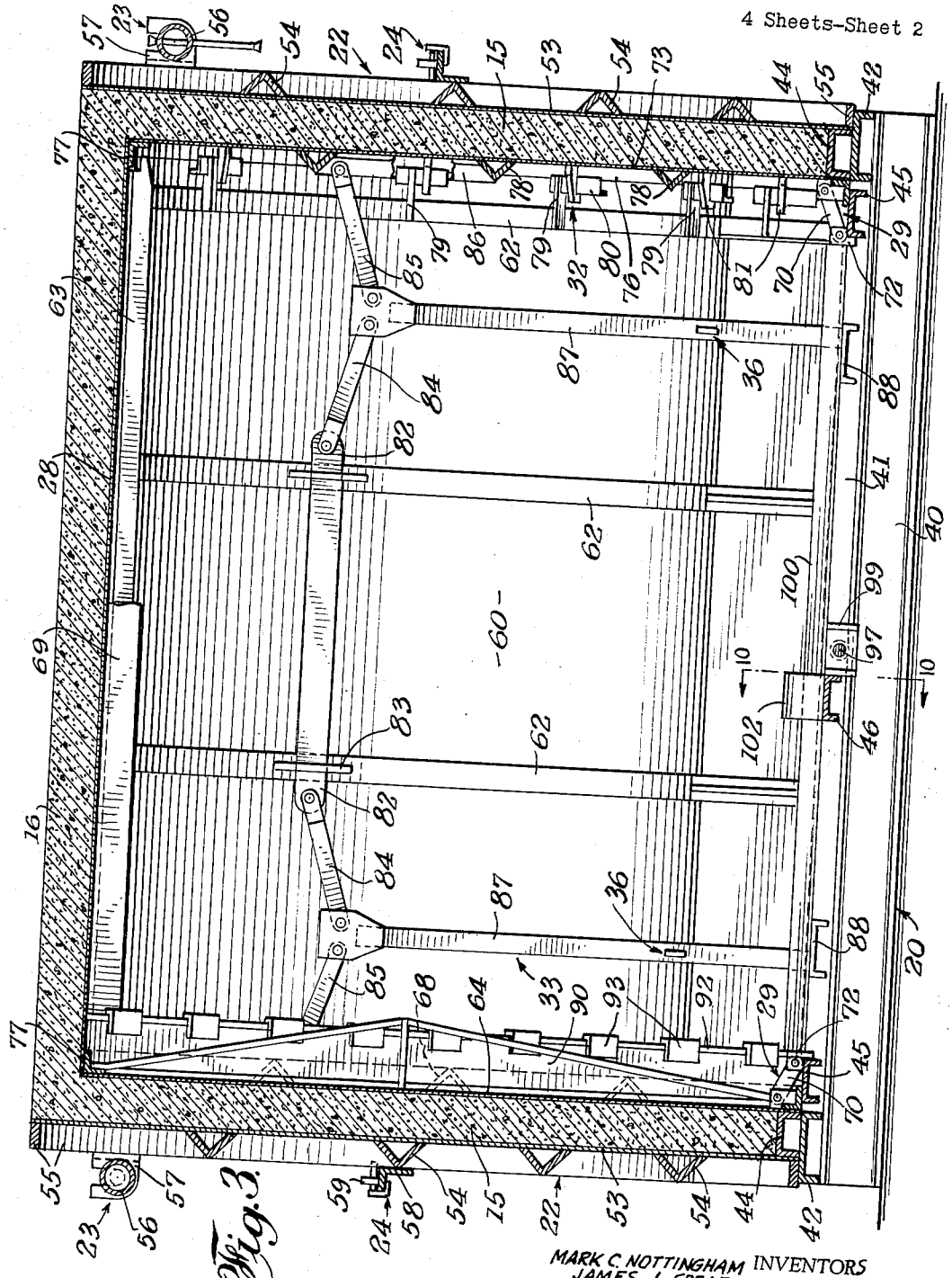

Fig. 3.

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METHOD FOR CASTING CEMENT TANKS

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4 Sheets-Sheet 3

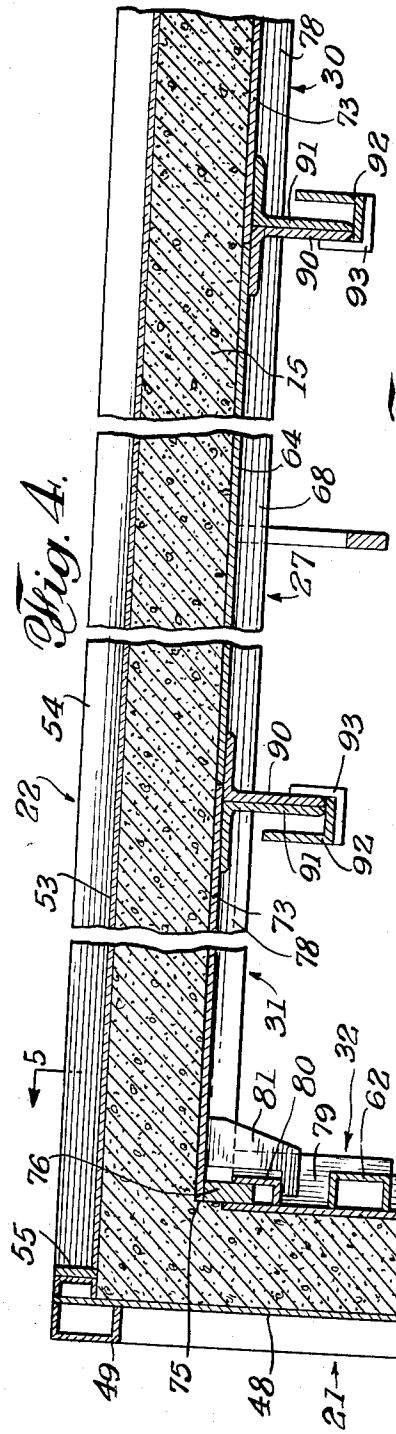

Fig. 4.

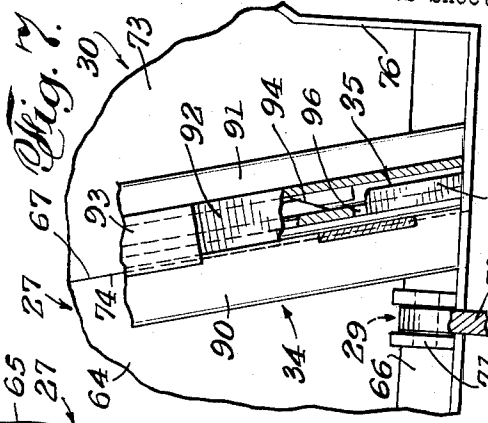

Fig. 7.

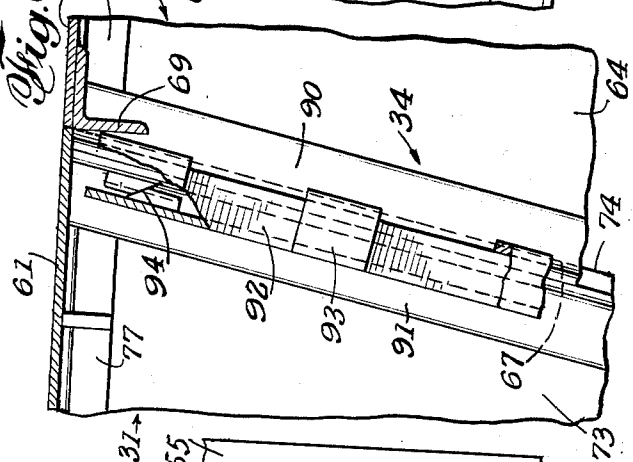

Fig. 6.

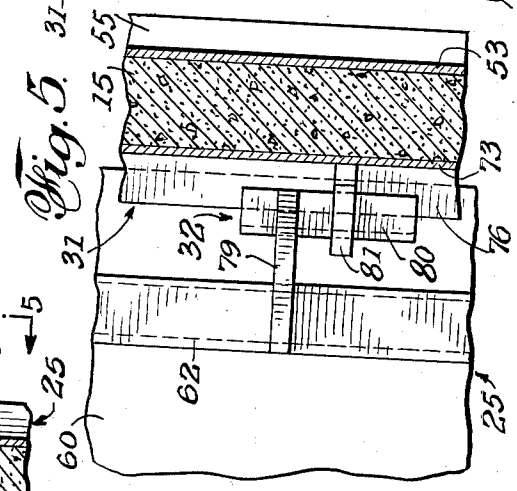

Fig. 5.

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METHOD FOR CASTING CEMENT TANKS

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4 Sheets-Sheet 4

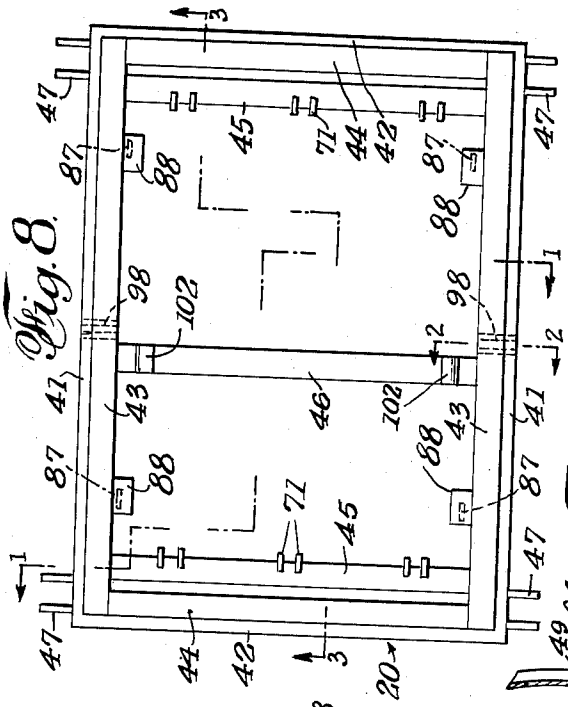

Fig. 8.

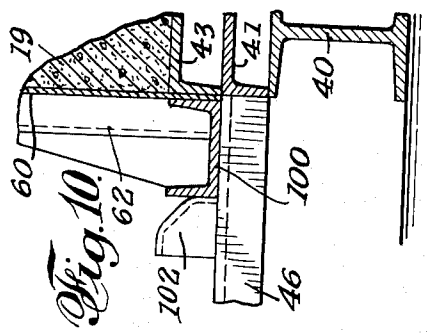

Fig. 10.

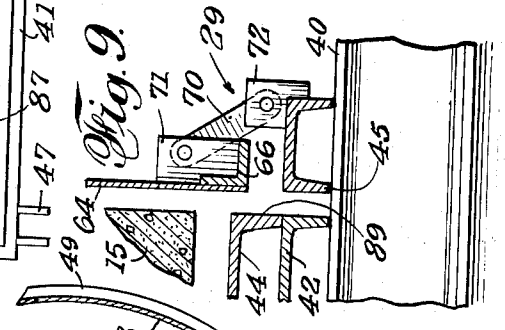

Fig. 9.

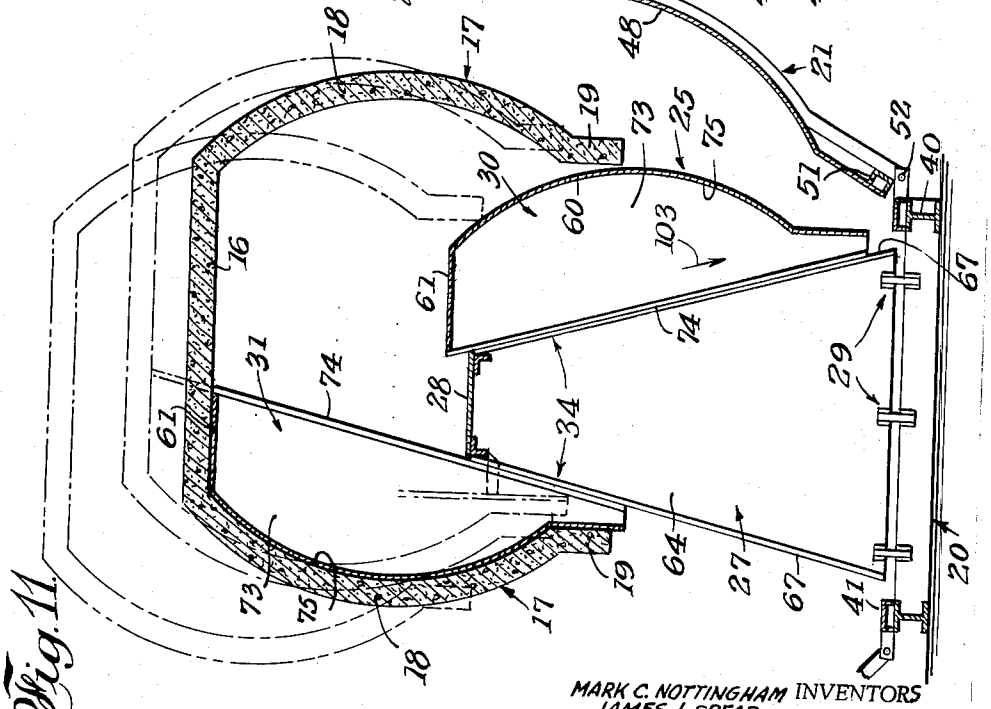

Fig. 11.

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United States Patent Office 3,206,532 Patented Sept. 14, 1965

3,206,532

METHOD FOR CASTING CEMENT TANKS

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Filed June 24, 1963, Ser. No. 289,797
7 Claims. (Cl. 264—304)

This invention relates to a method using casting forms for casting concrete receptacles, especially those having outwardly bulging walls. The present method is herein disclosed in connection with a concrete septic tank having flat end walls and outwardly bulged side walls.

An 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 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.

The invention also contemplates novel combinations of method steps, 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, 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.

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 components 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 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 and engaged with the ends of said angle. 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 84 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 show 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 angles 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 FIG. 2, comprises a pin 97 extending into a tube 98 at each side of the frame 20 and through a hole in the 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 corporation with locating mem-

bers **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 cocrete 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 the method, 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, but to cover all equivalents or modifications of method steps 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. A method for casting a concrete tank that has oppositely bulged sides, said method consisting in

(a) pouring concrete around an inner form that has continuous convex sides and sectional ends,

(b) loosening sections of said ends and one of said sides from one of the inner concave surfaces of the tank after the concrete has set while raising the tank which initially loosely retains assembly of said loosened sections and side,

(c) raising the tank sufficiently to allow the loosened form sections to gravitationally return to their initial tank-casting position while continuing raising movement of the tank,

(d) loosening additional sections of said sectional end and the other convex side from the other inner concave surface of the tank while continuing to raise the tank and while loosely retaining assembly of the latter end sections and convex side, and

(e) allowing said additional sections and side to gravitationally return to their initial tank-casting position.

2. A method according to claim **1** in which the end sections that are engaged in the bulges of the tank are held against loosening movement and are freed for such movement only when upward movement of the tank is begun.

3. A method according to claim **1** in which an outer form into which the concrete is poured is removed from around the set tank to enable engagement of the tank to raise the same.

4. A method according to claim **1** in which the tank to be cast is generally elongated and the inner form is made up of a plurality of sub-sections, including one centrally disposed sub-section of generally isosceles trapezoidal cross-sectional configuration.

5. A method according to claim **4** in which the inner form is made up of three sub-sections, including one centrally disposed sub-section as aforesaid, and a sub-section disposed on each side of the centrally disposed sub-section and abutting same, whereby the tank can be lifted, thus raising the two non-central sub-sections.

6. A method according to claim **5** in which the end sections that are engaged in the bulges of the tank are held against loosening movement and are freed for such movement only when upward movement of the tank is begun.

7. A method according to claim **5** in which the end sections are hingedly connected to supports, whereby they are held against loosening movement and freed for such movement only when upward movement of the tank is begun.

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