

Jan. 15, 1963

R. GAUTHRON

3,073,018

METHOD OF CONSTRUCTING AN ELEVATED RESERVOIR

Filed Nov. 14, 1960

2 Sheets-Sheet 1

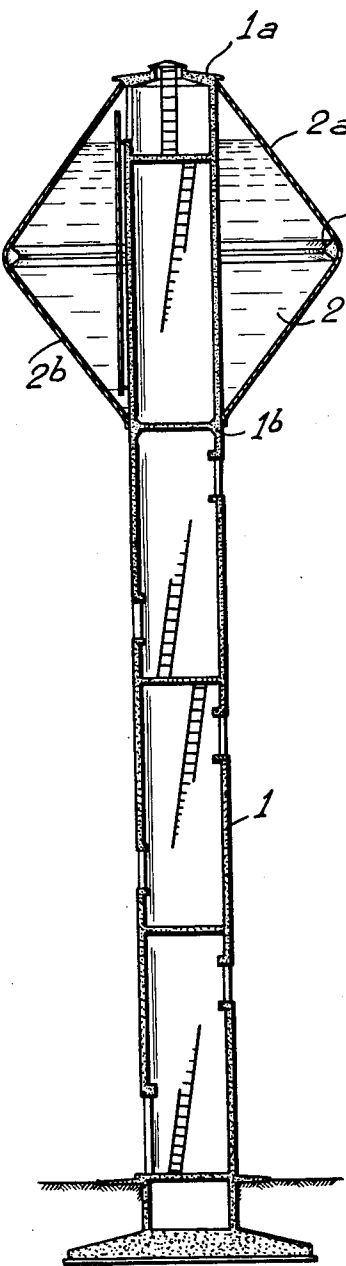


Fig. 2.

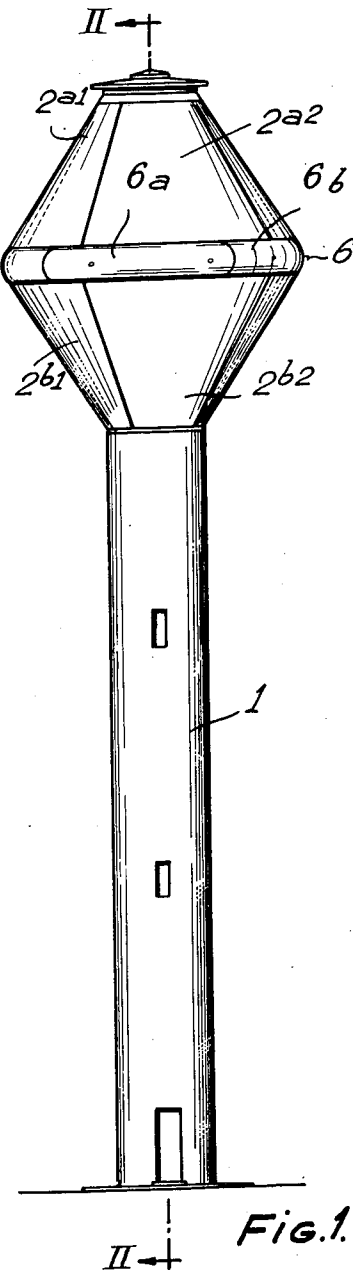


Fig. 1.

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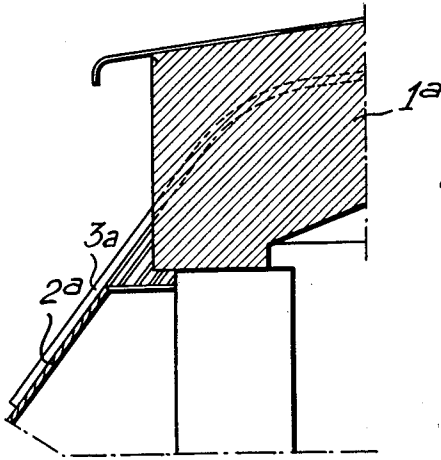


Fig. 4.

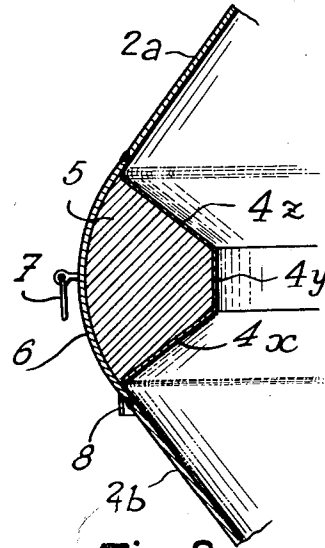
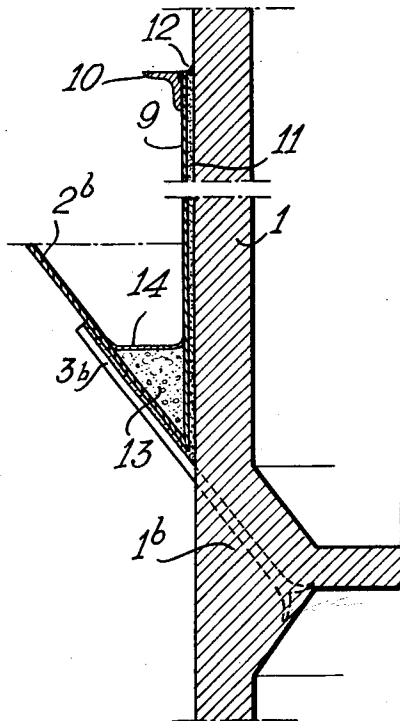


Fig. 3.

Fig. 5.

1

2

3,073,018 METHOD OF CONSTRUCTING AN ELEVATED RESERVOIR

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Filed Nov. 14, 1960, Ser. No. 68,953

Claims priority, application France Nov. 14, 1959
4 Claims. (Cl. 29—421)

This invention relates to elevated reservoir structures, such as water towers and the like, particularly of the type including a tower of cylindrical shape usually of concrete and an annular metallic tank surrounding an upper portion of said tower and suspended from the top thereof.

It is an object of the invention to provide an elevated reservoir or water-tower structure in which the metallic tank is suspended from the tower through suspension or connecting means that will be stressed under a substantially uniform tension load at all times regardless of the loaded condition of the tank. A further object is to provide a tank structure that will effectively behave, in service, as though it were suspended from the tower exclusively from the top of the tank insofar as forces due to tank loading are concerned, and in which the tank will not tend to be subjected to objectionable rotational and lateral forces about its top suspension, due to wind loading effect, and the like, as would be the case if only an upper suspension were provided.

Still further objects of the invention also include the provision of a method of erecting an elevated reservoir structure having the above indicated features; and which method will have the further important advantages of facility and expeditiousness especially through elimination of the extensive scaffolding usually required. According to this method the tank can be assembled from prefabricated elements around the foot of the tower, and then hoisted to its final suspended position.

The invention in one aspect provides a method of constructing an elevated reservoir, which comprises erecting a generally cylindrical tower, providing an annular tank assembly surrounding the tower, structurally connecting the top of the tank assembly with an upper circumference of the tower, filling the tank to cause a downward shift of the lower end of the loaded tank assembly relatively to its unloaded position, and connecting said lower end of the tank assembly as shifted with another circumference of the tower so that substantially only the top connection is stressed by the load of the full tank.

In another aspect the invention provides an elevated reservoir structure comprising a generally cylindrical tower, an annular tank assembly surrounding the tower, means structurally connecting the upper end of the tank assembly with an upper circumference of the tower for suspending the tank from the tower, and means structurally connecting the lower end of the tank assembly with another circumference of the tower, the latter means being so arranged that in the loaded condition of the tank said latter means is substantially unstressed and substantially only the upper connecting means is subjected to tension forces.

Further features and objects will become apparent from an exemplary embodiment of the invention which is described for purposes of illustration but not of limitation in the accompanying drawings, wherein:

FIG. 1 shows a simplified vertical elevation of the structure,

FIG. 2 is a sectional view along line II—II in FIG. 1,

FIGS. 3, 4 and 5 are larger-scale sectional views of details of the structure, FIG. 3 illustrating the intermediate concrete belt interconnecting the two tank sections, FIG. 4 showing the top connecting means of the tank with the tower and FIG. 5 showing the lower connecting means of the tank with the tower.

The overhead reservoir structure illustrated comprises a cylindrical tower or column 1, conveniently made of reinforced concrete, and an annular metallic tank 2 secured around an upper-section of the tower by having the upper and lower ends of said annular tank secured to annular cross web elements 1a and 1b of the tower. The tank is in the shape of two similar cone frusta 2a and 2b having their larger base circumferences interconnected by means of an annular concrete element or "belt" and their smaller end circumferences connected to crosswebs of the tower as previously noted. One advantage of this arrangement, as will later appear, is that the annular tank or reservoir can be conveniently constructed on the ground round the foot of the tower, and then the completed tank can be hoisted up along the tower and secured thereto first at the top then at the base of the tank. As shown in FIGS. 4 and 5, flat strip elements 3a and 3b imbedded in and projecting from the crosswebs 1a and 1b serve for the attachment of the tank by simply welding the strips 3a and 3b to the top and bottom outer surfaces of the tank respectively. The intermediate annular member or belt 4 of the tank comprises (as shown in FIG. 3) an annular metallic member having an outwardly-opening channel section configuration, adapted to contain concrete 5 cast therein whereupon an outer annular cambered cover strip 6 is welded to the member 4 around the body of concrete therein. The cover strip 6 is welded along its side edges to the large bases of the frustoconical tank sections 2a and 2b thereby interconnecting these sections. Secured to the outer surface of cover strip 6 are spaced rings 7 which serve primarily for attachment of the tank to hoisting apparatus, and also for minor handling purposes during construction and maintenance. A narrow annular strip 8 having a vertical surface is welded to the base of strip 6 to provide a gutter-drip preventing rainwater from running down along the lower frustoconical tank section.

As shown in FIG. 5, means are provided for ensuring the watertightness of the structure at the bottom end of the lower tank section 2. Such sealing means comprise a cylindrical annular sheet element 9 surrounding the tower 1 and having its lower end welded to the bottom circumference of tank section 2b. The sheet element 9 extends upward to a suitable elevation within the tank and has a stiffener angle 10 welded to its upper circumference. The very narrow annular space defined between the outer surface of tower 1 and the surrounding sheet 9 is filled with mortar or grout and a seal ring of bituminous or the like compound 12 is placed over the top of the filling. The outer surface of column 1 within the tank above the top of the sealing element 9 is coated with any suitable watertight coating composition. In an alternative construction, not shown, the cylindrical sealing sheet element 9 is extended upwards to a point overlying the overflow outlets of the tank, which would then be provided by apertures formed in the element 9 with outlet pipes welded to said element. This modified construction will impart practically absolute watertightness to the structure should this be desired.

In the annular trough formation defined at the bottom of tank section 2b between said section and the bottom of annular element 9 a ring of concrete 13 is cast, with the upper surface thereof preferably being inclined to the horizontal plane so as to provide a lowermost point with which a drain pipe (not shown) is connected. Over the concrete mass 13 an annular cover strip 14 is placed and welded both to the tank section 2b and the sheet element 9.

In some cases, especially when the height of the tower is particularly high, the column or tower 1 may be constructed in two (or more) vertical parts, with the lower part being of larger diameter than the upper.

The following procedure may be used in constructing a water tower or overhead reservoir according to the invention.

The concrete tower 1 is first erected by conventional means. Structural elements such as 6, 4x, 4y (but not 4z) of arcuate form in plan, which are to make up the intermediate belt structure of the tank are individually prefabricated in a workshop and are positioned on the ground around the foot of the tower 1 and assembled. In cases where the tower 1 is built in two parts, the said belt elements would be placed and assembled on a flat platform temporarily erected around the base of the upper part of the tower rather than on the ground. As will be apparent from FIG. 3, there is thus provided an annular trough structure open at the top, and the concrete belt 5 is then cast in said trough. After the concrete has completely set, the upper sheet elements such as 4z are assembled and welded in position, thereby completing the belt structure of the tank.

The upper frustoconical tank section 2a is then assembled around the tower from prefabricated arcuate elements such as 2a1, 2a2, . . . and its lower end is welded to the upper end of the belt structure. The arcuate elements such as 2a1, 2a2, are made as large as possible in arcuate extent and correspondingly small in number. The rings 7 attached to the outer surface of the intermediate belt are then used to hoist the partial tank structure thus assembled by an amount sufficient to provide clearance for the lower tank section 2b, and this section is then assembled similarly to the upper section including cylindrical sheet element 9, and welded to the lower end of the intermediate belt. The substantially complete tank structure thus produced is then hoisted to the top of the tower, and the projecting strips 3a which were previously imbedded in the top 1a of the concrete tower as shown in FIG. 4, are welded to the outer upper surface of the tank section 2a.

The strips 3b (FIG. 5) are then welded to the lower outer surface of the lower tank section 2b, and the inwardly and downwardly projecting ends of said strips are freely received in sockets provided therefor in the outer surface of the tower 1, adjacent the cross web member 1b.

At this stage, then, the empty tank is thus suspended at its top from the top of the tower. It is at this point that the major improvement of the invention is introduced.

It is noted that the cylindrical sealing sheet 9 is at this time still freely slidable around the tower. The mortar filling 11 is not yet in place nor are the stiffener angle 10 and seal strip 12 in position. Hence, a temporary water seal is now placed between the tank and the tower, which should be of such nature as to permit filling of the tank without however providing a rigid connection between tank and tower, for reasons that will presently appear. Such temporary seal may take the form for example of an inflated annular rubber tube, which may be positioned either at the bottom or at the top of the cylindrical sheet 9.

The tank is now filled with water substantially to its top. During the filling process the lower end of the lower tank section shifts downward relatively to the tower by a substantial amount. The tank as a whole is deformed in such a manner that the generatrices of both its cone sections are elongated, while the belt structure thereof is stressed in compression. After the filled tank has settled to its final shape and position the strips 3b projecting from the lower end of the tank are firmly sealed within their sockets in the tower. When this has been done, and after the cement sealing the strips in the tower has set, the tank is emptied to permit removal of the temporary seal, insertion of the grout filling 11, mounting the angle 10 and placing the seal 12. Also, the concrete ring 13 is cast and the cover strip 14 is welded in place. Finally the tank surfaces are coated with suitable anti-corrosive paint both inside and outside.

With the water tower constructed as described, it will be understood that in service, with the reservoir full or substantially full as is normally the case, the tank is effectively suspended through the upper strips 3a from the top of the tower, so that said strips are loaded in tension and resist substantially all of the weight of the tank and water therein, whereas the lower strips 3b are practically unstressed and serve almost exclusively to prevent rotational displacements of the tank about its suspension means under the action of wind forces and the like. The lower attaching means (strips 3b) instead of being subjected in service to compression forces due to the load of the filled tank as would be the case if during the erecting procedure the teaching of the invention were not followed, are not subjected to any load at all due to the weight of the tank and water therein when the tank is substantially full. In periods when the tank is partly or completely empty, the lower attaching means or strips are subjected to tensile stresses, similar to the upper suspension strips. Thus undesirable compression forces in any of the means attaching the tank to the tower are completely eliminated by the invention. Moreover, variations in reservoir loading due to variations in liquid level therein are taken up or compensated by corresponding variations in the tension of the lower connecting means (such as strips 3b) whereby the tension loading applied to the upper connecting means (such as strips 3a) remains substantially constant at all times irrespective of the amount of liquid stored.

What I claim is:

1. A method of constructing an elevated reservoir, which comprises erecting a generally cylindrical tower, providing an annular tank assembly surrounding the tower, structurally connecting the top of the tank assembly with an upper circumference of the tower, filling the tank to cause a downward shift of the lower end of the loaded tank assembly relatively to its unloaded position, and connecting said lower end of the tank assembly as shifted with a lower circumference of the tower so that substantially only the top connection of the tank assembly with the tower is stressed by the load of the full tank.

2. The method of claim 1, wherein said annular tank assembly is assembled in situ around the tower and is then hoisted up around the tower into position for connecting the top of the tank assembly with the upper circumference of the tower.

3. The method of claim 1, wherein structurally connecting the top of the tank assembly to the upper circumference of the tower comprises welding circumferentially spaced strips projecting from the upper tower circumference to the upper end of the tank assembly.

4. The method of claim 1, wherein the lower end of the tank assembly is connected to the lower circumference of the tower by connecting circumferentially spaced strips projecting from the lower circumference of the tower to the lower end of the tank assembly.

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