METHOD OF CONSTRUCTING A SPHERICAL TANK OR THE LIKE

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ABSTRACT

A method of constructing a spherical tank or the like, in which large-sized structural units or blocks of the triangular or the like shape are prefabricated by dividing the spherical surface of the tank along the equatorial line or other latitudinal lines on one hand and a plurality of longitudinal lines on the other hand, so as to provide convenience in mounting and assembling them into a complete spherical tank. Reinforcements are temporarily attached on the large-sized structural unit along the peripheral portion thereof, so that the reinforcements are disposed thereon substantially in the form of a triangle or the analogous shape, and may serve to increase the rigidity of the large-sized structural unit, thereby preventing the same from being subjected to deformation such as distortion.

4 Claims, 13 Drawing Figures

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METHOD OF CONSTRUCTING A SPHERICAL TANK OR THE LIKE

This invention relates to a method of constructing a spherical tank or the like.

It is an object of the present invention to provide an efficient method of constructing a spherical tank or the like.

It is another object of the invention to provide a method, in which structural units of larger sizes are prefabricated on the ground, so that the operations performed at elevated locations may be reduced, or the operation otherwise required at elevated locations can be replaced by operations performed at ground level thereby improving the efficiency of the entire construction operations, quality of welding, and safety, and shortening the time required for the operations.

It is a further object of the invention to provide a method, in which accuracy of the dimensions of prefabricated structural units is increased, and as a result a spherical structure of correct dimension can be constructed.

It is a still further object of the invention to provide a method, in which horizontal welding operations can be reduced, and as a result failure in welding can be minimized.

Other objects, features and advantages of the invention will become apparent from the following description, taken in connection with the accompanying drawings illustrating by way of example a preferred embodiment of the invention, in which:

FIG. 1 is a front view, illustrating the dividing and sub-dividing of a spherical tank constructed in accordance with a prior art method;

FIG. 2 is a view, showing a manner of lifting a circular structural unit prefabricated in accordance with the prior art method;

FIG. 3 is a view, showing a manner of lifting a typical structural unit used in the prior art method;

FIG. 4 is a front view, illustrating one example of the dividing and sub-dividing of a spherical tank constructed in accordance with the present invention;

FIG. 5 is a view, showing a manner of lifting a large-sized structural unit prefabricated in accordance with the present invention;

FIGS. 6 and 7 are perspective views, showing structural units of FIG. 3, on which reinforcements are attached to complete medium-sized structural units;

FIG. 8 is a perspective view, showing one example of a large-sized structural unit of the present invention, with reinforcements attached on the inner surface thereof;

FIG. 9 is a view, showing one example of produrec for assembling several medium-sized structural units into one large-sized structural unit;

FIGS. 10 to 12 are perspective views, illustrating examples of a manner of fastening reinforcements on the structural units of the present invention; and

FIG. 13 is a sectional view, taken along line A-A of FIG. 10.

Referring to the drawings, in a method of the prior art, the spherical surface of the tank 1 to be constructed is divided into many smaller elements 2 as shown in FIG. 1, and in the field, the smaller elements are set in place one by one, and are thereafter welded in a predetermined order to complete the spherical structure. In another prior art method of constructing a spherical tank, as shown in FIG. 3, several smaller elements 2 are welded at joints 4 to accomplish a medium-sized unit 5, and thereafter the medium-sized units 5 are set in place one by one by a crane and are welded at the joints 6 of these medium-sized units. In a further prior art method, several medium-sized units 5 as above described are welded together on the ground to form a larger, circular unit 7 as shown in FIG. 2, and then the large-sized units 7 are lifted by a heavy duty crane and set in place to construct the tank.

However, the method in which medium-sized units 5 or smaller elements 2 are set in place one by one on the structure has the difficulty that the number of field joints is very large. As a result, an extremely large number of man-hours are required in the field assembly and welding, and thus good quality of the welding can not be expected considering that the field work is dangerous on such a structure as spherical tank. In comparison with the above, the field assembly and welding is considerably reduced in the method using the above-described circular units 7. In this method, however, vertical welding still takes a greater allotment of work, and therefore it is difficult from the nature of the vertical welding to expect a high efficiency in assembly and welding in the case of flat welding. Further, it is difficult to complete the circular unit 7 with correct dimensions.

Therefore, the present invention aims at providing a novel method of constructing a spherical tank or the like, by which disadvantages of the conventional methods as described in the above are removed. In accordance with the present invention, there is provided a method which comprises the steps of prefabricating medium-sized structural units, producing large structural units in the form of a triangle or the similar shapes by combining the medium-sized structural units, attaching reinforcements on the peripheral portion of the triangular units, and finally assembling them one after another to obtain a complete structure of spherical tank or the like.

The present invention will now be described with reference to FIGS. 4 and 5, and FIGS. 8 through 13 of the accompanying drawings, by way of an example in which a large spherical or hemispherical tank is constructed. Referring first to FIGS. 4 and 5, the surface of a tank 1 is divided into sections by the equatorial line or other latitudinal line 8 and a plurality of longitudinal lines 9, 10, 11, 12. The large-sized structural unit or block 13, which has an outline defined by the equatorial line or latitudinal line 8 and longitudinal lines 11 and 12 is in the form of a triangle or similar shape. In FIGS. 4, 5, 8 and 9, the triangular block 13 has a flat apex. Reinforcements 3 are welded on the block 13 along the block joints 8, 11 and 12 as shown in FIG. 8, and the reinforcements are arranged also in a triangle or similar shape. Since the reinforcements 3 thus arranged have three points of intersection 19, 20 and 21, any torsional deformation in relation to the three points of intersection can not possibly occur. Thus, at least the portion of the block 13 lying on the three reinforcements 3 holds its shape correctly conforming to a part or segment of a spherical surface, and in addition rigidity of the large-sized block 13 is increased.

The present invention will be described in more detail with reference to FIGS. 8 and 9. Spherical shell segment or structural element constituting the large-sized block of FIG. 5 or FIG. 8 are assembled from medium-sized structural units or blocks 14, 15 and 16 of suitable
sizes as shown in FIG. 9. These medium-sized structural units are completed on the welding jig in the factory by flat welding. Then, these medium-sized blocks 14, 15 and 16 are welded together to form a large-sized block 13. The large-sized block thus constructed is of an extremely small thickness in comparison with its relatively large surface area, and therefore its rigidity is extremely low as it is. As a result, handling such as transportation, inversion and mounting of the block would be very difficult and dangerous. Thus, it is highly beneficial in the method of the present invention to apply reinforcements on the large-sized block, since these reinforcements serve to keep the block in its correct dimensions.

As described in the above, in accordance with the method of the present invention, reinforcements in a correct form are temporarily attached on a large-sized block which has been prefabricated on the assembling jigs, and thereby not only the portion of the block adjacent to the reinforcements but also the portion far away from the reinforcements can be reformed into correct shape. Such block fabricated as above is by far more correct in its shape than one that is fabricated by the assembling jigs alone. At the same time, the large-sized block is imparted with a high rigidity not only in the region adjacent to the reinforcement but also all over the block, so that handling such as transportation, inversion or field mounting of the large-sized block can be done with ease.

Large-sized blocks 13 thus prefabricated are mounted one by one on the structure in the manner as illustrated in FIG. 5. When welding of the joints 8, 9, 10, 11 and 12 are completed, the tank is imparted with a sufficient rigidity to support the structure by itself. The reinforcements are removed after the completion of welding, so that deformation of the tank may not occur while the joints 8, 9, 10, 11 and 12 are welded, and correct shape in the finished spherical structure can be attained with ease and reliability.

It is preferable to design the reinforcements 3 in such that their shape on construction may not be affected by the heat, if it is repeatedly experienced to attach them on the block by way of welding and to detach therefrom by way of gas cutting or the like. For example, an attachment piece 18 is fixed to the reinforcement 3 by means of such as bolts 17, as shown in FIGS. 10 to 13, so that the attachment of the reinforcements 3 on the block 13 may be accomplished by welding the attachment piece 18 on the spherical surface of the block 13. Such arrangement would be economically advantageous, since the reinforcements can be used semipermanently.

The reinforcements 3 of the present invention can be attached to the inside of the spherical surface as shown in FIG. 8, or alternatively to the outside of the spherical surface as shown in FIG. 5, according to the requirements set forth. Either of the above two arrangements can be employed, if it provides convenient mounting and dismantling of the blocks. In case of constructing a spherical tank, however, it is preferable to attach the reinforcements to the inside of the lower hemisphere, while it is preferable to attach the reinforcements to the outside of the upper hemisphere.

From the standpoint of preventing distortion of the reinforcements 3, it is preferable to fashion them in the form of a triangle as shown in FIG. 8 or FIG. 11. But, if it is not permitted according to shape of the tank to fashion the reinforcements in the form of a complete triangle, they may be fashioned into a shape analogous to a triangle, although the performance will be more or less degraded.

Of course, it is the best that the reinforcements are fixedly interconnected to each other at the joints where they intersect with each other, but they may be interconnected other than in a fixed manner, taking into consideration the convenience in dismantling the reinforcements.

While the principles of the invention have been described above in connection with specific embodiments thereof, it is to be understood that this description has been made only by way of example and not as a limitation on the scope of the invention.

We claim:

1. A method of constructing a tank or the like in the form of a sphere having an equatorial line and several longitudinal lines, comprising the steps of prefabricating large-sized blocks of a triangular shape with a surface conforming to a segment of a spherical surface, the outline of each block extending along the equatorial line and plurality of the longitudinal lines of the segmental spherical surface, welding connecting pieces to the segmental spherical surface of said blocks and bolting triangular reinforcements to said connecting pieces to thereby temporarily attach the same, and assembling these large-sized blocks by welding along the longitudinal lines and the equatorial line to complete the structure, and, after assembling the blocks, removing the reinforcements.

2. A method according to claim 1 wherein the blocks forming the lower hemisphere of the tank have the reinforcements temporarily attached to the interior surface and the blocks forming the upper hemisphere of the tank have the reinforcements temporarily attached to the outer surface.

3. A method according to claim 1 wherein said triangular blocks are prefabricated from a plurality of medium-sized units which are welded together.

4. A method according to claim 3 wherein said medium-sized units are completed on a welding jig in the factory by flat welding.

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