

Dec. 11, 1934.

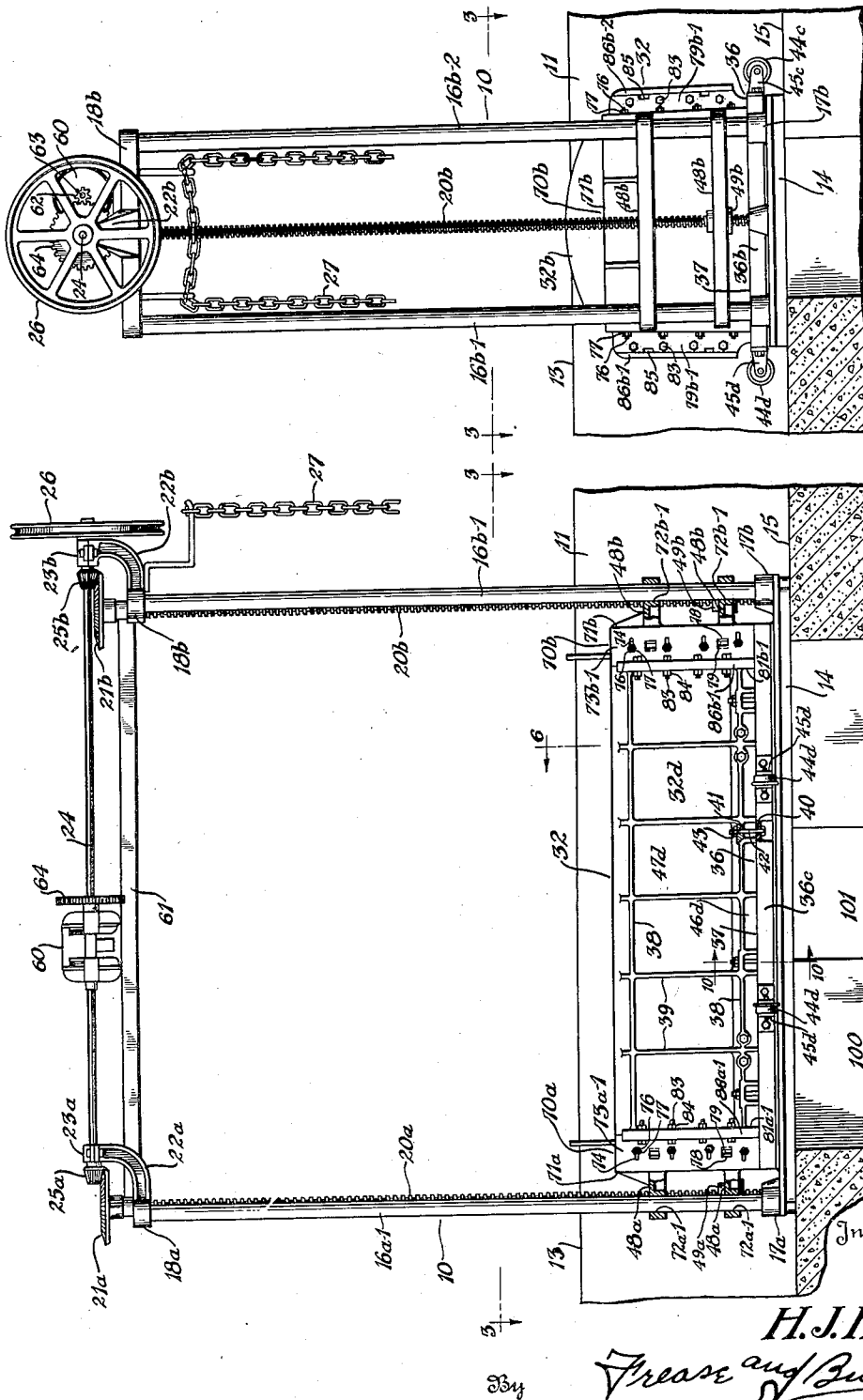
H. J. HICK

1,983,757

METHOD FOR CASTING MASSIVE STRUCTURES

Filed June 7, 1932

6 Sheets-Sheet 1



Dec. 11, 1934.

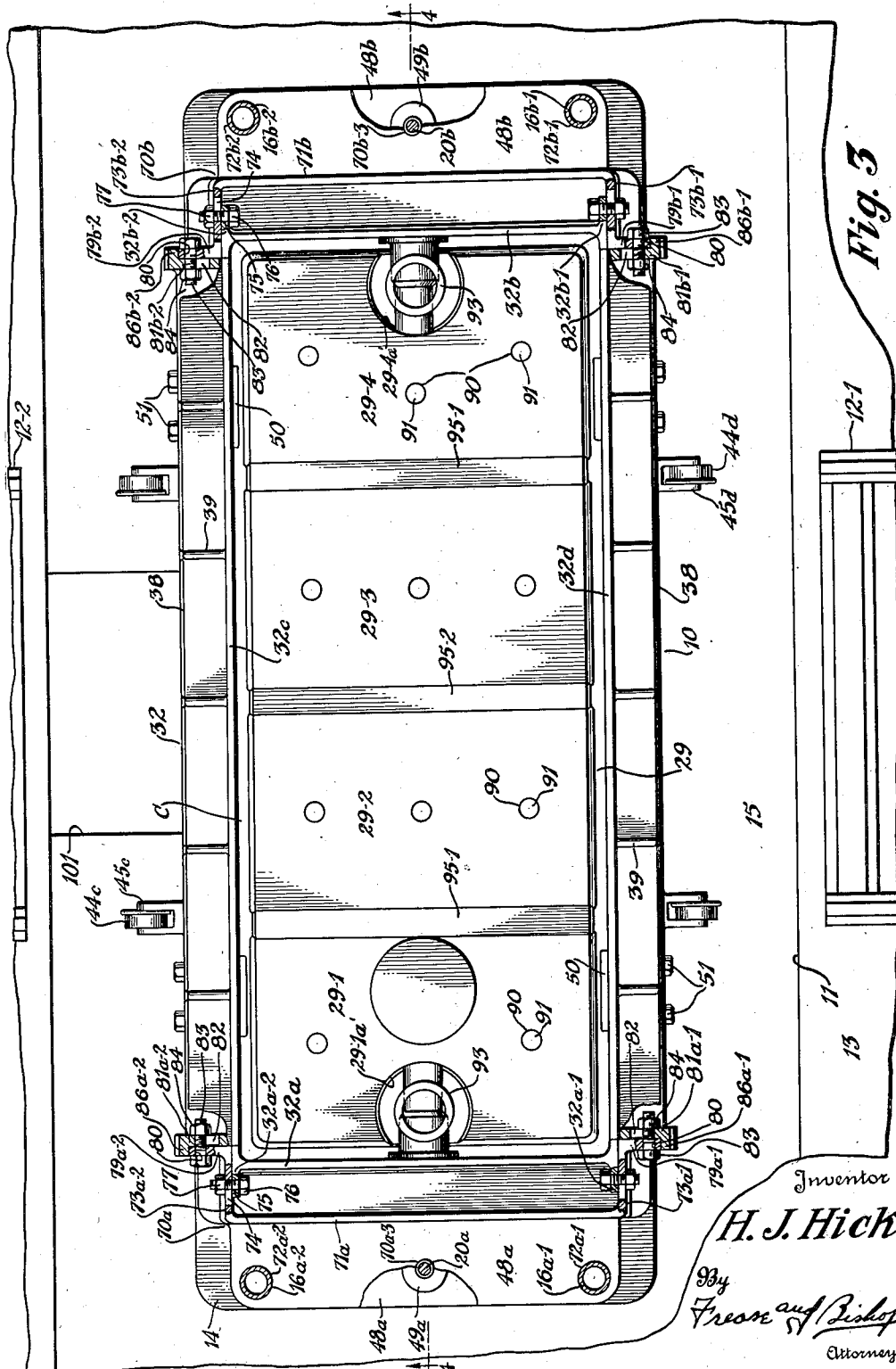
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METHOD FOR CASTING MASSIVE STRUCTURES

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6 Sheets-Sheet 2



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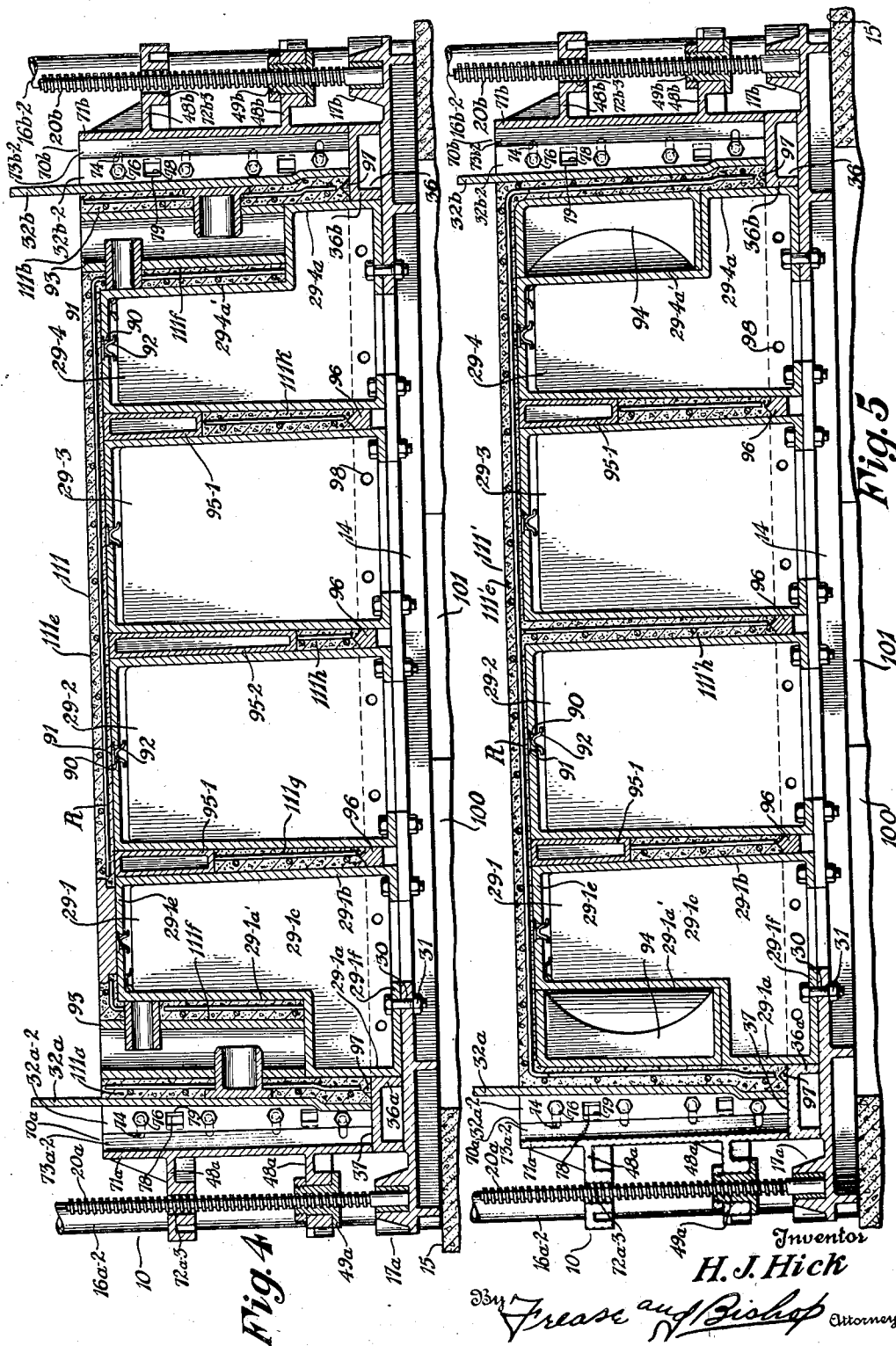
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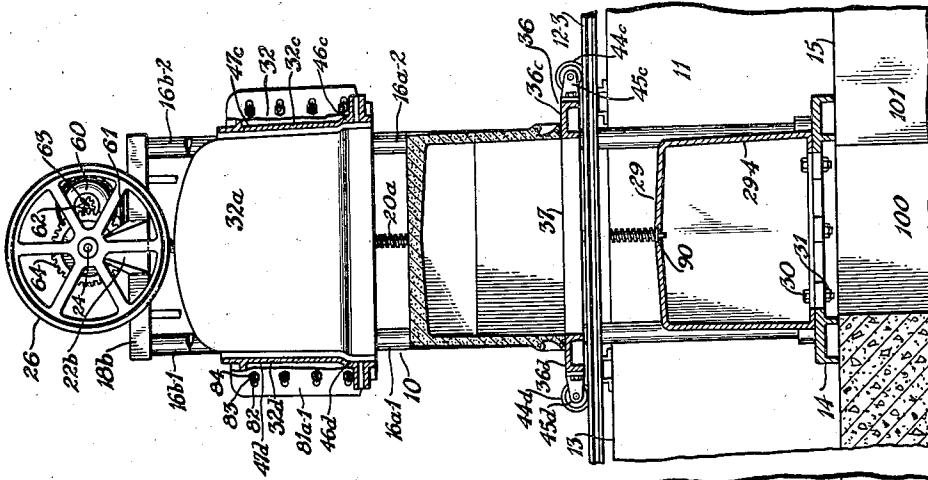


Fig. 8

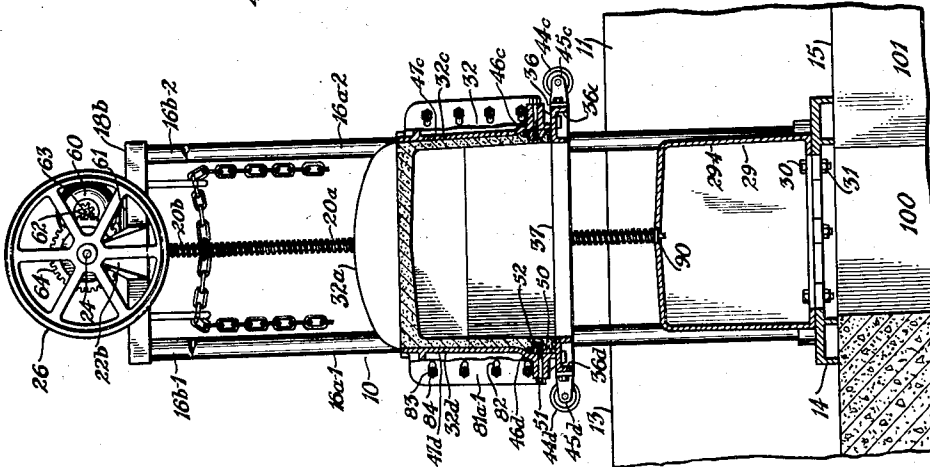


Fig. 7

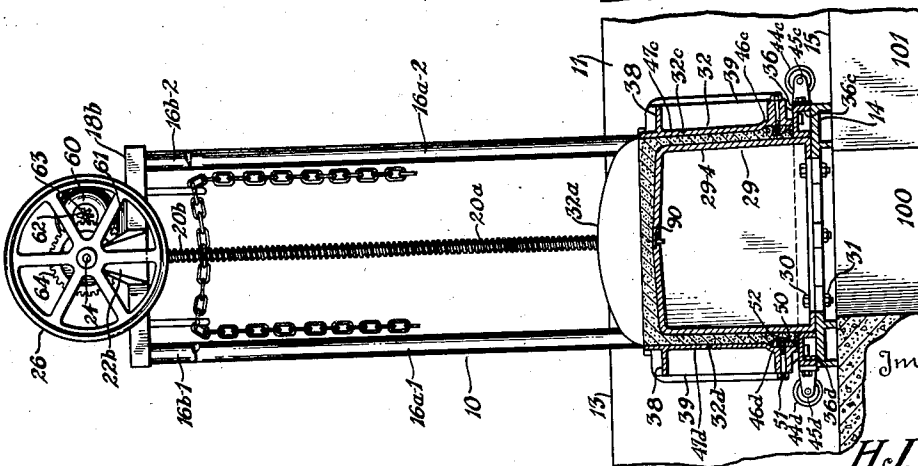


Fig. 6

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METHOD FOR CASTING MASSIVE STRUCTURES

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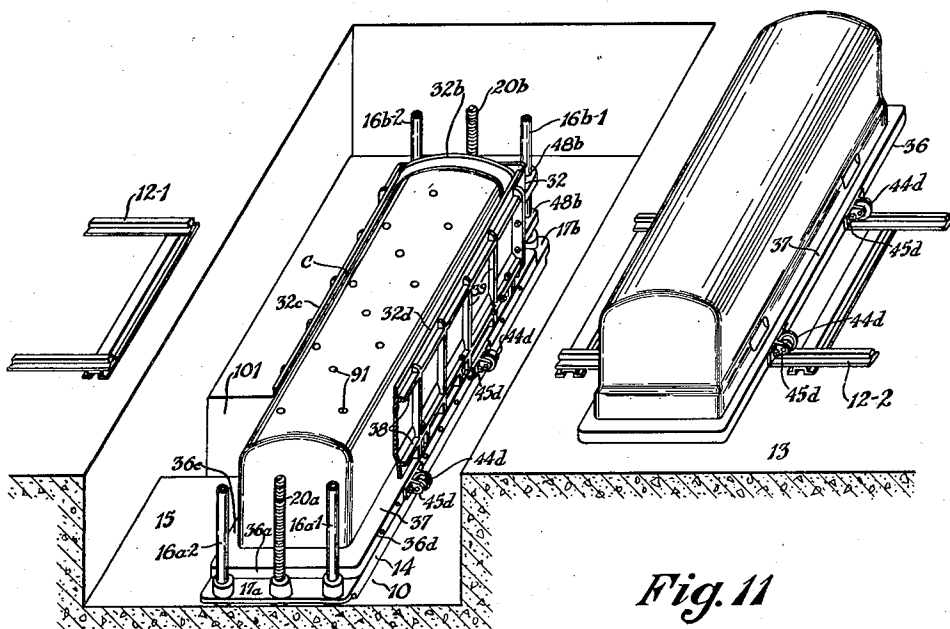


Fig. 11

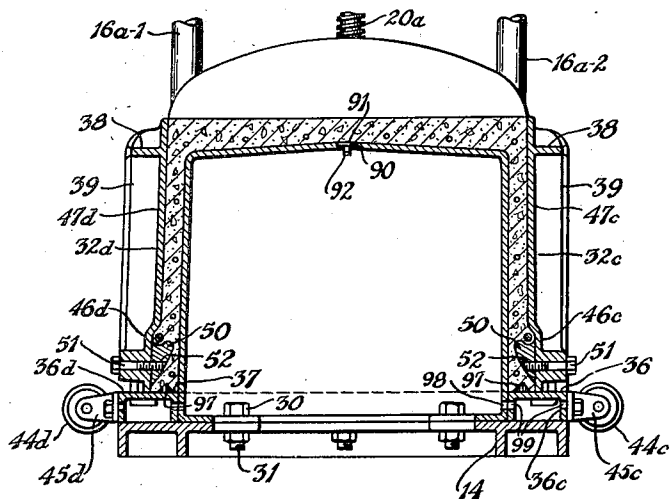


Fig. 9

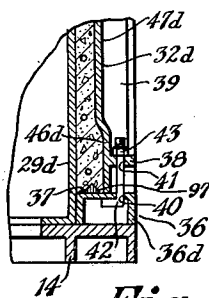


Fig. 10

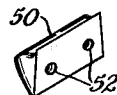


Fig. 12

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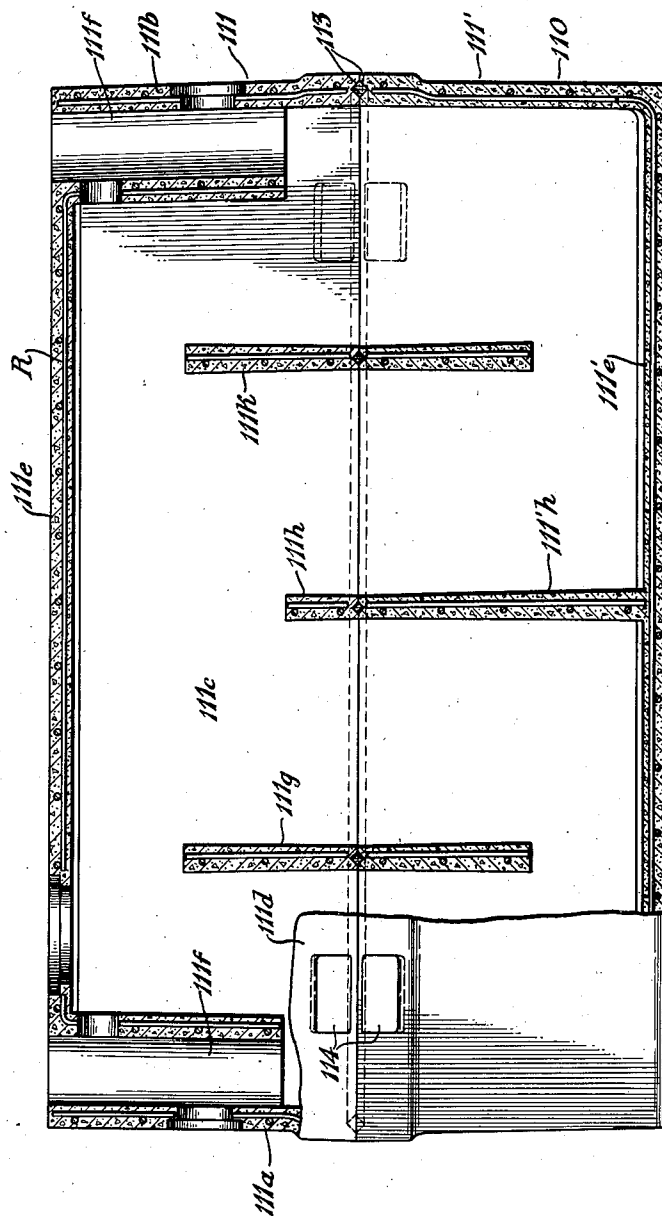
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METHOD FOR CASTING MASSIVE STRUCTURES

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UNITED STATES PATENT OFFICE

1,983,757

METHOD FOR CASTING MASSIVE
STRUCTURES

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Application June 7, 1932, Serial No. 615,844

1 Claim. (Cl. 25—155)

My invention relates to methods and apparatus for casting massive structures, such as septic tanks, and the like; which may be pre-cast preferably in permanent molds usually from plastic material such as concrete.

The present invention includes certain improvements set forth but not claimed in my prior application for United States Letters Patent for Methods and apparatus for casting massive structures, filed January 15, 1932, Serial No. 586,721, of which the present application is a continuation in part of common subject matter, and the present invention also includes improvements in the methods and apparatus of said prior application.

Generally speaking, casting methods and apparatus available prior to the methods and apparatus of said prior application, whether particularly adapted for casting structures from plastic material such as concrete, or whether adapted for casting structures from molten metallic material, are primarily designed for intermittent and irregular operation, are relatively slow in operation, and thus involve a relatively high cost in machine and man hours per unit of manufactured product.

Methods and apparatus adapted for use in continuous production lines must be capable of relatively rapid operation, and always result in a lower cost in machine and man hours per unit of manufactured product, than the cost in machine and man hours per unit of the same manufactured product when produced by slower intermittent and irregular methods.

On the other hand, the casting of massive structures as practiced by the use of the usual methods and apparatus, involves a relatively high cost in machine and man hours per unit of manufactured product, without considering reductions in cost attainable by the adoption of continuous manufacturing methods, due to the fact that casting single units under ordinary conditions is relatively slow, because excessive manipulation of the molds or forms is required in preparing the same for pouring and in removing the cast product or structure from the molds.

From another standpoint, in the casting of massive concrete or cement structures as heretofore practiced, particularly when said structures are relatively high or deep dome shells, such as grave vaults, half-sections of septic tanks, or the like, great difficulty has been experienced in avoiding cracking of the wall or walls of the dome shell during setting of the

structure after pouring, and heretofore it has always been considered absolutely necessary to permit the cast dome shell structure to reach a final set after pouring before removing any of the molds, and despite which, losses due to wall cracking have been relatively high.

Accordingly, common objects of the invention of said prior application and of the present invention include the provision of improved methods and apparatus for casting massive structures, whereby a substantial reduction is attained in the machine and man hours required per unit of manufactured product, and by the use of which continuous manufacturing methods may be carried out for casting massive structures.

Further common objects of the invention of said prior application and of the present invention include the provision of improved methods and apparatus for casting massive structures, whereby the improved apparatus may be operated for carrying out the improved methods, with rapidity and with a high degree of facility.

Further common objects of the invention of said prior application and of the present invention include the provision of improved methods and apparatus for casting massive structures which are particularly adapted for use in connection with permanent molds, and by the use of which the cast structure may be removed from the molds in a minimum period of time after pouring the structure, and with the requirement of a minimum manipulation of the molds in preparation for pouring and during removal of the cast structure from the molds.

Further common objects of the invention of said prior application and of the present invention, include the provision of improved methods and apparatus for casting massive high or deep dome shell structures, whereby losses due to wall cracking are reduced to a minimum.

Additional objects of the present invention include the provision of improvements in the methods and apparatus of said prior application, said improvements being particularly directed toward facilitating manipulation of the molds, both for assembling the molds for casting, and for stripping the molds from the cast product, and said improvements being further directed towards facilitating stripping of a cast dome shell structure from its inner mold, and said improvements being further directed towards providing an apparatus whereby a number of different dome shell structures, such as half-sections of septic tanks, grave vaults, and the

like, may be made by the use of similar outer molds, and by interchanging inner molds, and said improvements being further directed towards facilitating the interchanging of the inner molds.

The foregoing and other objects are attained by the methods, apparatus, improvements, combinations, and sub-combinations, which comprise the present invention, and the nature of which is set forth in the following general statement, and preferred embodiments of which are set forth in the following description, and which are particularly and distinctly pointed out and set forth in the appended claim forming part hereof.

In general terms the method of making cast structures hereof includes improvements in the method set forth in my said prior application, Serial No. 586,721, and is particularly adapted for making relatively high or deep dome shells, and includes the use of one or more dome-shaped inner molds, and independently supported preferably separable members forming an outer mold which is movable into and out of position with respect to the inner mold or molds so as to form a mold cavity or cavities in which the structure is cast with its material in engagement with the outer mold, and after the material of the cast structure has attained an initial set, the outer molds and the cast structure engaged thereby are separated from the inner mold or molds, and the outer mold is disengaged and separated therefrom for permitting the material of the cast structure to attain a final set, whereby after removal of the cast structure with its material in the condition of initial set from the molds, adequate shrinkage of the material of the cast structure is attainable during the further setting process, whereby substantially any desired mix may be employed without the otherwise usual losses which occur when dome shells are cast and permitted to attain a permanent set before removing the inner molds.

The casting apparatus of the present invention includes in general the improvements in casting apparatus set forth in my said prior application, Serial No. 586,721, and more particularly includes longitudinally spaced jack members or frames, means for simultaneously moving the jack members or frames selectively in either one of opposite directions, one or more inner molds located between the jack members or frames, preferably separable members forming an outer mold, each of the separable members being preferably adjustably supported either on one of the jack members or frames, or with one end on one and one end on the other, the outer mold being thus arranged for being supported solely by the jack members or frames, and the outer mold being preferably arranged for engagement with a structure cast in the mold cavity formed when the outer and inner molds are in mold cavity forming position, whereby movement of the outer mold away from the inner mold serves to strip the cast structure from the inner mold or molds, and the foregoing being preferably provided with other improved details of construction, as are hereinafter more fully set forth.

Preferred embodiments of the improved apparatus hereof, preferably adapted for carrying out the improved methods, are illustrated in the accompanying drawings forming part hereof, in which

Figure 1 is a fragmentary side elevation of an embodiment of the improved apparatus, as arranged for making half-sections of concrete septic tanks, with portions broken away and illustrated in section;

Fig. 2, a fragmentary end elevation thereof, with portions broken away and illustrated in section;

Fig. 3, an enlarged plan sectional view thereof, as on line 3—3, Figs. 1 and 2, with portions broken away and illustrated in section, and the inner and outer molds being associated with suitable cores for making the top half-section of a concrete septic tank, and the inner and outer molds being in their relative positions for having the top half-section of a septic tank cast therein;

Fig. 4, a longitudinal vertical sectional view thereof as on line 4—4, Fig. 3, and with the top half-section of a concrete septic tank cast between the molds;

Fig. 5, a similar view illustrating the arrangement of cores for making the bottom half-section of a concrete septic tank, and with the bottom half-section of a concrete septic tank cast between the molds;

Fig. 6, an end elevation and transverse sectional view of the apparatus as on line 6—6, Fig. 1, illustrating the relative arrangements of the parts just after the half-section of a concrete septic tank has been cast;

Fig. 7, a view similar to Fig. 6, illustrating the outer mold with the cast tank half-section separated from the inner molds by operation of the apparatus to elevate the outer mold and cast tank half-section;

Fig. 8, a similar view illustrating the outer mold bodily separated from the cast tank half-section, the cast tank half-section resting on the preferred separable lifting and engaging ring member, and the ring member being preferably provided with wheels for rolling on a length of track placed beneath the wheels as illustrated, whereby the ring member and the tank half-section carried thereon may be laterally rolled away from the remaining parts of the casting apparatus, in carrying out the improved methods;

Fig. 9, an enlarged fragmentary transverse sectional view of the apparatus, similar to Fig. 6;

Fig. 10, a similar fragmentary transverse sectional view thereof as on line 10—10, Fig. 1;

Fig. 11, a detached isometric view illustrating one of the preferred separable combined engaging and socket forming members, preferably for the outer mold members of the apparatus;

Fig. 12, a detached fragmentary oblique view illustrating the improved apparatus with an inner mold adapted for making grave vaults; and

Fig. 13, a longitudinal vertical sectional view illustrating cast top and bottom half-sections of an improved septic tank, made by the improved methods and apparatus, and assembled together as a complete tank.

Similar numerals refer to similar parts throughout the drawings.

The improved casting apparatus is indicated generally by 10 and for most advantageously carrying out the improved methods, the lower portions of the casting apparatus 10 are preferably located in a pit 11 which extends laterally, preferably between opposite spaced ends

of track sections 12—1 and 12—2 which are laid upon the ground or floor surface 13.

For facilitating the carrying out of the improved methods as will hereinafter be set forth in greater detail a portable track section 12—3 is provided for selectively bridging across the top of the pit 11 and connecting the opposite ends of the sections 12—1 and 12—2.

The casting apparatus 10 includes a base 14 which rests upon the bottom 15 of the pit 11. Laterally spaced corner posts 16a—1 and 16a—2 are secured at their lower ends to one end 17a of the base 14 and extend upwardly therefrom; and similarly, laterally spaced corner posts 16b—1 and 16b—2 are secured at their lower ends to the other end 17b of the base and extend upwardly therefrom.

The upper ends of the posts 16a—1 and 16a—2 are secured to and support a gear mounting and bearing bracket 18a; and similarly, the upper ends of the posts 16b—1 and 16b—2 are secured to and support a gear mounting and bearing bracket 18b.

Members forming improved inner and outer molds indicated generally by 29 and 32, respectively, are located above the base 14 and between the posts 16a—1 and 16a—2, and the posts 16b—1 and 16b—2, and the height of these posts is such that the distance between the base 14 and the brackets 18a and 18b is preferably over three times the overall height of the mold forming members, for enabling the preferred operation of the apparatus for carrying out the improved method, as will be hereinafter set forth in greater detail.

A jack screw shaft 20a is preferably located between the posts 16a—1 and 16a—2, and the shaft 20a is journaled at its lower end in the end 17a of the base 14, and the shaft 20a is journaled adjacent its upper end in the bracket 18a, and the shaft 20a preferably extends above the bracket 18a, and a bevel gear 21a is secured upon the upper end of the shaft 20a, above one side of the bracket 18a.

Similarly, a jack screw shaft 20b is preferably located between the posts 16b—1 and 16b—2 and the shaft 20b is journaled at its lower end in the end 17b of the base 14, and the shaft 20a is journaled adjacent its upper end in the bracket 18b, and the shaft 20a preferably extends above the bracket 18b, and a bevel gear 21b is secured upon the upper end of the shaft 20b above one side of the bracket 18b.

The bracket 18a includes an angled arm 22a extending laterally from one side of the bracket and upwardly at one side of the bevel gear 21a; and similarly the bracket 18b includes an angled arm 22b extending laterally from one side of the bracket and upwardly at one side of the bevel gear 21b.

The arms 22a and 22b are preferably arranged as illustrated, so that the arm 22a is located between the set of posts 16a—1 and 16a—2, and the set of posts 16b—1 and 16b—2, and the arm 22b is located on the other or outer side of the set of posts 16b—1 and 16b—2.

The arm 22a preferably terminates in a bearing block 23a which is preferably located above the bevel gear 21a; and similarly the arm 22b terminates in a bearing block 23b which is preferably located above the bevel gear 21b, and the bearing blocks 23a and 23b have journaled therein a drive shaft 24 which extends longitudinally between and through the bearing blocks, as illustrated.

A bevel pinion 25a is secured on the end of the shaft 24 adjacent the bevel gear 21a, and the pinion 25a is meshed with the gear 21a.

A bevel pinion 25b is secured on the shaft 24 between the bearing blocks 23a and 23b, and the pinion 25b is meshed with the gear 21b.

A chain drive wheel 26 is secured upon the end of the shaft 24 on the outer side of the bearing block 23b, and an endless pull chain 27 may be meshed with a suitably socketed peripheral groove 28 which as illustrated is provided for the chain drive wheel 26.

The chain 27 is preferably of sufficient length so that when applied to the wheel 26, the chain 27 will hang down substantially to the ground level 13, in order that the chain may be easily grasped by the operator of the apparatus; whereby a pull on the chain will cause rotation of the wheel 26 and of the shafts 20a and 20b, by reason of the above described gearing and drive shaft connection between the shafts 20a and 20b and the wheel 26.

Obviously the direction of rotation of the shafts 20a and 20b depends upon which side portion of the chain 27 is grasped and pulled by the operator.

Normal rotation of the drive shaft 24 is preferably effected by means of a motor 60 which is mounted on a base channel 61 extending between and being supported on the brackets 18a and 18b.

The motor 60 is operatively connected with the shaft 24 as by means of a pinion 62 secured on one end of the motor shaft 63, and meshed with a gear 64 which is secured on the drive shaft 24.

The motor 60 is a reversing motor, and is supplied with power from any usual power line, not shown, and is controlled by any usual reversing switches and suitable auxiliary controlling apparatus, not shown.

The bevel pinions 25a and 25b are the same size and have the same number of teeth, and the bevel gears 21a and 21b are the same size and have the same number of teeth, and accordingly the jack screw shafts 20a and 20b rotate at the same speed.

The threads of the jack screw shafts 20a and 20b have the same pitch, and the shaft 20a is screw connected with a jack frame 70a which is slidably mounted on and thus guided by the posts 16a—1 and 16a—2.

Similarly, the jack screw shaft 20b is screw connected with a jack frame 70b which is slidably mounted on and thus guided by the posts 16b—1 and 16b—2.

Accordingly the jack frames 70a and 70b will be raised or lowered simultaneously, and at the same speed, depending upon the direction of rotation of the jack screw shafts 20a and 20b. In other words the improved apparatus 10 includes the longitudinally spaced jack frames 70a and 70b, and means for simultaneously raising and lowering the jack frames preferably at the same speed.

As illustrated, the jack frame 70a preferably includes a laterally and transversely extending web member 71a, and transversely spaced laterally extending upper and lower ribs 48a which protrude outwardly from the outer face of the web member 71a; and the ribs 48a have formed therein guide bearing apertures 72a—1 and 72a—2 which slidably fit respectively on the posts 16a—1 and 16a—2; and the upper rib 48a of the jack frame 70a has formed therein an

aperture 72a—3 through which the screw shaft 20a slidably extends; and the lower rib 48a of the jack frame 70a has secured therein a nut 49a, and the shaft 20a extends through and screws in the nut 49a.

Similarly as illustrated, the jack frame 70b preferably includes a laterally and transversely extending web member 71b, and transversely spaced laterally extending upper and lower ribs 48b which protrude outwardly from the outer face of the web member 71b; and the ribs 48b have formed therein guide bearing apertures 72b—1 and 72b—2 which slidably fit respectively on the posts 16b—1 and 16b—2; and the upper rib 48b of the jack frame 70b has formed therein an aperture 72b—3 through which the screw shaft 20b slidably extends; and the lower rib 48b of the jack frame 70b has secured therein a nut 49b, and the shaft 20b extends through and screws in the nut 49b.

As is hereinafter set forth in greater detail, the jack frames 70a and 70b provide the sole supporting or suspending means for the outer mold 32, whereby the outer mold 32 may be raised, lowered, or maintained at any desired elevation, during operation of the apparatus.

Also, as is hereinafter set forth in greater detail, the inner molds 29 are normally releasably secured upon the base 14, but when it is desired to change the inner molds, in order to change the product to be cast, the inner molds are released from the base 14, and the inner and outer molds are arranged so that the inner molds 29 may be selectively supported on the outer mold 32, whereby when the inner molds are supported by the outer mold 32, raising and lowering of the outer mold 32 serves to raise and lower the inner molds 29.

The improved molds 29 and 32 as illustrated, are arranged for making half-sections of septic tanks. The inner molds 29 include a plurality of dome-shaped molds 29—1, 29—2, 29—3, and 29—4.

The inner mold 29—1 includes longitudinally spaced laterally extending end walls 29—1a and 29—1b, the side corners of which are connected by and merge with the end corners of longitudinally extending laterally spaced side walls 29—1c and 29—1d, and the upper corners of the side and end walls are connected by and merge with the outer corners of a top wall 29—1e.

From the lower corners of the end and side walls, there extends inwardly a peripheral flange 29—1f, by which the dome-shaped inner shell member 29—1 is separably secured to the base 14 as by means of bolts 30 and nuts 31, the shanks of the bolts extending through suitable registering apertures in the flange 29—1f and the base 14, and the nuts 31 being screwed on the threaded ends of the bolts and serving to clamp the flange 29—1f and the base 14 between the nuts and the heads of the bolts in a usual manner.

Each of the inner molds 29—2, 29—3, and 29—4 is generally similar to the inner mold 29—1 in its construction and in its mode of being separably secured to the base 14.

The molds 29—1 and 29—4 comprise end molds, and the molds 29—2 and 29—3 comprise intermediate molds, which are longitudinally spaced from each other and from the end molds for purposes hereinafter to be set forth in greater detail.

Similar sets of side walls of all the inner molds are alined with each other as illustrated.

The outer mold indicated generally by 32 is preferably formed of separable members, and is adapted for being moved into and out of position with respect to the inner molds 29—1, 29—2, 29—3, and 29—4, so that when the molds are in mold cavity forming position, a mold cavity indicated generally by C is formed between the outer and inner molds.

As illustrated, the outer mold 32 includes a laterally extending end wall member 32a whose inner face is longitudinally spaced from the outer face of the outer end wall of the inner mold 29—1 when the molds are in mold cavity forming position.

Similarly, the outer mold 32 also includes a laterally extending end wall member 32b whose inner face is longitudinally spaced from the inner face of the outer end wall of the inner mold 29—4 when the molds are in mold cavity forming position.

The outer mold 32 furthermore includes a longitudinally extending side wall member 32c whose inner face is laterally spaced from the alined outer faces of one set of side walls of the inner molds 29—1, 29—2, 29—3, and 29—4, when the molds are in mold cavity forming position.

Similarly, the outer mold 32 includes a longitudinally extending side wall member 32d whose inner face is laterally spaced from the alined outer faces of the other set of side walls of the inner molds when the molds are in mold cavity forming position.

For permitting movement of each of the members of the outer mold 32 away from the outer surface of the product cast in the mold cavity C, after the product has set, and thereby facilitating stripping of the outer mold from the cast product, the outer mold end wall member 32a is adjustably mounted on the jack frame 70a, and the outer mold end wall member 32b is adjustably mounted on the jack frame 70b, and the outer mold side wall member 32c extends between and is adjustably mounted on one set of similar sides of the jack frames 70a and 70b, and the outer mold side wall member 32d extends between and is adjustably mounted on the other set of similar sides of the jack frames 70a and 70b.

For the purpose of adjustably mounting, as aforesaid, the outer mold end wall member 32a on the jack frame 70a, as illustrated, the jack frame 70a includes laterally spaced side members 73a—1 and 73a—2 extending longitudinally from the web member 71a towards the jack frame 70b, and the side members 73a—1 and 73a—2 each has formed therein a plurality of transversely spaced longitudinally extending slots 74. The outer mold end wall member 32a has formed at one side a flange 32a—1 and at the other side a flange 32a—2, and the flanges 32a—1 and 32a—2 extend towards the web member 71a between the side members 73a—1 and 73a—2, and the outer faces of the flanges 32a—1 and 32a—2 slidably abut respectively against the inner faces of the side members 73a—1 and 73a—2, and the flanges 32a—1 and 32a—2 have apertures 75 formed therein which register with the slots 74 of the side members 73a—1 and 73a—2.

Bolts 76 and nuts 77 are provided, as illustrated, for connecting the flanges 32a—1 and 32a—2 of the end wall member 32a, respectively, with the side members 73a—1 and 73a—2 of the jack frame 70a, and the shank of one of the

bolts 76 extends through each registering flange aperture 75 and side member slot 74, and preferably the heads of the bolts 76 abut against the inner faces of the end wall member flanges, and the threaded ends of the bolts extend beyond the outer faces of the slotted side members, and one of the nuts 77 is screwed on each threaded outer end of each bolt 76, thereby permitting clamping of the end wall member 32a in the normal position for casting as best illustrated in Fig. 3, with the shanks of the bolts 76 located in the ends of the slots 74 farthest removed from the web member 71a.

When it is desired to displace the outer mold end wall member 32a away from the inner molds 29 and towards the web member 71a, it is only necessary to loosen the nuts 77, and to pry the end wall member 32a in the desired direction.

For the purpose of facilitating the desired displacement of the end wall member 32a by prying with a crow bar or the like, the side members 73a-1 and 73a-2 of the jack frame 70a are provided with apertures 78 each of which is horizontally aligned with, but longitudinally offset from an aperture 79 formed in the adjacent flange 32a-1 or 32a-2 of the side wall member 32a.

Accordingly, when the end wall member 32a is in the normal position for casting illustrated in Fig. 3, and after the nuts 77 have been loosened, the end of a crow bar may be inserted into each set of offset apertures 78 and 79, whereby the end wall member 32a may be pried away from the inner molds 29.

As illustrated, the end wall member 32b is adjustably mounted in the jack frame 70b in a manner similar to the preferred adjustable mounting just described of the end wall member 32a on the jack frame 70a, the jack frame 70b being provided with side members 73b-1 and 73b-2, and the side members 73b-1 and 73b-2 being provided with slots 74, and the end wall member 32b being provided with flanges 32b-1 and 32b-2, and the flanges 32b-1 and 32b-2 being provided with apertures 75 registering with the slots 74 of the side members 73b-1 and 73b-2, and bolts 76 and nuts 77 adjustably connecting the flanges 32b-1 and 32b-2 of the end wall member 32b, respectively, with the side members 73b-1 and 73b-2 of the jack frame 70b.

The side members 73b-1 and 73b-2 are likewise provided with prying apertures 78 cooperating with prying apertures 79 provided in the flanges 32b-1 and 32b-2.

For the purpose of adjustably mounting, as aforesaid, the outer mold side wall member 32d on one set of similar sides of the jack frames 70a and 70b, as illustrated, the side member 73a-1 of the jack frame 70a is provided with a transversely and laterally extending flange 79a-1 which protrudes outwardly from the side member 73a-1, and which has formed therein a plurality of apertures 80. The adjacent end of the outer mold side wall member 32d is provided with a transversely and laterally extending end flange 81a-1, which protrudes outwardly from the side wall member 32d, and which abuts against the flange 79a-1 of the side member 73a-1.

The side member 73b-1 of the jack frame 70b aligned with the side member 73a-1 of the jack frame 70a is similarly provided with a flange 79b-1 having apertures 80 formed therein, and the end of the outer mold side wall member 32d

adjacent the flange 79b-1 is similarly provided with an end flange 81b-1 abutting against the flange 79b-1, and the flange 81b-1 is similarly provided with a plurality of laterally extending slots 82 which register with the apertures 80 in the flange 79b-1.

Bolts 83 and nuts 84 are provided, as illustrated, for connecting the end flanges 81a-1 and 81b-1, respectively, with the flanges 79a-1 and 79b-1, in a manner similar to the connections heretofore described by which the bolts 76 and nuts 77 adjustably connect the end wall member flanges with the jack frame side members.

When it is desired to displace the outer mold side wall member 32d away from the inner molds 29, it is only necessary to loosen the nuts 84, and to pry the side wall member 32d in the desired direction.

For the purpose of facilitating the desired displacement of the side wall member 32d by prying with a crow bar or the like, the side wall member flanges 79a-1 and 79b-1 are provided with notches 85, and a tongue flange 86a-1 is provided on the flange 81a-1 and overlaps the notches 85 of the flange 79a-1, and the flange 81b-1 is provided with a tongue flange 86b-1 overlapping the notches 85 of the flange 79b-1.

Accordingly, when the side wall member 32d is in the normal position for casting illustrated in Fig. 3, and after the nuts 84 have been loosened, the end of a crow bar may be inserted in each notch 85, and pried against the overlapping flange 86a-1 or 86b-1, whereby the outer mold side wall member 32d will be displaced away from the inner molds 29.

As illustrated, the outer mold side wall member 32c is adjustably mounted on the other set of similar side members 73a-2 and 73b-2 of the jack frames 70a and 70b, in a manner similar to the preferred adjustable mounting just described of the side wall member 32d on the side members 73a-1 and 73b-1, the jack frame 70a being provided with a flange 79a-2 protruding outwardly from the side members 73a-2, and the jack frame 70b being provided with a flange 79b-2 protruding outwardly from the side member 73b-2, and a plurality of apertures 80 being provided in each of the flanges 79a-2 and 79b-2, and the side wall member 32c being provided with end flanges 81a-2 and 81b-2, and the end flanges 81a-2 and 81b-2 being provided with a plurality of laterally extending slots 82 which register with the apertures 80 in the flanges 79a-2 and 79b-2, and bolts 83 and nuts 84 adjustably connecting the flanges 81a-2 and 81b-2, respectively, with the flanges 79a-2 and 79b-2.

The flanges 79a-2 and 79b-2 are likewise provided with notches 85, and the flanges 81a-2 and 81b-2 are likewise provided respectively with overlapping tongue flanges 86a-2 and 86b-2.

The outer mold members furthermore include an engaging and lifting ring ledge member indicated generally by 36 which includes longitudinally spaced laterally extending end sections 36a and 36b connected at their extremities with the extremities of laterally spaced longitudinally extending side sections 36c and 36d.

The ring ledge member 36 may be channel-shaped as illustrated, and is preferably removably secured to the outer mold so that the upper preferably flat ledge face 37 of the ring ledge

member 36 abuts against the lower ends of the members of the outer mold 32 and extends therefrom towards the inner molds 29—1, 29—2, 29—3, and 29—4, preferably so that the inner

5 sides of the ledge member sections 36a, 36b, 36c, and 36d may slidably abut against and be centered by the opposite outer faces of the inner member walls 29—1, 29—2, 29—3, and 29—4.

Transversely spaced longitudinally extending

10 ribs 38, and longitudinally spaced transversely extending ribs 39 preferably protrude from the outer face of each of the outer mold side members 32c and 32d, and the ring ledge member 36 has formed therein a plurality of apertures 40

15 each of which may be registered with one of a plurality of apertures 41 formed in the opposite lowermost ribs 38 of the side members, whereby the ring ledge member may be separably secured in abutment against the lower ends of the mem-

20 bers 42 and nuts 43, the shank of each bolt extending through one of the sets of registering apertures 40 and 41, and the head of each bolt as illustrated abutting against the underside of the

25 web of the channel-shaped ring ledge member, and one of the nuts 43 being screwed on the threaded end of each bolt against the opposed rib 38.

Oppositely flanged wheels 44c are longitudinally spaced with reference to the ring ledge member section 36c, and each wheel 44c is jour-

30 nalled in a bracket 45c which is secured to the outer side of the ring ledge member section 36c.

Similarly, oppositely flanged wheels 44d are longitudinally spaced with reference to the ring ledge member section 36d, and each wheel 44d

35 is journaled in a bracket 45d which is secured to the outer side of the ring ledge member section 36d.

The spacing of the wheels is of the proper gauge so that the wheels and ring member 36 constitute a car which may roll on the track sections 12—1, 12—2, and 12—3, for purposes hereinafter to be set forth in greater detail.

45 A relatively narrow lower longitudinally extending portion 46c of the side wall member 32c is laterally and outwardly offset with respect to the remaining upper longitudinally extending portion 47c.

50 Similarly, a relatively narrow lower longitudinally extending portion 46d of the side wall member 32d is laterally and outwardly offset with respect to the remaining upper longitudinally extending portion 47d.

55 Accordingly, the spacing of the inner faces of the lower portions 46c and 46d from the opposite portions respectively of the outer faces of the side walls of the inner molds is greater than the spacing of the inner faces of the upper portions 47c and 47d respectively from the outer faces of the side walls of the inner molds.

Longitudinally spaced combined socket forming and engaging members 50 may be separably secured upon the inner face of the lower portion 46c of the side wall member 32c and likewise

65 upon the inner face of the lower portion 46d of the side wall member 32d, as by means of cap screws 51, the shanks of which extend through apertures provided in the side members

70 32c and 32d and the threaded ends of which screw into threaded apertures 52 provided in the socket forming and engaging members 50.

For facilitating stripping of the cast product from the inner molds, the top wall of each inner

75 mold is preferably provided with a plurality of

air valve openings 90, in the upper end of each of which a valve disk 91 is seated, and means such as a spring yoke 92 is secured to the lower face of each valve disk 91 for limiting the displacement of each valve disk from its seat.

As illustrated, the end inner mold 29—1 has a notch pocket 29—1a' formed in its outer end wall 29—1a, and the notch pocket 29—1a' is adapted for having located therein either a tank inlet or outlet core assembly 93, or a filler

10 core 94 depending upon whether the upper or lower half-section of a septic tank is to be cast.

The outer end wall 29—4a of the end inner mold 29—4 is similarly provided with a notch pocket 29—4a', which is likewise adapted for

15 having located therein either a core assembly 93 or a filler core 94.

Filler cores 95—1 and 95—2 are also preferably provided for being releasably located between opposite end faces of the inner molds, in order

20 to form partition walls of the desired heights in the cast septic tank half-sections.

Bridge members 96 are also preferably provided for being releasably located between the lower opposite end faces of the inner molds,

25 with the ends of the bridge members 96 supported on the side sections of the ring member 36, and the upper faces of the bridge members 96 are preferably ridged for forming V grooves in the outer end faces of the partition walls of the tank half-sections cast between the molds.

For similar purposes, ridge cores 97 are laid upon the upper faces of the ring member 36 between the outer mold 32 and the inner molds

30 29.

In order to permit easy changing of the inner molds, each inner mold is preferably provided in each of its side walls with a plurality of apertures 98, each of which registers with a set of registering apertures 99 preferably provided in

40 the legs of the channel-shaped ring ledge member 36, whereby when the bolts and nuts 30 and 31 are removed, bolt shanks may be inserted through each set of registering apertures 98 and 99, and the inner molds may be elevated from the base 14 for facilitating removal of the same therefrom, and substituting other inner molds for making other products.

For facilitating removal of the bolts 30 and nuts 31, a sub-pit 100 is formed beneath portions of the base 14, and a laterally extending passage 101 permits entrance to the sub-pit 100 from the bottom 15 of the pit 11.

In Fig. 9 is illustrated a novel cast concrete septic tank indicated generally by 110 and made by the use of the improved methods and apparatus, and which includes a top half-section 111, and a bottom half-section 111'. The top half-section 111 includes a relatively high dome shell having laterally extending longitudinally spaced end walls 111a and 111b, the sides of which are connected by and merge with the ends of longitudinally extending laterally spaced side walls 111c and 111d, and the upper ends of the side and end walls are connected by and merge with the outer portions of a top wall 111e. All the walls are preferably formed of reinforced concrete, and the end wall 111a and adjacent portions of the top wall 111e also preferably include an inlet or outlet duct 111f, and similarly the

70 end wall 111b and adjacent portions of the top wall 111e preferably include another inlet or outlet duct 111f.

Longitudinally spaced partition walls 111g, 111h, and 111k extend laterally between the

75

side walls 111c and 111d, and the lower faces of the half-section end walls, side walls and partition walls, are all in the same plane, and preferably each have formed therein a V groove 113. Longitudinally spaced hand or hook sockets 114 are preferably formed in the outer face of each of the side walls 111c and 111d.

The upper faces of the partition walls 111g and 111h terminate in the same plane spaced below the inner face of the top wall 111e, and the upper face of the partition wall 111h is spaced below the plane of the upper faces of the partition walls 111g and 111k.

The bottom half-section 111' of the tank is generally similar to the top half-section 111, and in use is inverted so that the grooved faces of the end, side and partition walls are uppermost, and register with the grooved faces of the top half-section 111, with grout or similar material indicated by 115 sealing the joint between the grooved faces.

The center partition 111'h of the bottom half-section extends from the grooved faces to the upper face of the wall 111'e of the bottom half-section, and the bottom half-section does not include any inlet or outlet ducts.

In using the improved apparatus 10, to carry out the improved methods, the inner mold or molds are arranged for the particular product to be cast, as for example in Figs. 3 and 4 the inner molds 29 are arranged with suitable cores for casting the top half-section 111 of the novel concrete septic tank 110, and in Fig. 5 the inner molds 29 are arranged with suitable cores for casting the bottom half-section 111', and in each case the outer mold 32 and the lifting and engaging ring member 36 supported from the bottom thereof, as aforesaid, have been lowered about the inner molds.

The socket forming members 50 in each case are preferably provided on the outer molds, as aforesaid, and after the molds have been positioned as illustrated in Fig. 4 or 5, reinforcing R is applied about the inner molds and between the inner and outer molds, and concrete is poured between the molds, and applied over the top walls of the inner molds, and the desired dome shell structure is cast, as for example the tank top half-section 111 in Fig. 4, or the tank bottom half-section 111' in Fig. 5.

The pit 11 and the sub-pit 100 is each preferably of ample size to permit the operator or operators of the apparatus to walk around the same during operation of the apparatus.

The material of the dome shell structure thus cast in each case has its lower ends in engagement with the upper ledge face 37 of the ring member 36 and also the socket forming members 50 are in engagement with the side walls of the cast structure.

After the initial set has been attained in the cast structure, the drive shaft 24 is rotated in the proper direction either by the motor 60 or the chain 27, so as to rotate the shafts 20a and 20b in the direction to separate the outer mold 32 and the cast structure engaged thereby from the inner molds 29, by elevating the outer mold 32 and the cast structure engaged thereby from the casting position, illustrated in Figs. 1, 2, 3, 4, 5, and 6, to the intermediate position, illustrated in Fig. 7.

The initial set may be attained for example in substantially 6 hours, after the expiration of which as aforesaid the parts of the appa-

ratus are separated to the positions illustrated in Fig. 7.

Stripping of the cast structure from the inner molds is facilitated by the air valve openings 90 each provided as aforesaid with a valve disk 91, the operation of which to admit air beneath the inner faces of the top of the cast structure prevents formation of a vacuum between the cast structure and the inner molds.

After the parts have been positioned as illustrated in Fig. 7, the nuts 43 are unscrewed from the bolts 42, and the bolts 42 are removed from the registering apertures 40 and 41, whereby the lifting ring member 36 is disengaged from the side and end wall members of the outer mold 32.

The cap screws 51 are also unscrewed and removed, whereby the socket forming members 50 are disengaged from the side members 32c and 32d of the outer mold 32.

Also, the side members and end members of the outer mold 32 are preferably displaced away from the inner molds and the cast structure, as heretofore described.

Also, the track section 12-3 is bridged across the top of the pit 11 so that the wheels 44c and 44d of the ring member 36 rest upon the rails of the track section 12-3.

The drive shaft 24 is then rotated so as to further elevate the displaced side end members of the outer mold 32 to the position illustrated in Fig. 8, wherein the side and end members are separated from the ring member 36, and the ring member 36 with its green cast structure in supporting engagement thereon may be rolled on the track laterally away from the apparatus, so that the cast structure may attain a final set away from the apparatus.

Another ring member 36 is then connected to the outer mold side and end members, together with another set of handle members 50, and another structure may be immediately poured after the apparatus parts have been moved to their casting position, as illustrated in Figs. 1 to 6 inclusive.

Each structure thus cast and removed from the apparatus with its material in the condition of initial set is each rolled on its own ring member 36 to any desired location for seasoning and final hardening.

The inner molds may be changed to make different structures as heretofore described, and in Fig. 12 is illustrated the improved apparatus as set up for making grave vaults, with one cast grave vault shown at one side of the apparatus.

The apparatus as set up in Fig. 12 is similar to the apparatus as set up in my said prior application, Serial No. 586,721, with the exception that the apparatus of Fig. 12 is provided with the improvements hereof.

I claim:

The method of making massive hollow cast structures of plastic material by the use of inner and outer mold members, which includes casting the structure of plastic material between the inner and outer mold members, elevating the cast structure together with the outer mold members to be entirely above the inner mold member after the plastic material has attained an initial set, and then elevating the outer mold members as a unit to be entirely above the cast structure.

HARRY J. HICK.