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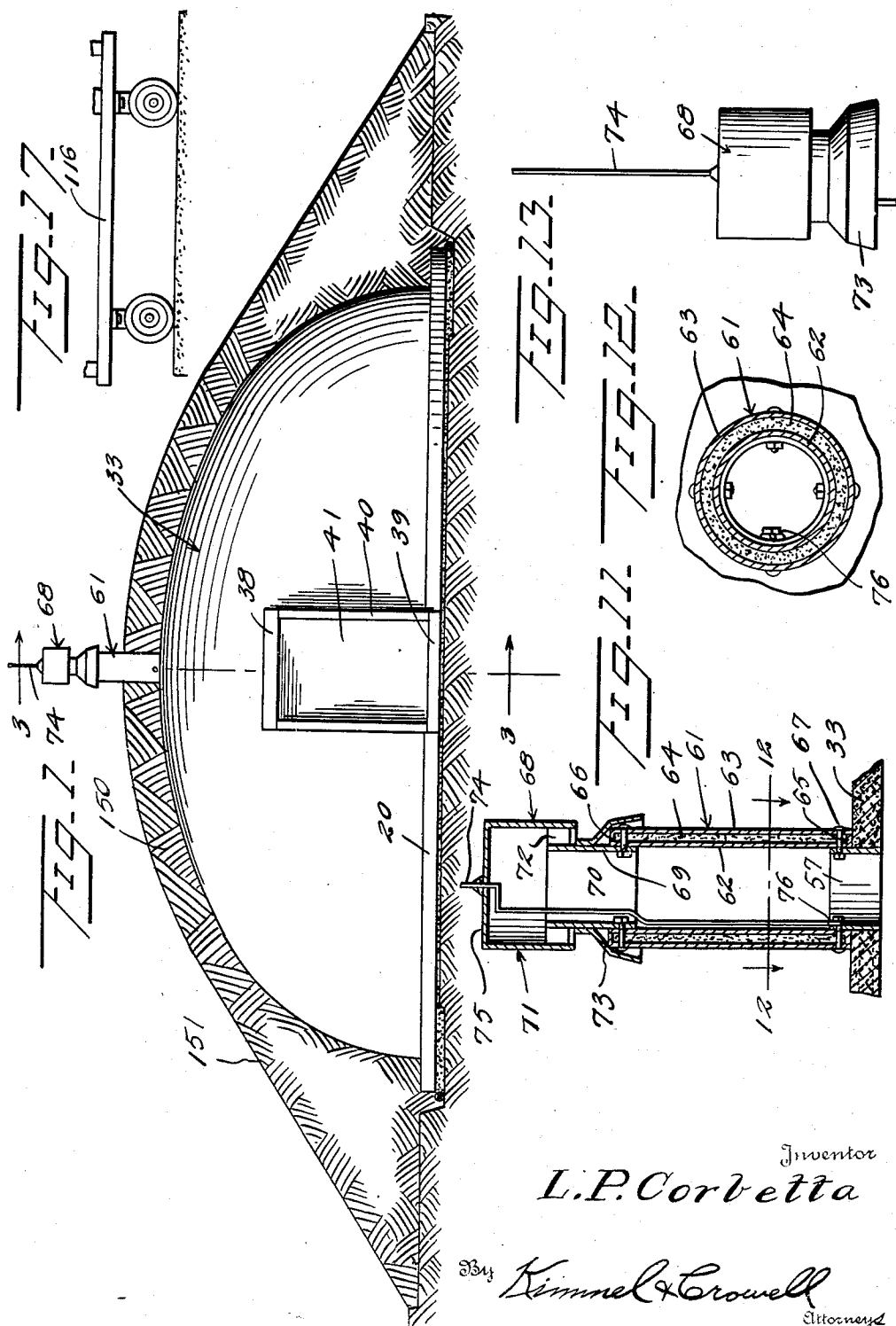
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APPARATUS FOR FORMING CONCRETE DOMES

Filed March 16, 1942

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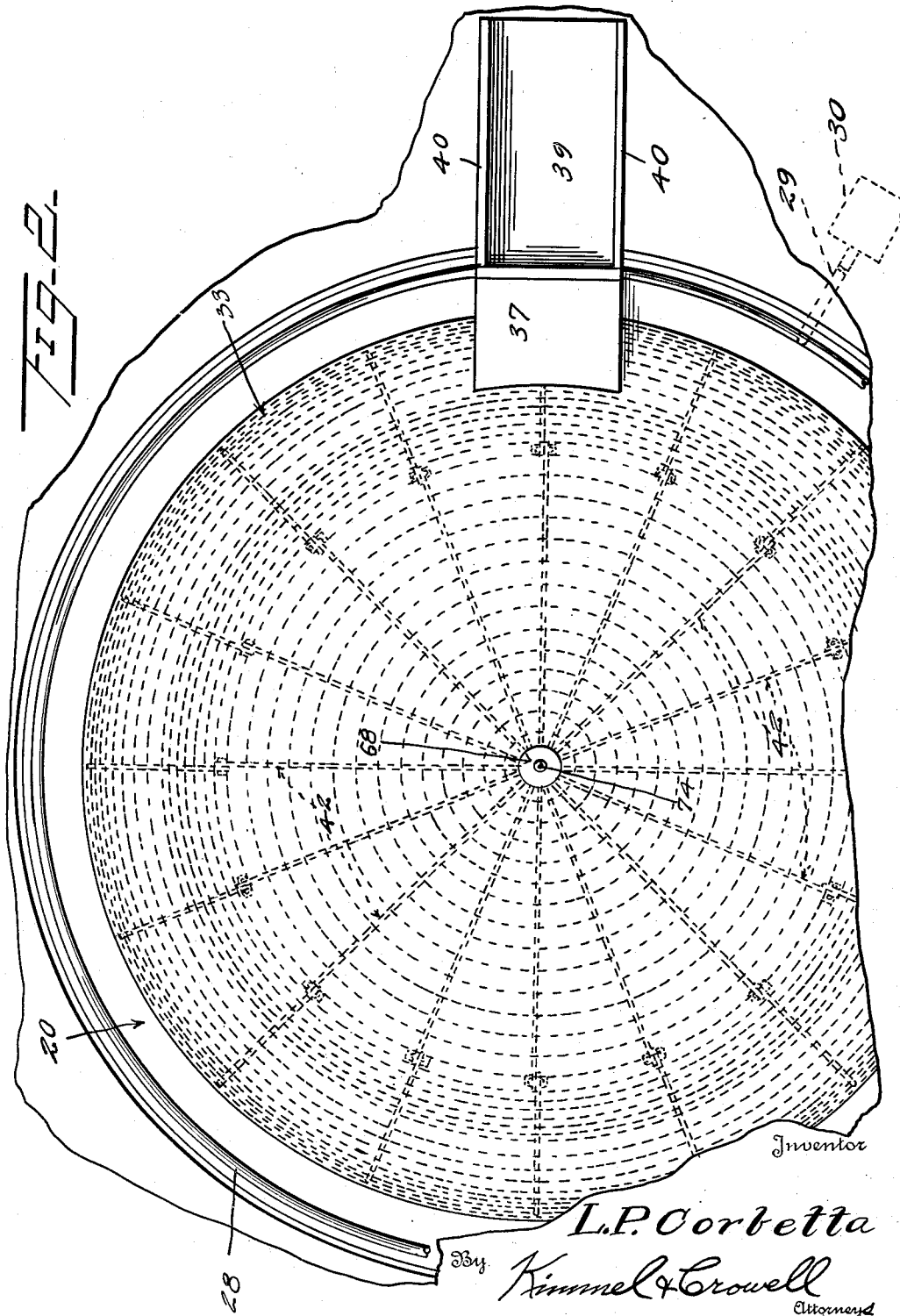
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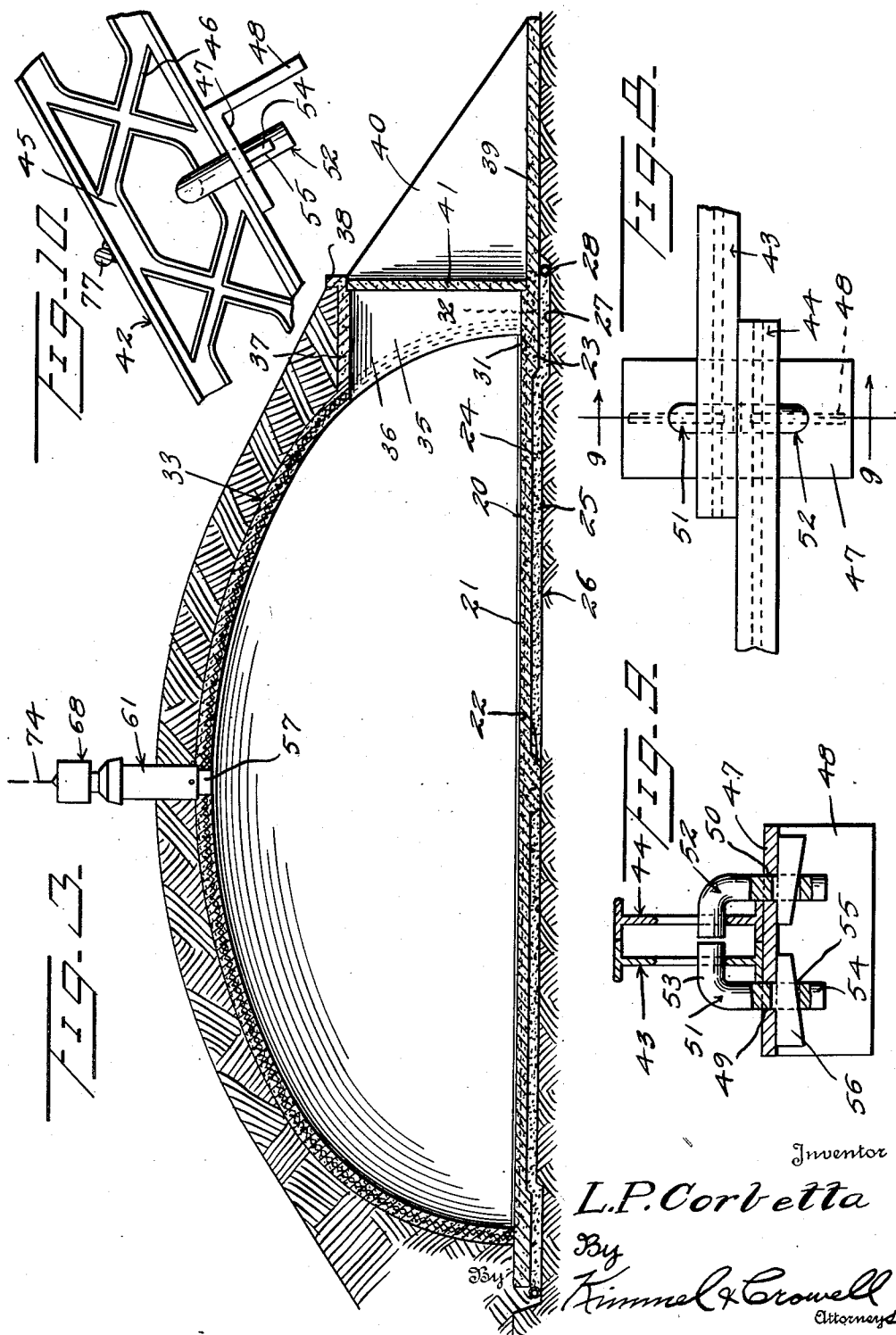
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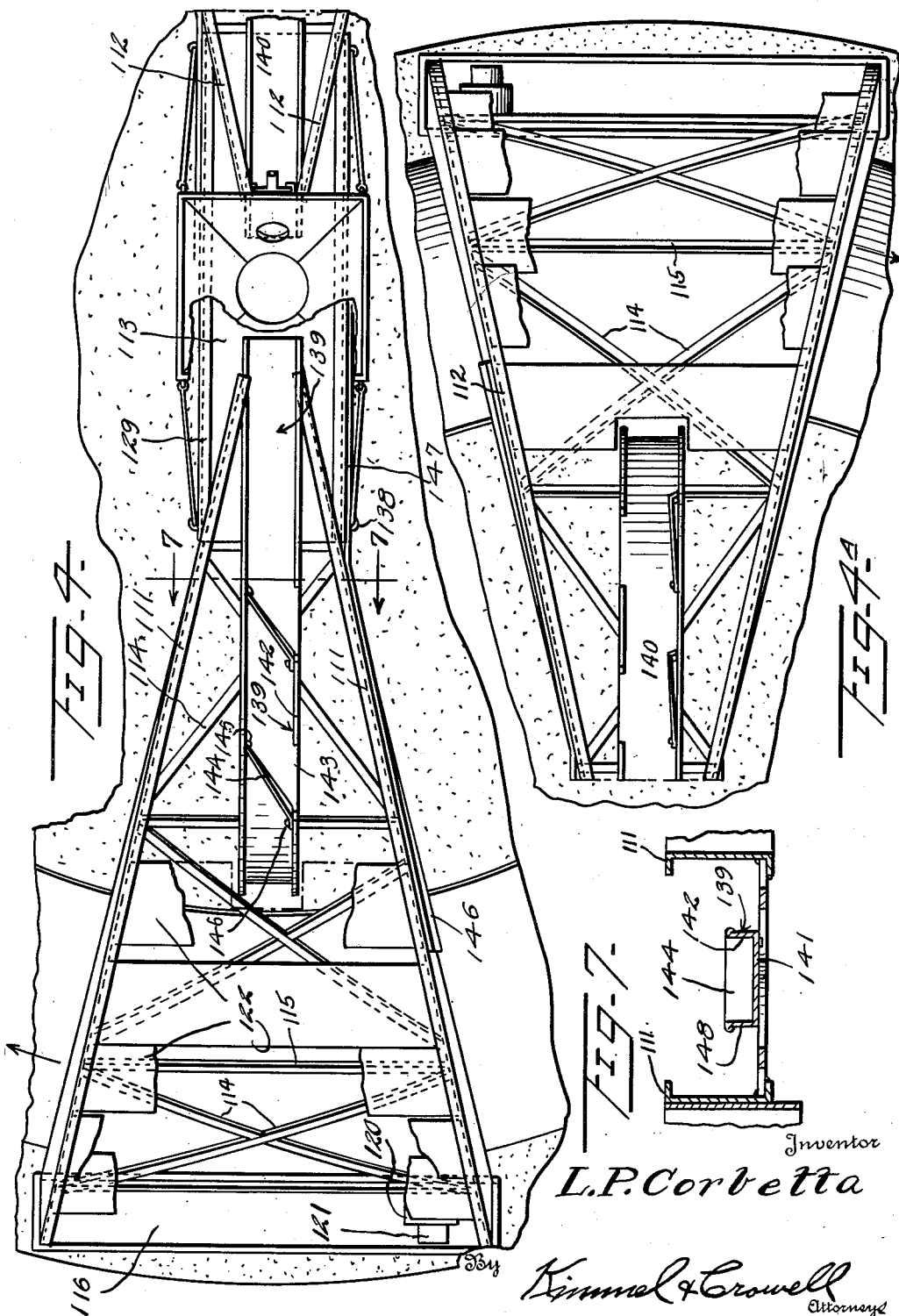
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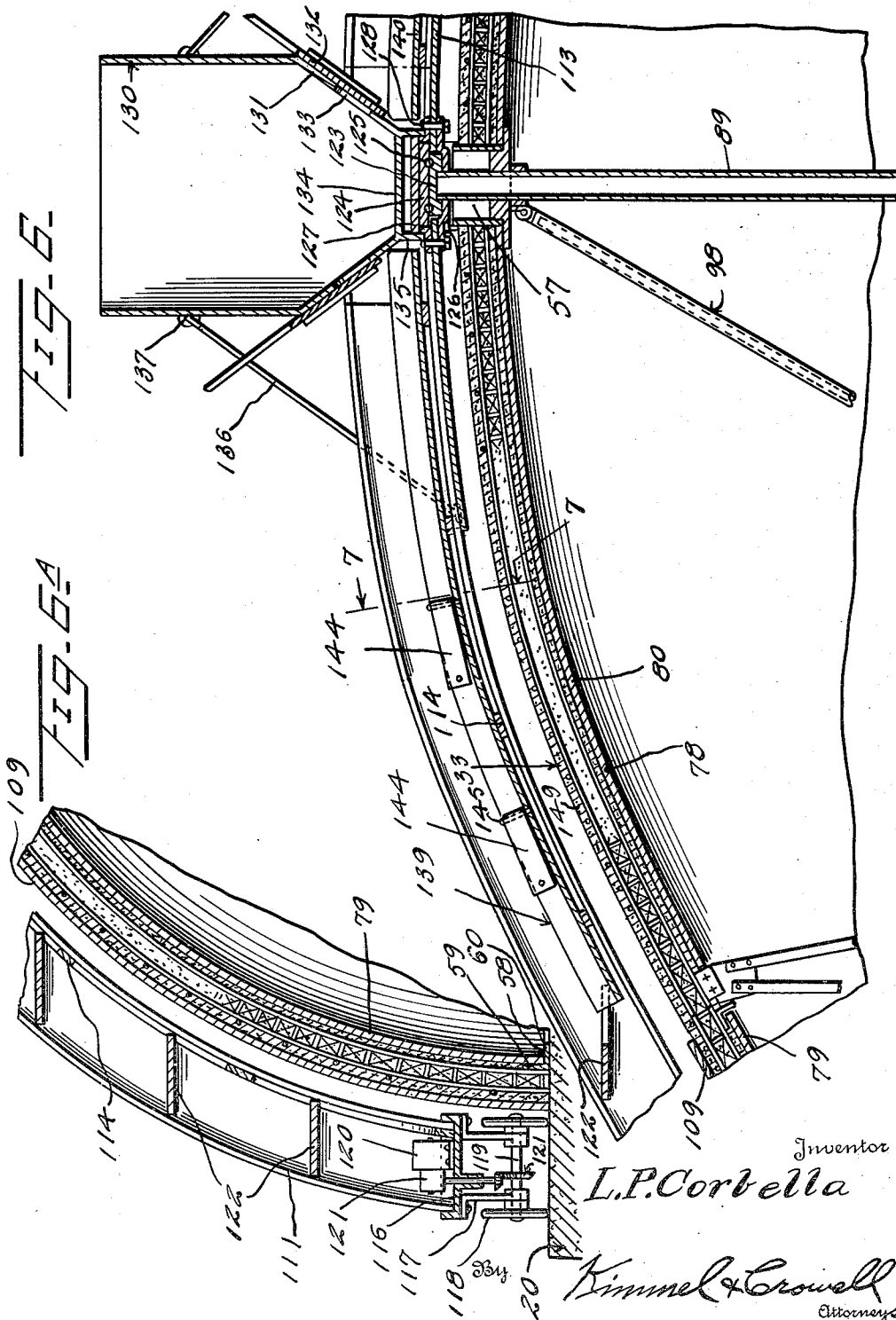
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UNITED STATES PATENT OFFICE

2,296,984

APPARATUS FOR FORMING CONCRETE
DOMES

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Application March 16, 1942, Serial No. 434,940

8 Claims. (Cl. 25—11.8)

This invention relates to a magazine, shelter or storage, and to a method of and apparatus for constructing the same.

An object of this invention is to provide an improved dome shaped magazine which is adapted to be constructed out of concrete and which may be covered with earth to the desired depth so as to permit concealment of the magazine.

A further object of this invention is to provide an improved apparatus by means of which the magazine may be easily and quickly constructed.

A further object of this invention is to provide a magazine of this kind which is formed with relatively thin walls which upon an explosion within the magazine will fly upwardly rather than laterally due to the fact that the outer portions of the magazine are more deeply covered with earth than the top thereof.

To the foregoing objects and others which may hereinafter appear, the invention consists of the novel construction, combination and arrangement of parts as will be more specifically referred to and illustrated in the accompanying drawings, but it is to be understood that changes, variations and modifications may be resorted to which fall within the scope of the invention as claimed.

In the drawings:

Figure 1 is a detail front elevation of a dome shaped concrete structure constructed according to an embodiment of this invention showing the structure covered with earth;

Figure 2 is a fragmentary top plan of the device,

Figure 3 is a vertical section taken on the line 3—3 of Figure 1,

Figure 4 is a fragmentary plan view of the concrete pouring and shaping frame structure used for constructing the device,

Figure 4A is a plan view of an extension of Figure 4 showing the opposite end of the frame structure,

Figure 5 is an enlarged fragmentary vertical section of the frame structure showing the concrete forms in position for pouring of the concrete,

Figure 6 is a view similar to Figure 5 but on an enlarged scale,

Figure 6A is a fragmentary vertical section of the lower portion of the structure shown in Figure 6,

Figure 7 is a sectional view taken on the line 7—7 of Figure 6,

Figure 8 is a fragmentary plan view of the joint between the reinforcing beams,

Figure 9 is a sectional view taken on the line 9—9 of Figure 8,

Figure 10 is a fragmentary side elevation of the tie structure used for connecting the upper and lower beams together,

Figure 11 is a vertical section of the ventilator in the upper portion of the structure,

Figure 12 is a sectional view taken on the line 12—12 of Figure 11,

Figure 13 is a detail side elevation of the ventilator hood,

Figure 14 is a fragmentary side elevation partly in section of the adjusting means for the brace used for the supporting posts,

Figure 15 is a fragmentary vertical section of the lower end of the supporting posts,

Figure 16 is a sectional view taken on the line 16—16 of Figure 15, and

Figure 17 is a fragmentary side elevation of the dolly at an end of the frame structure.

Referring to the drawings the numeral 20 designates generally a floor or bottom wall of a concrete housing structure constructed according to an embodiment of this invention. The concrete floor 20 may be reinforced in any suitable manner and as shown in Figure 2 is of circular configuration. The floor 20 includes a central body 21 which is formed in the axial center thereof with a thickened body 22. The outer marginal portions of the body 21 are also formed with a downwardly offset thickened portion 23, thereby providing an annular space 24 within which gravel or other loose material 25 is adapted to be positioned.

The surface of the ground on which the housing, to be hereinafter described is positioned, is preferably cut away for the desired depth and smoothed out as at 26 so as to provide a flat surface. The outer marginal portions of the flat surface 26 are then recessed as at 27 in the form of an annular recess which is disposed below the offset portion 23 of the bottom wall 20. The positioning of the gravel or pervious material 25 below the bottom 20 provides a means whereby the moisture may flow beneath the bottom wall 20, and this moisture will then flow downwardly into the annular well or space defined by the offset portion 27.

The drain tile 28 is positioned below the bottom wall 20 and extends entirely about the outer marginal portions of the bottom wall 20. The tile 28 may be extended by means of an inclined tile 29 which communicates with a well 30 positioned in spaced relation to the bottom wall 20. The bottom wall 20 on the upper side thereof and in-

wardly of the outer marginal portions thereof is provided with a drain groove 31 which may be connected with the drain tile 28 by means of a duct 32.

A dome shaped housing generally designated as 33 is mounted on the upper side of the bottom wall 20 and has a configuration circular in plan and is of a diameter substantially smaller than the outer diameter of the bottom wall 20 thereby providing a ledge 34 extending outwardly from the outer side of the housing 33. The housing 33 is constructed in dome shape, being substantially semi-elliptical in vertical section. The housing 33 has an entrance 35 by means of which access may be had to the interior of the housing. The entrance 35 is formed by a pair of side walls 36 which are vertical and in parallelism and which extend outwardly from the housing 33.

A top wall 37 is connected to the upper ends of the entrance side walls 36 and an upwardly extending flange or ledge 38 is formed at the forward end of the top wall 37, so as to provide a means for retaining dirt or other loose material on the upper side of the top wall 37. A forwardly extending plate 39 is formed integral with the bottom wall 20 and extends forwardly from the entrance 35. A pair of triangularly shaped side walls 40 are disposed in upstanding relation with respect to the plate 39 and extend forwardly from the entrance side walls 36.

A door 41 is hinged mounted at the forward end of the entrance 35 and is disposed at the rear of the triangular side walls 40. The triangular side walls 40 provide a means for retaining the dirt or other loose material which covers the housing 33, so that the dirt will not enter the space between these side walls and will not contact with the door 41 or prevent operation of this door.

The housing 33 has embedded therein a plurality of radially arranged reinforcing beam members generally designated by the numeral 42. The beam members 42 are preferably constructed of an upper longitudinally bent I beam 43 and a lower longitudinally bent or curved I beam 44. The beams 43 and 44 have the web 45 thereof vertical and this web is preferably formed with a plurality of openings 46 through which the plastic concrete is adapted to engage. The beams 43 and 44 may be formed in any suitable manner, such as by rolling, fabrication or the like. The lower end of the beam 43 overlaps the upper end of the beam 44 as shown more clearly in Figure 8. These overlapping beam ends are tied together by means of a tie plate 47 which engages the bottom flanges of the beams 43 and 44.

The plate 47 may be formed as an angle plate having a depending side 48 which extends downwardly from the beams 43 and 44. The plate 47 is provided with a pair of spaced apart openings 49 and 50 within which L shaped clamping members 51 and 52 are adapted to engage. The clamping members 51 and 52 are of like construction, and each includes an upper side 53 engaging in one of the openings of the web 45 of an I beam, and the opposite side 54 of the clamping member 53 extends downwardly through an opening 49 and extends below the tie plate 47.

The depending side 54 of the clamping member 51 is formed with a transversely disposed elongated slot 55 within which a wedge 56 is adapted to engage. The wedge 56 at its upper side is adapted to bear against the bottom side of the tie plate 47, and the lower inclined edge of the wedge 56 bears against the lower end of the slot 55. In

this manner the tie plate 54 may be securely fastened to each of the overlapping ends of the beams 43 and 44. The upper ends of the radial beams 42 are secured as by welding or other suitable fastening means to a centrally disposed cylindrical sleeve 57. The sleeve 57 is substantially longer than the height of each beam member 42, so that a portion of the sleeve 57 will extend downwardly below the concrete after setting of the concrete and will also extend upwardly from the upper side of the concrete, as shown more clearly in Figure 6. The sleeve 57 provides a ventilating opening by means of which the interior of the housing 43 may be properly ventilated.

The lower ends of the lower beam members 44 are secured as by welding or other suitable fastening means to an angle shaped base member 58 which is circular in configuration and extends entirely about the lower end of the housing 43. The angle member 58 has a vertical side 59 bearing against the inner side of each lower beam member 44 and the lower horizontal side 60 of the angle member 58 forms a metal base which rests on the upper side of the bottom wall 20.

An upstanding tubular member 61 rises from the upper side of the housing 33 and at its lower end encompasses the sleeve 57. The tubular member constitutes an air duct and includes an inner cylindrical jacket 62, an outer jacket 63, and insulating means 64 disposed between the two jackets 62 and 63. A bottom wall 65 connects the lower ends of the inner and outer jackets 62 and 63 and a top wall 66 connects the upper ends of the two jackets 62 and 63. Fastening means 67 engage through the jackets 62 and 63, and also engage through the upper end portion of the sleeve 57.

A ventilating hood structure generally designated as 68 is secured to the upper end of the duct 61. The hood 68 includes a cylindrical sleeve 69 which at its lower end engages within the duct 61, and is secured therein by fastening devices 70. An inverted cup-shaped hood member 71 is secured to the upper end portion of the sleeve 69, being of a diameter substantially greater than the outer diameter of the sleeve 69 and secured to the sleeve 69 by means of a plurality of radially disposed webs 72. An annular flashing member 73 is secured to the outer side of the sleeve 69 and engages about the upper end portion of the duct 61, so that water or other fluid will be prevented from entering the duct 61.

In order to provide a means whereby any electricity, such as lightning or static electricity, may be grounded and thereby dissipated, I have provided a metallic electrical discharge rod 74 which extends upwardly from the top wall 75 of the hood 71. The rod 74 extends downwardly through the interior of the ventilating hood member 68 and is secured at the lower end 76 thereof on one of the fastening members 67, so that there will be a direct or electrical connection between the electrical discharge member 74 and the material reinforcing beams 42.

The beams or reinforcing members 42 are tied together against circumferential movement by means of a plurality of annular reinforcing rods or members 77 which engage on the upper sides of the beams 42, and which are welded or otherwise fixedly secured to the beams 42. The reinforcing members 77 also provide a reinforcing means between the beams 42 for reinforcing the concrete of which the housing 33 is formed.

The housing 30 is constructed by initially dis-

posing an inner dome shaped form generally designated as 78 on the upper side of the floor or bottom wall 20. The inner form 78 includes a lower form member 79 and an upper form member 80. The form member 80 at its lower edge forms a continuation of the lower form 79 and, if desired, may be formed as an integral part of the lower form member 79. A plurality of circumferentially spaced apart upright bracing members 81 are disposed interiorly of the form 78, and each bracing member includes a vertically disposed leg 82 which is secured at its lower end to a horizontal base angle member 83. An upwardly and outwardly inclined member 84 is secured at its lower end to the connecting member 83 and secured at its upper end as by welding or the like to a plate 85. The vertical leg 82 is also secured as by welding or other suitable fastening means to the plate 85. An intermediate connecting member 86 is connected at the opposite ends thereof to the bracing members 82 and 84.

An angle plate 87 is secured as by bolts 88 to the upper end of the plate 85 and bears against the lower sides of the overlapping portions of the beam members 43 and 44. The central portion of the inner form 78 is supported by means of a central post 89 which is preferably of tubular construction. The post or upright bracing member 89 at its lower end is secured to a base plate 90 having a bar 91 secured thereto and formed with slots 92 for adjustably receiving securing bolts 93. A vertically disposed rod or bar 94 is embedded in the bottom wall 20 in the axial center thereof and extends upwardly through an opening 95 formed in the bottom plate 90. The post 89 at its upper end has secured thereto a collar or sleeve 96. The sleeve or collar 96 has secured thereto a plurality of circumferentially spaced apart eye members 97 with which the upper ends of a plurality of circumferentially arranged angled bracing members 98 are adapted to be secured.

The bracing members 98 are constructed of an upper tubular bracing member 99 and a lower tubular bracing member 100. The two bracing members 99 and 100 are connected together by means of a threaded sleeve 101 having handles 102, and preferably the adjacent ends of the bracing members 99 and 100 are provided with right and left hand threads, so that adjustment of the sleeve or nut 101 will increase or decrease the length of a bracing member 99. The lower end of the lower bracing member 100 is secured as by a fastening member 103 to a base plate 104 secured by fastening members 105 to the bottom wall 20. In practice there are three of the bracing members 98 secured to the post 89. An annular plate 106 is mounted on the upper end of the collar or sleeve 96 and is formed at its upper side with a second plate 107 having a diameter less than the diameter of the plate 106, and of sufficient diameter to engage within the sleeve 57. If desired, the top plate 107 may be welded or formed integral with the plate 106. The inside form 78 is provided with an opening 108 within which the sleeve 57 engages and the plate 106 is larger in diameter than the opening 108, so that the inside form 78 will rest on the upper side of the plate 106.

An outer lower form 109 is disposed in outwardly spaced relation to the inner lower form 79 and is of a height substantially equal to the height of the inner form 79. The lower edge

of the outer form 109 is adapted to rest on the upper side of the bottom wall 20.

In order to provide a means whereby the plastic concrete may be discharged between the two forms 79 and 109 and on the upper side of the upper form 80, I have provided a frame structure generally designated as 110. The frame structure 110 as shown in Figures 4 and 4A is constructed of two pairs of outwardly divergent channel shaped beams 111 and 112. The beams 111 and 112 are of longitudinally arcuate configuration and have the channel sides thereof in confronting relation. The upper or inner convergent ends of the beams 111 and 112 are welded or otherwise fixedly secured to an upper longitudinally arcuate plate 113. The construction of the frame structure is the same on each side of the upper plate 113 and the description of one side of the frame structure will apply equally as well to the description of the other side of the frame.

The two channel members 111 are connected together by a plurality of crossed or intersecting bracing bars 114 which are welded or otherwise fixedly secured to the lower flanges of the channel members 111. Transversely extending bars 115 extend between the adjacent ends of the bracing members 114. The outer or lower ends of the channel members 111 are connected together by a bottom plate 116, and the plate 116 has secured to the lower side thereof bolsters or bearing members 117.

Wheels 118 are carried by shafts 119 journaled to the bolsters or bearings 117 and the wheels 118 are adapted to engage on the apron or ledge 34 which is disposed outwardly of the outer form member 109. If desired, the frame structure comprising the pairs of frame members 111 and 112 may be rotated about the form member 109 by means of a power member 120 which is connected by gearing 121 to the shaft 119. While the power member 120 is herein described as an electric motor or the like, this power member may be in the form of a hand operated power means whereby the frame structure may be manually rotated during the filling and shaping of the plastic concrete forming the housing 33. A plurality of vertically spaced apart plates 122 are secured between the outer lower portions of the channel members 111 and constitute steps which terminate at a point slightly above the outer edge of the outer lower form member 109.

The post 89 constitutes a pivot member for the frame structure and preferably the upper end of the post or pivot member 89 extends upwardly above the sleeve 57 and has fixed thereto an annular race plate 123. The plate 123 opposes an upper race plate 124, and ball bearings 125 are interposed between the two plates 123 and 124. A lower housing member 126 is disposed below the plate 113 and encloses the lower race plate 123. An upper housing member 127 is disposed on the upper side of the plate 113 and encloses the upper race plate 124. The two housings 126 and 127 are secured together by fastening devices 128 in the form of bolts or the like, so that the frame structure may be detachably connected with the pivot post 89. The plate 113 on the opposite longitudinal edges thereof has fixed thereto opposed channel members 129 which are welded or otherwise fixed to the upper side of the plate 113 and extend at their opposite ends to a point where the channel members 129 contact with the outer sides of the channel members 111 and 112.

A concrete receiving hopper generally designated as 130 is disposed above the plate 113 and is open at its upper end. The hopper 130 is provided with downwardly inclined opposed walls 131 having gates 132 for controlling the flow of plastic concrete through discharge openings 133 formed in the walls 131. The hopper 130 is provided with a flat bottom wall 134, and a ring 135 is fixed to the lower side of the bottom wall 134 and engages about the upper housing member 127. In this manner the lower end of the hopper 130 is held against movement relative to the plate 113. The hopper 130 is held in upstanding position with respect to the frame structure by means of a plurality of outwardly and downwardly inclined guy wires or rods 136, which are secured at their upper ends to eyes 137 carried by the hopper 130 and are secured to eyes 138 fixed to the beams or channel members 111 and 112.

A pair of oppositely extending troughs 139 and 140 are mounted between the pairs of channel members 111 and 112, and extend from a point adjacent the ring 135 downwardly and outwardly to a point spaced upwardly a slight distance from the upper edge of the outer form member 109. The two troughs or chutes 139 and 140 are of like construction, and each is constructed in the form of a U-shaped trough or chute member shown more clearly in Figure 7.

The bottom wall 141 of each chute is secured as by welding or other suitable fastening means to the bracing members 114 and 115 and the chute or trough 139 extends radially from the axial center of the hopper 130. The chute 139 is formed in one side wall 142 thereof with at least a pair of spaced apart openings 143. A gate 144 is pivotally mounted as at 145 within the chute 139 at a point opposite from the opening 143. The gate 144 is adapted to be swung laterally across the bottom wall 141 and may be secured as by detachable fastening means 146 to the side wall 142 in a position with the gate 144 inclined to the length of the chute 139 as shown in Figure 4. In this manner a selected gate 144 may be swung across the chute 139 so as to thereby direct the plastic material from the chute or trough 139 onto the upper side of the inner form member 78. The position of a gate 144 across the chute or trough 139 will prevent the plastic concrete from flowing out of the open lower end of the chute or trough 139.

In order to provide a means whereby the plastic concrete engaging on the upper side of the inner form member 78 may be leveled or smoothed off, one channel member of each pair of channel members 111 and 112 has secured to the outer side thereof a screed plate 146. The screed plate 146 on the channel member 111 is disposed oppositely from the screed plate disposed on the outer side of a channel member 112. The screed plate 146 extends upwardly from substantially the upper edge of the outer form member 109 and may be bent obtusely to position the upper portion thereof along the outer side of a channel member 129 as shown at 147. The upper end of the screed extension 147 terminates at a point substantially in line with the axial center of the pivot or post member 89.

In carrying out the method of construction of the housing hereinbefore described, the radially arranged longitudinally arcuate reinforcing beams 42 are initially mounted on the upper side of the floor 20 and the post 89 secured in position. The bracing members 81 are also secured to the

floor 20 and to the beams 42. The inner form structure 78 is then put in position in spaced relation to the lower sides of the beams 42. The outer form 109 is then positioned in outwardly spaced relation to the outer lower form 79 leaving an open space at the upper end of the outer frame member 109 within which the plastic concrete is adapted to be poured as it flows from the troughs or chutes 139 and 140.

The concrete is poured into the hopper 130 and initially the frame structure 110 is rotated with the gate members 144 in substantially parallel relation with the adjacent side wall 148 of the chute or trough 139. The gates 132 may then be moved to an open position to permit the concrete to flow into the chutes or troughs 139 and 140. This plastic concrete will drop into the space between the two forms 79 and 109. After this space has been filled with concrete the lowermost one of the gates 144 may be swung across the chute 139, and a similar gate 144 swung across the lower portion of the chute or trough 140.

This gate 144 will then direct the plastic concrete onto the upper side of the inner upper form member 80 at a point above the outer form member 109. The screed members 146 will smooth the concrete as the frame structure 110 is rotated, and when a sufficient amount of concrete has been discharged from the lower portion of the chute or trough 139 with the gate 144 in operative position, the next gate 144 above the lower gate may be moved to an operative position to provide for the discharge of the plastic concrete in a higher position. This operation will continue until the entire form 80 has been covered with concrete and the concrete smoothed by the several screed members 146.

After the concrete 149 has set, the ventilator structure, including the tubular member 61 and the hood, may be secured to the sleeve 57 after the removal of the frame structure 110. With the ventilator structure in position, the housing 33 is then adapted to be covered by dirt 150 to the desired depth, the dirt being flared out as at 151 about the lower portion of the housing 33. The increase in the depth of the dirt 151 about the lower portion of the housing 33 provides a means whereby in the event any explosion should occur which would destroy the housing 33, the increased depth of the dirt as shown at 151 will prevent the fragments of concrete from scattering to lateral points, whereas the substantially thin coating of dirt shown at 150 will permit the upper portion of the housing 33 to shatter and to be blown in a more vertical position.

The housing structure hereinbefore described has been designed particularly for the reception of explosives such as bombs, shells, powder or the like, and by providing a housing structure or magazine which is so constructed that it may be readily covered with dirt, the dirt covering the magazine may be sodded or otherwise provided with means for camouflaging the magazine. By providing an improved method of constructing the magazine or housing hereinbefore described, the magazine or housing may be easily and quickly constructed at any desired point, and if desired, a number of these housings may be mounted in a group a slight distance from each other, so that an explosion in one housing will not affect an adjacent housing. This is accomplished by providing the greater depths of dirt as shown at 151 about the lower portions of the housings,

thereby providing a cushioning means to prevent the fragments of the housing from being thrown laterally or horizontally in an area close to the exploded housing. After the concrete has properly set, the interior form is removed and the exterior form also removed, so that the housing will appear as shown in Figure 3.

What is claimed is:

1. Apparatus for constructing and shaping a concrete dome shaped structure, comprising a longitudinally arcuate frame, wheels carried by the opposite ends of said frame, and an upright supporting post engaging the central portion of said frame.

2. Apparatus for constructing and shaping a concrete dome shaped structure comprising a longitudinally arcuate frame, traction means carried by the opposite ends of said frame, opposed concrete guiding troughs carried by said frame, and a centrally disposed hopper extending above the inner ends of said troughs.

3. Apparatus for constructing and shaping a concrete dome shaped structure, comprising a longitudinally arcuate frame, traction means carried by the opposite ends of said frame, opposed concrete guiding troughs carried by said frame, independently operable gates carried by each trough for discharging the concrete at predetermined points along the length of said frame, and a centrally disposed hopper extending above the inner ends of said troughs.

4. Apparatus for constructing and shaping a concrete dome shaped structure comprising a longitudinally arcuate frame, traction means carried by the opposite ends of said frame, opposed concrete guiding troughs carried by said frame, a centrally disposed hopper extending above the inner ends of said troughs, and screed means dependently carried by said frame.

5. Apparatus for constructing and shaping a concrete dome shaped structure, comprising a longitudinally arcuate frame, traction means carried by the opposite ends of said frame, said frame including opposed pairs of inwardly and upwardly convergent channel members, intersecting bracing members secured to said channel members, a longitudinally arcuate plate fixed to the convergent ends of said pairs of channel members, a hopper extending upwardly from said plate, and a pair of troughs carried by said frame and extending from said hopper.

6. Apparatus for constructing and shaping a concrete dome shaped structure, comprising a longitudinally arcuate frame, traction means carried by the opposite ends of said frame, said frame including opposed pairs of inwardly and upwardly convergent channel members, intersecting bracing members secured to said channel members, a longitudinally arcuate plate fixed to the convergent ends of said pairs of channel members, a hopper extending upwardly from said plate, a pair of troughs carried by said frame and extending from said hopper, each trough having an opening in a side thereof between the ends thereof, and a gate movably carried by each trough for positioning across the trough adjacent said opening to thereby direct the plastic concrete through the opening.

7. Apparatus for constructing and shaping a concrete dome shaped structure comprising a longitudinally arcuate frame, traction means carried by the opposite ends of said frame, said frame including opposed pairs of inwardly and upwardly convergent channel members, intersecting bracing members secured to said channel members, a longitudinally arcuate plate fixed to the convergent ends of said pairs of channel members, a hopper extending upwardly from said plate, a pair of troughs carried by said frame and extending from said hopper, each trough having an open lower end and at least a pair of openings in a side thereof, and a pair of gates pivotally carried by each trough oppositely from said openings and swingable across the trough bottom to thereby direct the discharge of concrete through a selected opening.

8. Apparatus for constructing and shaping a concrete dome shaped structure, comprising a longitudinally arcuate frame, traction means carried by the opposite ends of said frame, said frame including opposed pairs of inwardly and upwardly convergent channel members, intersecting bracing members secured to said channel members, a longitudinally arcuate plate fixed to the convergent ends of said pairs of channel members, a central supporting post, means supporting said post in upright position, means rotatably supporting said frame on the upper end of said post, a hopper extending upwardly from said plate, and a pair of troughs carried by said frame and extending from said hopper.

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