

Description

In a pressure-resistant tank known from EP-A-0303796, the tank casing has a substantially cloverleaf shaped cross-section formed by four part-cylindrical casing portions which are fitted between four tubular longitudinal members.

Based on the current ISO container standards, the known configuration results in a circumferential length of the individual casing portions which does not exceed the maximum possible rolling width of about 2 m. Welds are therefore necessary only between the casing portions and the tubular longitudinal members while they are not required within the casing portions themselves.

However, the specified rolling width of about 2 m can only be achieved by "surface cold rolling" of an initially hot-rolled sheet material. With the rolling technique presently available in Europe, cold-rolled coils produced continuously from wide strip material can be obtained up to a width of about 1.6 m. If it is attempted to build dual-shell tanks in accordance with the principle known from EP-A-0303796, it will be apparent that the two casing portions require circumferential dimensions which are substantially in excess of the above-specified rolling width, if the ISO framework profile is to be fully utilized. Such a tank, which corresponds to the first part of claim 1, is disclosed in DE-U-7910244.

By longitudinally joining two cold-rolled sheets each having a width of about 1.6 m, a dimension in the circumferential direction of at most about 3.2 m can be obtained for a casing portion provided with one weld. In view of the desired utilization, of the ISO profile this dimension is still insufficient for building a dual-shell tank.

DE-A-2114993 discloses another pressure-resistant tank the casing of which is formed of a total of six part-cylindrical shells with tie rods extending horizontally through the tank interior. In the embodiment illustrated in Figure 18 of this document, the tie rods have their ends connected to hollow longitudinal members of generally oblong cross-section.

It is an object of the invention to provide a pressure-resistant tank the casing of which is composed of a minimum number of parts while optimally utilising the available cross-section of ISO containers and the available width of cold-rolled material.

The solution of this object in accordance with the present invention is defined in claim 1. The tank casing, as in DE-U-7910244, comprises only two longitudinal members and two casing portions. The top shell used for the top longitudinal member may be circumferentially dimensioned so as to complete the circumferential dimension of the two casing portions, each of which may be prefabricated from two cold-rolled sheets to the size required for optimum utilization of the available profile. As said top shell is also curved, it provides substantially the same resistance to internal pressure as the tank casing portions. Simultaneously, the shape of the top shell, which projects into the tank interior, provides a protected space for the recessed accommodation of manhole members and tank fittings. Thus, the width of the top longitudinal member created by the top shell, which width is greater than that of a normal tubular member, is appropriately utilized.

The tension plate not only provides a cover for the fittings mounted in the top shell but also further increases the tank strength. The tension plate may conveniently be used as an operator's catwalk for the tank.

Further advantageous configurations of the top shell area as regards manufacture, utilisation of material, and strength are specified in claims 4, 5 and 7 to 10.

In another advantageous embodiment the top shell is used as a spill-over trough encompassing the manhole and the tank fittings; by way of inexpensive measures as specified in claim 6, this trough may be provided with an overflow member.

Preferred embodiments of the invention will now be explained in detail below with reference to the drawing, in which:

- Figure 1 is a sectional view of a pressure-resistant tank,
- Figure 2 is an enlarged side view illustrating the top area of the tank of Figure 1, and
- Figures 3 to 6 are further embodiments of the top area of the tank similar to Figure 2.

The casing of the tank illustrated in Figure 1 is substantially composed of two part-circular cylindrical casing portions 10, 11 having parallel longitudinal axes. The bottom longitudinal edges of the casing portions 10, 11 are welded to a tubular bottom longitudinal member 12 while their top longitudinal edges are welded to a somewhat trough-shaped top longitudinal member 13. Depending on the tank length, the two longitudinal members 12, 13 are interconnected by one or more tubular tie rods 14.

The maximum width of the tank cross-section illustrated in Figure 1 is 2460 mm and the maximum height is 1943 mm. In this case, when the tubular bottom longitudinal member 12 has a diameter of about 100 mm and the top longitudinal member 13 has a width of about 700 mm, each casing portion 10 and 11 will have a circumferential length of less than 3200 mm. A casing portion of dimension can be formed of a sheet which is

prefabricated from two cold-rolled strips joined by a longitudinal weld. As a result, the tank casing according to Figure 1 in its circumferential direction requires a total of only six welds extending in the longitudinal direction of the tank, and of these six welds only four have to be produced while the tank is actually assembled.

As will be apparent in detail from Figure 2, the top longitudinal member 13 comprises a top shell 15 which is convexly curved toward the tank interior and the upper ends of which constitute flanges 16, 17 bent towards each other. A flat tension plate 18 has its longitudinal edges bolted or welded to the two flanges 16, 17, and a profile element is fitted inbetween the top shell 15 and the plate 18. In the embodiment shown in Figure 2, the profile element is constituted by a wide-flanged I-beam 19 including a vertical web 20, a top flange 21 and a bottom flange 22.

The tie rod 14 may be connected to the bottom longitudinal member 12 in the way described in EP-A-0303796. In the vicinity of the upper end of the tie rod 14, the top shell 15 and the bottom flange 22 of the I-beam 19 are recessed corresponding to the tie rod cross-section. The tie rod 14 is provided with a vertical slot corresponding to the thickness of the web 20 of the I-beam 19, the length of said slot being dimensioned such that the tie rod 14 reaches right to the top flange 21. The tie rod 14 is welded to the I-beam 19 in the vicinity of the mentioned slot and also of the recess in the bottom flange 22.

As indicated in dashed lines in Figure 2, the top shell 15 is penetrated by a manhole flange 23 and tank fittings (not illustrated), these elements being welded to the top shell 15 and the I-beam 19 which latter is recessed in these areas. The manhole flange 23 including a manhole cover 24 and the other tank fittings are disposed completely within the space defined by the top shell 15 and the plate 18.

The top shell 15 has the function of a spill-over trough and to this end may be subdivided into a plurality of compartments by partition webs extending transverse to the longitudinal axis. As will be apparent from Figure 2, the hollow tie rod 14, at a location slightly above the top shell 15, is formed with a port 25 in its tubular wall through which port any liquid entering the spill-over trough may enter the tie rod 14 to be discharged from the open bottom end 26 thereof (Figure 1). The bottom flange 22 of the I-beam 19 is welded with its two longitudinal edges to the inner surface of the top shell 15 at least within the area of said spill-over trough.

The top longitudinal member 33 shown in Figure 3 differs from the longitudinal member 13 of Figure 2 in that the top shell 35 is substantially gusset-shaped and, in contrast to Figure 2, is concavely shaped towards the tank interior, its two wall portions being curved so as to form continuations of the casing portions 10, 11. Furthermore, the beam, which has an overall cross-sectional shape similar to an I-beam, is composed of a T-beam 39 and an L-member 32 shaped to conform to the gusset region of the top shell 35. The side edges of the top shell 35 are butt-welded to the upper side edges of the casing portions 10, 11.

In the configuration of the top longitudinal member 43 illustrated in Figure 4, the top shell 45 in the vicinity of its weld joints with the casing portions 10, 11 is bent inwardly, and the thus formed flanges 46, 47 are lap-welded to the top flange 41 of a T-beam 49, which is similar to that used in Figure 3. In this case, there is no separate tension plate like that indicated at 38 in Figure 3. Furthermore, in the embodiment of Figure 4, the L-member 32 of Figure 3 has been replaced by two L-bars 42 each of which has the outer edge of one leg welded to the lower web of the T-beam 49 and that of the other leg engaging in the corner area between web and flange of the T-beam 49.

The top longitudinal member 53 of Figure 5 differs from that of Figure 4 in that the section member is a rectangular tube 59 the cross-sectional diagonals of which extend vertically and horizontally. In this case the flanges 56 and 57 of the top shell 55 are welded to the rectangular tube 59 near the vertex thereof.

In the embodiment illustrated in Figure 6, a rectangular tube 69 is fitted between top and bottom L-bars 61 and 62 of which the bottom one (62) rests in the gusset area of a top shell 65 while the top one (61) has the flanges 66, 67 of the top shell 65 welded thereto.

Provided a separate tension plate 18, 38 as illustrated in Figure 2 or Figure 3 is present, the upper face thereof may be formed with upwardly projecting fluted, diamond-shaped or point-like formations and may be used as a non-skid catwalk. Similar non-skid measures may be provided on the upper surfaces of the flanges 46, 47 ; 56, 57 ; and 66, 67 of the top shell 45 ; 55 ; and 65 as shown in Figures 4 to 6, respectively.

Claims

1. A pressure-resistant tank having a casing formed of only two part-cylindrical casing portions (10, 11) with parallel longitudinal axes fitted between longitudinal members (12, 13), opposite longitudinal members (12, 13) being interconnected by tie rods (14) which extend vertically through the tank interior, characterized in that both longitudinal members (12, 13) are formed as hollow members, and that the top longitudinal member (13; 33 ; 43 ; 53 ; 63) is composed of a top shell (15 ; 35 ; 45 ; 55 ; 65) which is curved transverse to the longitudinal direction, encompasses a manhole (23) provided at the tank top, and projects into the tank interior, and of a



prefabricated from two cold-rolled strips joined by a longitudinal weld. As a result, the tank casing according to Figure 1 in its circumferential direction requires a total of only six welds extending in the longitudinal direction of the tank, and of these six welds only four have to be produced while the tank is actually assembled.

As will be apparent in detail from Figure 2, the top longitudinal member 13 comprises a top shell 15 which is convexly curved toward the tank interior and the upper ends of which constitute flanges 16, 17 bent towards each other. A flat tension plate 18 has its longitudinal edges bolted or welded to the two flanges 16, 17, and a profile element is fitted inbetween the top shell 15 and the plate 18. In the embodiment shown in Figure 2, the profile element is constituted by a wide-flanged I-beam 19 including a vertical web 20, a top flange 21 and a bottom flange 22.

The tie rod 14 may be connected to the bottom longitudinal member 12 in the way described in EP-A-0303796. In the vicinity of the upper end of the tie rod 14, the top shell 15 and the bottom flange 22 of the I-beam 19 are recessed corresponding to the tie rod cross-section. The tie rod 14 is provided with a vertical slot corresponding to the thickness of the web 20 of the I-beam 19, the length of said slot being dimensioned such that the tie rod 14 reaches right to the top flange 21. The tie rod 14 is welded to the I-beam 19 in the vicinity of the mentioned slot and also of the recess in the bottom flange 22.

As indicated in dashed lines in Figure 2, the top shell 15 is penetrated by a manhole flange 23 and tank fittings (not illustrated), these elements being welded to the top shell 15 and the I-beam 19 which latter is recessed in these areas. The manhole flange 23 including a manhole cover 24 and the other tank fittings are disposed completely within the space defined by the top shell 15 and the plate 18.

The top shell 15 has the function of a spill-over trough and to this end may be subdivided into a plurality of compartments by partition webs extending transverse to the longitudinal axis. As will be apparent from Figure 2, the hollow tie rod 14, at a location slightly above the top shell 15, is formed with a port 25 in its tubular wall through which port any liquid entering the spill-over trough may enter the tie rod 14 to be discharged from the open bottom end 26 thereof (Figure 1). The bottom flange 22 of the I-beam 19 is welded with its two longitudinal edges to the inner surface of the top shell 15 at least within the area of said spill-over trough.

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In the configuration of the top longitudinal member 43 illustrated in Figure 4, the top shell 45 in the vicinity of its weld joints with the casing portions 10, 11 is bent inwardly, and the thus formed flanges 46, 47 are lap-welded to the top flange 41 of a T-beam 49, which is similar to that used in Figure 3. In this case, there is no separate tension plate like that indicated at 38 in Figure 3. Furthermore, in the embodiment of Figure 4, the L-member 32 of Figure 3 has been replaced by two L-bars 42 each of which has the outer edge of one leg welded to the lower web of the T-beam 49 and that of the other leg engaging in the corner area between web and flange of the T-beam 49.

The top longitudinal member 53 of Figure 5 differs from that of Figure 4 in that the section member is a rectangular tube 59 the cross-sectional diagonals of which extend vertically and horizontally. In this case the flanges 56 and 57 of the top shell 55 are welded to the rectangular tube 59 near the vertex thereof.

In the embodiment illustrated in Figure 6, a rectangular tube 69 is fitted between top and bottom L-bars 61 and 62 of which the bottom one (62) rests in the gusset area of a top shell 65 while the top one (61) has the flanges 66, 67 of the top shell 65 welded thereto.

Provided a separate tension plate 18, 38 as illustrated in Figure 2 or Figure 3 is present, the upper face thereof may be formed with upwardly projecting fluted, diamond-shaped or point-like formations and may be used as a non-skid catwalk. Similar non-skid measures may be provided on the upper surfaces of the flanges 46, 47 ; 56, 57 ; and 66, 67 of the top shell 45 ; 55 ; and 65 as shown in Figures 4 to 6, respectively.

Claims

1. A pressure-resistant tank having a casing formed of only two part-cylindrical casing portions (10, 11) with parallel longitudinal axes fitted between longitudinal members (12, 13), opposite longitudinal members (12, 13) being interconnected by tie rods (14) which extend vertically through the tank interior, characterized in that both longitudinal members (12, 13) are formed as hollow members, and that the top longitudinal member (13; 33 ; 43 ; 53 ; 63) is composed of a top shell (15 ; 35 ; 45 ; 55 ; 65) which is curved transverse to the longitudinal direction, encompasses a manhole (23) provided at the tank top, and projects into the tank interior, and of a



tension plate (18 ; 38) interconnecting the upper ends of the top shell (15 ; 35 ; 45 ; 55 ; 65).

2. The tank of claim 1, wherein a section member (19 ; 39 ; 49 ; 59 ; 69) is fitted between said tension plate (18 ; 38) and top shell (15 ; 35 ; 45 ; 55 ; 65).

3. The tank of claim 1 or 2, wherein the upper surface of said tension plate (18 ; 38) is provided with projections to constitute a non-skid catwalk.

4. The tank of claim 2, wherein said tension plate is constituted by upper flanges (46, 47 ; 56, 57 ; 66, 67) of said top shell (45 ; 55 ; 65), said flanges being joined to said section member (49 ; 59 ; 69).

5. The tank of any one of claims 2 to 4, wherein said section member (19) is recessed in a manhole area and welded to an outer tubular manhole flange (23).

6. The tank of claim 5, wherein at least one tie rod (14) is hollow with openings (25, 26) at its top and bottom ends and is in communication with the interior of said top shell (15).

7. The tank of any one of claims 2 to 6, wherein said section member (19 ; 39 ; 49) is an I- or T-beam having a vertical web (20).

8. The tank of claim 7, wherein said tie rod (14) is welded to the bottom flange (22) and web (20) of said beam (19), said bottom flange (22) being recessed to conform to the cross-section of said tie rod (14).

9. The tank of any one of claims 2 to 6, wherein said section member (59 ; 69) is a rectangular tube with a perpendicularly extending cross-section diagonal.

10. The tank of any one of claims 1 to 9, wherein the cross-section of said top shell (35 ; 45 ; 55 ; 65) is gusset-shaped with its two wall portions having a curvature to conform to said tank casing portions (10, 11).

Patentansprüche

1. Druckfester Tank, dessen Mantel aus nur zwei zwischen Längselemente (12, 13) eingefügten teilzylindrischen Mantelteilen (10, 11) mit parallelen Längsachsen gebildet ist, wobei gegenüberliegende Längselemente (12, 13) über das Tankinnere senkrecht durchsetzende Zuganker (14) miteinander verbunden sind, dadurch gekennzeichnet, daß beide Längselemente (12, 13) als Hohlelemente ausgebildet sind und daß das obere Längselement (13 ; 33 ; 43 ; 53 ; 63) aus einer quer zur Längsrichtung gewölbten Scheitelschale (15 ; 35 ; 45 ; 55 ; 65), die in das Tankinnere eingreift und ein an der Tankoberseite vorgesehenes Mannloch (23) umschließt, und einer die oberen Enden der Scheitelschale (15 ; 35 ; 45 ; 55 ; 65) miteinander verbindenden Zugplatte (18 ; 38) aufgebaut ist.

2. Tank nach Anspruch 1, wobei zwischen die Zugplatte (18 ; 38) und die Scheitelschale (15 ; 35 ; 45 ; 55 ; 65) ein Profilelement (19 ; 39 ; 49 ; 59 ; 69) eingefügt ist.

3. Tank nach Anspruch 1 oder 2, wobei die Zugplatte (18 ; 38) als gleitsicherer Bedienungssteg an ihrer Oberfläche mit Ausformungen versehen ist.

4. Tank nach Anspruch 2, wobei die Zugplatte von mit dem Profilelement (49 ; 59 ; 69) verbundenen oberen Flanschen (46, 47 ; 56, 57 ; 66, 67) der Scheitelschale (45 ; 55 ; 65) gebildet ist.

5. Tank nach einem der Ansprüche 2 bis 4, wobei das Profilelement (19) in einem Mannlochbereich ausgespart und an einen äußeren rohrförmigen Mannlochflansch (23) angeschweißt ist.

6. Tank nach Anspruch 5, wobei mindestens ein Zuganker (14) hohl ist, an seinem oberen und seinem unteren Ende Öffnungen (25, 26) aufweist und mit dem Innenraum der Scheitelschale (15) in Verbindung steht.

7. Tank nach einem der Ansprüche 2 bis 6, wobei das Profilelement (19 ; 39 ; 49) ein I- oder T-Profil-Träger mit senkrechtem Steg (20) ist.

8. Tank nach Anspruch 7, wobei der Zuganker (14) mit dem entsprechend dem Querschnitt des Zugankers (14) ausgesparten unteren Flansch (22) und dem Steg (20) des Trägers (19) verschweißt ist.

9. Tank nach einem der Ansprüche 2 bis 6, wobei das Profilelement (59 ; 69) ein Vierkantrohr mit senkrecht stehender Querschnittsdiagonale ist.

10. Tank nach einem der Ansprüche 1 bis 9, wobei die Scheitelschale (35 ; 45 ; 55 ; 65) im Querschnitt zwickelartig geformt ist und ihre beiden Teilflächen eine den Mantelschalen (10, 11) entsprechende Krümmung aufweisen.

Revendications

1. Conteneur résistant à la pression possédant une enveloppe constituée de seulement deux parties d'enveloppe (10, 11) partiellement cylindriques à axes longitudinaux parallèles, montées entre des éléments longitudinaux (12, 13), les éléments longitudinaux opposés (12, 13) étant reliés entre eux par des barres d'accouplement (14) s'étendant verticalement à travers l'intérieur du conteneur, caractérisé en ce que les deux



éléments longitudinaux (12, 13) sont réalisés sous la forme d'éléments creux, et en ce que l'élément longitudinal supérieur (13 ; 33 ; 43 ; 53 ; 63) est constitué d'une coquille supérieure (15 ; 35 ; 45 ; 55 ; 65) qui est incurvée transversalement à la direction longitudinale, entoure un trou d'homme (23) prévu au sommet du conteneur et fait saillie dans l'intérieur du conteneur, et d'une plaque de tension (18 ; 38) reliant entre elles les extrémités supérieures de la coquille supérieure (15 ; 35 ; 45 ; 55 ; 65).

2. Conteneur selon la revendication 1, dans lequel un élément profilé (19 ; 39 ; 49 ; 59 ; 69) est monté entre ladite plaque de tension (18 ; 38) et la coquille supérieure (15 ; 35 ; 45 ; 55 ; 65).

3. Conteneur selon la revendication 1 ou 2, dans lequel la surface supérieure de ladite plaque de tension (18 ; 38) est munie de parties saillantes pour constituer une course antidérapante.

4. Conteneur selon la revendication 2, dans lequel ladite plaque de tension est constituée par les rebords supérieurs (46, 47 ; 56, 57 ; 66, 67) de ladite coquille supérieure (45 ; 55 ; 65), lesdits rebords étant réunis audit élément profilé (49 ; 59 ; 69).

5. Conteneur selon l'une quelconque des revendications 2 à 4, dans lequel ledit élément profilé (19) est évidé dans une région de trou d'homme et soudé à un rebord tubulaire extérieur de trou d'homme (23).

6. Conteneur selon la revendication 5, dans lequel au moins une barre d'accouplement (14) est creuse avec des ouvertures (25, 26) à ses extrémités supérieure et inférieure et est en communication avec l'intérieur de ladite coquille supérieure (15).

7. Conteneur selon l'une quelconque des revendications 2 à 6, dans lequel ledit élément profilé (19 ; 39 ; 49) est une poutre en I ou en T possédant une âme verticale (20).

8. Conteneur selon la revendication 7, dans lequel ladite barre d'accouplement (14) est soudée au rebord inférieur (22) et à l'âme (20) de ladite poutre (19), ledit rebord inférieur (22) étant évidé pour épouser la section transversale de ladite barre d'accouplement (14).

9. Conteneur selon l'une quelconque des revendications 2 à 6, dans lequel ledit élément profilé (59 ; 69) est un tube rectangulaire dont la diagonale de la section s'étend verticalement.

10. Conteneur selon l'une quelconque des revendications 1 à 9, dans lequel la section transversale de ladite coquille supérieure (35 ; 45 ; 55 ; 65) est en forme de gousset avec ses deux parties de paroi présentant une courbure s'adaptant auxdites parties d'enveloppe du conteneur (10, 11).