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(54) TANK-TYPE CONTAINER AND END FRAME STRUCTURE THEREOF

(57) Disclosed are a tank-type container and an end frame structure (2) thereof. The end frame structure comprises: an upper beam (21), a lower beam (22), and two corner posts (23). The corner post comprises a body (231) and a reinforcement portion (232), wherein the reinforcement portion and the body are arranged in parallel in the axial direction of a tank, and the reinforcement portion and the body are adapted to each other and enclose a tubular structure. In the end frame structure of the tank-type container, by designing the shape of the corner post, the reinforcement portion is arranged in parallel with the body in the axial direction of the tank. The corner post is provided with the reinforcement portion to increase the width thereof, so as to increase the strength of the corner post, so that the load of the end frame structure can meet the requirement of 78 tons.

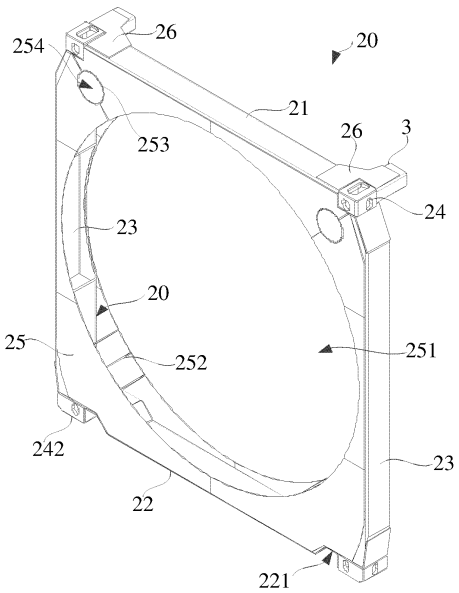

FIG.1

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Description

TECHNICAL FIELD

[0001] The present invention relates to the tank container field, and specifically, relates to a tank container and end frame structure thereof.

BACKGROUND

[0002] Tank containers are common transportation devices. A tank container usually includes a frame and a tank body supported by the frame. The frame protects and hoists the tank body. The frame usually includes a front end frame, a rear end frame and a beam connecting the front end frame and the rear end frame. For tank containers, it is necessary to consider the impact load, the fatigue load and load such as the inertial force of the liquid in the tank body, thus, the frame usually needs to be provided with a relatively complicated structure, to meet the strength requirements under the conditions of impact and the like.

[0003] Furthermore, swap body tank containers are often large volume tank containers. The heavier the large volume tank container is, the greater inertial impact the end frame has. The traditional end frame structure hardly meets these strength requirements.

SUMMARY

[0004] The object of the present invention is to provide an end frame structure with higher strength.

[0005] A end frame structure of a tank container, characterized in that, comprises a top rail, a bottom rail, two corner posts, two top corner castings disposed at the top of the two corner posts and two bottom corner castings disposed at the bottom of the two corner posts, both ends of the top rail connected to the two top corner castings respectively, both ends of the bottom rail connected to the two bottom corner castings respectively, wherein each corner post includes a body and a reinforcing part, the reinforcing part and the body disposed in parallel along the axial direction of a tank body, the body adapted with the reinforcing part to form a tubular structure.

[0006] In one embodiment, the width of the reinforcing part along the axial direction of the tank body is the same, or the width of the reinforcing part along the axial direction of the tank body increases gradually from the upper end and the lower end to the middle.

[0007] In one embodiment, the width of the reinforcing part along the axial direction of the tank body is the same, or the width of the reinforcing part along the axial direction of the tank body increases gradually from the upper end and the lower end to the middle.

[0008] In one embodiment, characterized by, the reinforcing part and the body are of an integral structure.

[0009] In one embodiment, the distance between the inner lateral surfaces of the two corner posts is greater than or equal to the distance between the two top corner castings or the two bottom corner castings.

[0010] In one embodiment, the inner lateral surface of the corner post is provided with an arc-shaped groove adapted with the tank body.

[0011] In one embodiment, an escape groove is disposed on the bottom rail, and the bottom rail is provided with a connecting block above the escape groove.

[0012] In one embodiment, further comprising a connecting plate provided with a through hole for allowing the tank body to pass through, wherein a frame is formed by the two corner posts jointing with the top rail and the bottom rail, and the connecting plate is connected to and covers the frame from at least one side of the frame.

[0013] In one embodiment, the connecting plates are disposed on the front side and the back side of the frame, and a reinforcing plate is disposed vertically between two connecting plates, the reinforcing plate extends from the top corner castings or the bottom corner castings to the through hole.

[0014] In one embodiment, the top corner castings and the bottom corner castings are castings or welded pieces, and the yield strength of the top corner castings and the bottom corner castings is greater than or equal to 420 MPa.

[0015] The present invention also provides a tank container.

[0016] The tank container comprises a tank body and the above described end frame structures, the end frame structures disposed at both ends of the tank body, the both ends of the tank body fixed by the end frame structures, the both ends of the tank body provided with seal heads, the seal heads passing through the end frame structures respectively.

[0017] In the end frame of the tank container described above, the reinforcing part and the body are disposed in parallel along the axial direction of the tank body by designing the shape of the corner posts. The corner posts are provided with the reinforcing parts to increase the width, so as to enhance the strength of the corner posts, so that the load of the end frame structure can meet the requirement of 78 tons. Moreover, by designing the shape of the corner post, the connecting position of the corner post and the corner casting, the distance between the two bodies is greater than the distance between the two top corner castings or the distance between the two corner castings. The end frame structure described above could fix the tank body with larger volume while not influencing the hoisting and transportation of the integral tank container.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018]

Fig. 1 is a perspective view of an end frame structure of a tank container of the present embodiment;

FIG. 2 is a side view of the end frame structure shown

in FIG. 1;

FIG. 3 is a schematic diagram of the end frame construction shown in FIG. 1;

FIG. 4 is a side view of another embodiment of the end frame structure shown in FIG. 3.

[0019] The reference numerals as follows: 2. end frame structure; 20. frame; 21. top rail; 22. bottom rail; 221. escape groove; 222. connecting blocks; 223. cut surface; 224. arc surface; 23. corner post; 231. body; 232. reinforcing part; 233. inclined surface; 234. arc-shaped groove; 235. inner lateral surface; 236. outer lateral surface; 24. corner casting; 241. top corner casting; 242. bottom corner casting; 25. connecting plate; 251. through hole; 252. reinforcing plate; 253. reinforcing tube; 254. hole; 26. hoisting protection plate; 3. cross beam.

DETAILED DESCRIPTION

[0020] While this invention is susceptible of embodiment in different forms, only some specific embodiments are shown in the drawings and will be described in detail in the present specification, and it can be understood that the present specification is to be considered as an exemplary description of the principles of the present invention, and is not intended to limit the present invention to that as illustrated herein.

[0021] Thus, a feature indicated in the present specification will serve to explain one of the features of one embodiment of the present invention, and does not imply that every embodiment of the present specification has to include the indicated feature. Further, it should be noted that many features are described in the present specification. Although some features may be combined to show a possible system design, these features may also be used in other combinations not explicitly described. Thus, the combinations illustrated are not intended to be limiting, unless otherwise specified.

[0022] In the embodiment shown in the drawings, the indications of the direction(such as up, down, left, right, front, and back) that are used to explain the structure and movement of the various elements of the present invention are not absolutely, but relatively. These illustrations are appropriate when these elements are in the positions shown in the figures. If the description of the positions of these elements is changed, the indications of these directions are changes accordingly.

[0023] The preferred embodiment of the present invention will be further described in detail with reference to the accompanying drawings.

[0024] Referring to FIG. 1, the present invention proposes a tank container and an end frame structure thereof.

[0025] The tank container of this embodiment includes a tank body and end frame structures 2 provided at both ends of the tank body. Both ends of the tank body are fixed by the end frame structure 2, and the both ends of the tank body are provided with seal heads. The seal heads pass through the two end frame structures 2 respectively. For the convenience of description, the end of the tank body close to the head of a vehicle is called the front end, and the other end of the tank body is the rear end. Therefore, the two end frame structures 2 are a front end frame and a rear end frame, respectively. The two ends of the tank body are respectively fixed by the front end frame and the rear end frame, and the seal heads pass through the front end frame and the rear end frame, respectively.

[0026] The tank body is a large volume tank body. The distance between the front end frame and the rear end frame is 30Ft or 40Ft.

[0027] Referring to FIGS. 1 and 2, the end frame structure 2 includes a top rail 21, a bottom rail 22, two corner posts 23 and four corner castings 24.

[0028] The corner casting 24 includes two top corner castings 241 provided at the top ends of the two corner posts 23 and bottom corner castings 242 provided at the bottom ends of the two corner posts 23. Both ends of the top rail 21 are respectively connected to two top corner castings 241, and both ends of the bottom rail 22 are respectively connected to two bottom corner castings 242. The top corner casting 241 and the bottom corner casting 242 are castings or welded pieces. The yield strength of the top corner castings 241 and the bottom corner castings 242 is greater than or equal to 420 MPa, so as to meet the need of the transporting large volume tank body.

[0029] In addition, the distance between the two top corner castings 241 is 2438 mm, and the distance between the two bottom corner castings 242 is less than or equal to 2600 mm, so as to ensure that the hole of the corner casting can be adapted to a lock which is disposed on a transport device of the rail, road, and shipping. It can be understood that the distance between the two top corner castings 241 may also be the same as the distance between the two bottom corner castings 242, as long as the transportation requirements of that the corner casting is able to match with the lock could be met.

[0030] The top rail 21 and the bottom rail 22 are oppositely disposed. The top rail 21 and the bottom rail 22 are tubular structures, for example, square tubes or round tubes. A hoisting protection plate 26 is provided at the joints between the top rail 21 and the top corner casting 241. The hoisting protection plate 26 is triangular. The hoisting protection plate 26 connects the top rail 21 with a cross beam 3 between the both end frame structures 2. The hoisting protection plate can strengthen the joints of the top rail 21, the top corner casting 241 and the cross-beam 3, and prevent damage during the hoisting process.

[0031] The bottom rail 22 is provided with an escape groove 221. The escape groove 221 is used to avoid a fixed lock on the vehicle frame and the like. When the end frame structure 2 is placed on the vehicle frame, the bottom rail 22 is prevented from colliding and being damaged. The bottom rail 22 is provided with a connecting

block 222 above the escape groove 221. The connecting block 222 connects the bottom rail 22 with the bottom corner casting 242. The connecting block 222 can strengthen the strength of the bottom rail 22 and the escape groove 221, so as to prevent the bottom rail 22 from affecting the overall strength of the bottom rail 22 due to the setting of the escape groove 221. The width of the connecting block 222 is equal to the width of the bottom rail 22. One end of the connecting block 222 is in contact with the inner lateral surface 235 of the corner post 23. The other end of the connecting block 222 is provided with a cut surface 223. The cut surface 223 is adapted to the outer surface of the tank body. It can be understood that the connecting block 222 is a rectangular square tube.

[0032] Specifically, in this embodiment, the length of the bottom rail 22 is smaller than the distance between the two bottom corner castings 242. Therefore, the escape groove 221 is formed by the end surface of the bottom rail 22 and the side surface of the bottom corner casting 242.

[0033] Moreover, the bottom rail 22 is provided with an arc surface 224, which is adapted to the surface of the tank body. When the tank body contacts the bottom rail 22, the arc surface 224 can better fix and support the tank body.

[0034] Referring to FIG. 3, a frame 20 is formed by the two corner posts 23 jointing with the top rail 21 and the bottom rail 22 through the corner castings 24 The side of the corner post 23 facing the inner lateral surface of the frame 20 is the inner lateral surface235 of the corner post 23, the side that is opposed to the inner lateral surface 235 is the outer lateral surface 236 of the corner post 23.

[0035] The corner post 23 includes a body 231 and a reinforcing part 232. The body 231 and the reinforcing part 232 are disposed in parallel along the axial direction of the tank body, and the reinforcing part 232 is adapted to the body 231 to form a tubular structure. The body 231 and the reinforcing part 232 are spliced into the corner post 23 of tubular shape.

[0036] The width of the reinforcing part 232 along the axial direction of the tank body is the same. The cross-sectional area of the middle portion of the reinforcing part 232 is equal to the cross-sectional area of both ends of the reinforcing part 232.

[0037] Specifically, in this embodiment, the cross-sectional area of the middle portion of the reinforcing part 232 is equal to the cross-sectional area of both ends. The width of the corner post 23 along the axial direction of the tank body is the same. That is, the corner post 23 is a rectangular square tube. Then, the body 231 and the reinforcing part 232 are steels with a square groove. The reinforcing part 232 reinforces the strength of the corner post 23 from the side of the body 231.

[0038] The reinforcing part 232 and the body 231 are integral structures.

[0039] In addition, the reinforcing part 232 widens the end surface of the corner post 23 along the axial direction of the tank body, increases the connection area between the corner post 23 and the corner casting 24, and strengthens the connection strength between the corner post 23 and the corner casting 24.

[0040] Since the corner post 23 is composed of the body 231 and the reinforcing part 232, the length of the corner post 23 is relatively large along the axial direction of the tank body and the length of the corner post 23 is relatively small in the direction perpendicular to the axial direction of the tank body. Therefore, the corner post 23 can be connected to the outer portion of the corner casting 24, so that the distance between the inner lateral surfaces 235 of the two corner posts 23 can be increased. The distance between the inner lateral surfaces 235 of the two corner posts 23 is greater than the distance between the two top corner castings 241 or the two bottom corner castings 242. Therefore, without affecting the hoisting and transportation of the entire tank container, the distance between the two corner posts 23 is increased, so that the end frame structure 2 can fix a larger volume tank body.

[0041] Specifically, in this embodiment, the outer lateral surfaces 236 of both ends of the corner post 23 are provided with inclined surfaces 233. The inclined surface 233 is bent toward the inner lateral surface 235 of the corner post 23, and the angle between the inclined surface 233 and the inner lateral surface 235 of the corner post 23 is an acute angle. The area of the cross section of the corner post 23 gradually decreases along the height direction, ensuring that both ends of the corner post 23 can be connected to the corner casting 24.

[0042] In other embodiments, the width of the reinforcing part 232 in the axial direction of the tank body increases from the upper end and the lower end to the middle. Referring to FIG. 4, the cross-sectional area of the middle portion of the reinforcing part 232 is larger than the cross-sectional area of both ends of the reinforcing part 232. The width of the corner post 23 in the axial direction of the tank body increases from both ends to the middle. In the axial direction of the tank body, the width of the central portion of the corner post 23 is increasing with respect to the widths of the both ends, which can enhance the strength of the corner post 23.

[0043] It can be understood that the corner post 23 may also be formed by splicing a special-shaped square tube, square tube or round tube, or a plate with each other.

[0044] Therefore, on the premise of ensuring its own strength and the strength of connection with the corner casting 24, the corner post 23 maximizes the distance between the two corner posts 23, so that the end frame structure 2 can fix a larger volume tank body.

[0045] The inner lateral surface 235 of the corner post 23 is provided with an arc-shaped groove 234 adapted to the tank body. On the one hand, the two arc-shaped grooves 234 can further expand the distance between the inner lateral surfaces 235 of the two corner posts 23,

so that the end frame structure 2 can fix a larger volume tank body; on the other hand, the arc-shaped grooves 234 enable the corner posts 23 to clamp the tank body to enhance the stability of the connection between the tank body and the end frame structure 2.

[0046] The height of the corner post 23 is less than or equal to 2743 mm, or the height of the corner post is less than or equal to 2896 mm.

[0047] Please also refer to FIG. 1, the end frame structure 2 further includes a connecting plate 25. The connecting plate 25 covers one side of the frame 20. The connecting plate 25 is connected to and covers the frame 20 from at least one side of the frame 20.

[0048] Specifically, in this embodiment, there may be two connecting plates 25, and the two connecting plates 25 are spaced apart and are provided on the front side and the back side of the frame 20, and enclosed with the frame 20 to form a box-like structure. The peripheral edges of the connecting plate 25 are welded to the peripheral edges of the frame 20. The connecting plate 25 covers the frame 20 into a box-like structure to enhance the strength of the end frame structure 2. The connecting plate 25 is a ribbed plate to improve the strength of the end frame structure 2.

[0049] The shape of the connecting plate 25 is adapted with the shape of the frame 20. The connecting plate 25 is provided with a through hole 251 for allowing the tank body to pass through. Moreover, the edge of the through hole 251 is aligned with the arc-shaped surface of the corner post 23. Both ends of the tank body extend from the through hole 251 of the connecting plate 25. By connecting the outer surface of the tank body to the through hole 251, the inertial force received by the tank body can be transmitted to the connecting plate 25.

A reinforcing plate 252 is vertically provided between the two connecting plates 25. The reinforcing plate is located vertically in the box-shaped structure. The reinforcing plate 252 enhances the strength of the box-like structure. In addition, the reinforcing plate 252 extends from the top corner casting 241 or the bottom corner casting 242 to the through hole 251. There are a plurality of reinforcing plates 252. When hoisting or transporting the tank body, the stress is transferred from the tank body to the corner casting 24 by the reinforcing plate 252 and is released.

[0050] In addition, the end frame structure 2 is also provided with a reinforcing tube 253. The connecting plate 25 is also provided with a hole 254. The reinforcing tube 253 is provided between the two connecting plates 25, and openings at both ends of the reinforcing tube 253 are face to face with the holes 254. The stress of the connecting plate 25 can be released through the hole 254, and the reinforcing tube 253 can enhance the strength of the end frame structure 2.

[0051] In other embodiments, there is one connecting plate 25. The connecting plate 25 may be provided on the front side or the backside of the frame 20. Alternatively, the connecting plate 25 is provided inside the frame 20, and the connecting plate 25 is located on the center surface of the frame 20. The central surface of the frame 20 is a central section of the frame 20 along the radial direction of the tank body. The connecting plate 25 inside the frame 20 reinforces the strength of the end frame structure 2.

[0052] It can be understood that the connecting plate 25 may be formed by welding multiple pieces of sheet metal, or may be an integrated structure.

[0053] In the end frame structure of the tank container described above, by designing the shape of the corner post, the width of the corner post 23 is increased in the axial direction of the tank body to strengthen the corner post, so that the load of the end frame structure can meet the requirement of 78 tons.

[0054] By designing the shape of the corner post and the connection position of the corner post and the corner casting, the distance between the two bodies is greater than the distance between the two top corner castings or the two bottom corner castings. The above-mentioned end frame structure 2 can fix a larger volume tank body without affecting the hoisting and transportation of the entire tank container.

Although the present invention has been described with reference to several exemplary embodiments, it should be understood that the terminology used is illustrative and exemplary rather than limiting. Since the present invention can be embodied in various forms without departing from the spirit or essence of the invention, it should be understood that the above-described embodiments are not limited to any of the foregoing details, but should be widely interpreted within the spirit and scope defined by the appended claims. Therefore, all changes and modifications falling within the scope of the claims or equivalents thereof should be covered by the appended claims.

Claims

1. A end frame structure of a tank container, **characterized in** comprising: a top rail, a bottom rail, two corner posts, two top corner castings disposed at the top of the two corner posts and two bottom corner castings disposed at the bottom of the two corner posts, both ends of the top rail connected to the two top corner castings respectively, both ends of the bottom rail connected to the two bottom corner castings respectively, wherein each corner post includes a body and a reinforcing part, the reinforcing part and the body disposed in parallel along the axial direction of a tank body, the body adapted with the reinforcing part to form a tubular structure.

2. The end frame structure of the tank container according to claim 1, **characterized in that**, the width of the reinforcing part along the axial direction of the tank body is the same, or the width of the reinforcing part along the axial direction of the tank body increas-

es gradually from the upper end and the lower end to the middle.

3. The end frame structure of the tank container according to claim 1, **characterized in that**, the reinforcing part and the body are of an integral structure.

4. The end frame structure of the tank container according to claim 1, **characterized in that**, the distance between the inner lateral surfaces of the two corner posts is greater than or equal to the distance between the two top corner castings or the two bottom corner castings.

5. The end frame structure of the tank container according to claim 1, **characterized in that**, the inner lateral surface of the corner post is provided with an arc-shaped groove adapted with the tank body.

6. The end frame structure of the tank container according to claim 1, **characterized in that**, an escape groove is disposed on the bottom rail, and the bottom rail is provided with a connecting block above the escape groove.

7. The end frame structure of the tank container according to claim 1, **characterized in that**, further comprising a connecting plate provided with a through hole for allowing the tank body to pass through, wherein a frame is formed by the two corner posts jointing with the top rail and the bottom rail, and the connecting plate is connected to and covers the frame from at least one side of the frame.

8. The end frame structure of the tank container according to claim 7, **characterized in that**, the connecting plates are disposed on the front side and the back side of the frame, and a reinforcing plate is disposed vertically between two connecting plates and extends from the top corner castings or the bottom corner castings to the through hole.

9. The end frame structure of the tank container according to claim 1, **characterized in that**, the top corner castings and the bottom corner castings are castings or welded pieces, and the yield strength of the top corner castings and the bottom corner castings is greater than or equal to 420 MPa.

10. A tank container, **characterized in that** comprising a tank body and end frame structures according to any one of claim 1 to claim 9, wherein the end frame structures are disposed at both ends of the tank body, the both ends of the tank body are fixed by the end frame structures, and the both ends of the tank body are provided with seal heads, the both ends of the tank body passing through the end frame structures respectively.

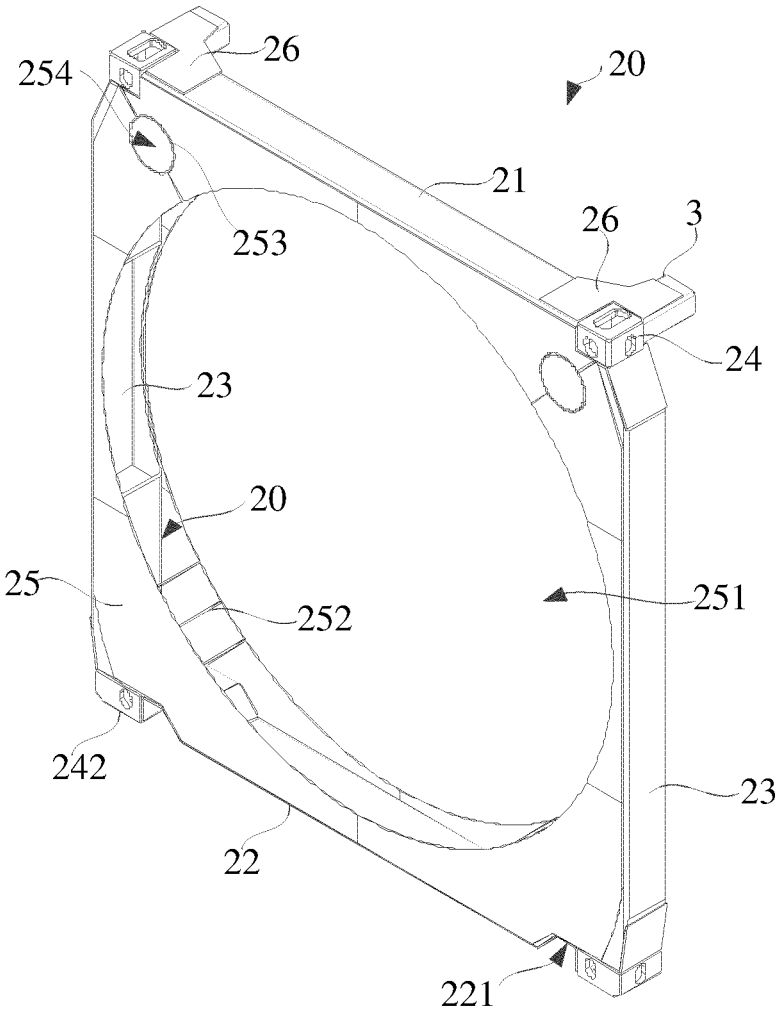

FIG.1

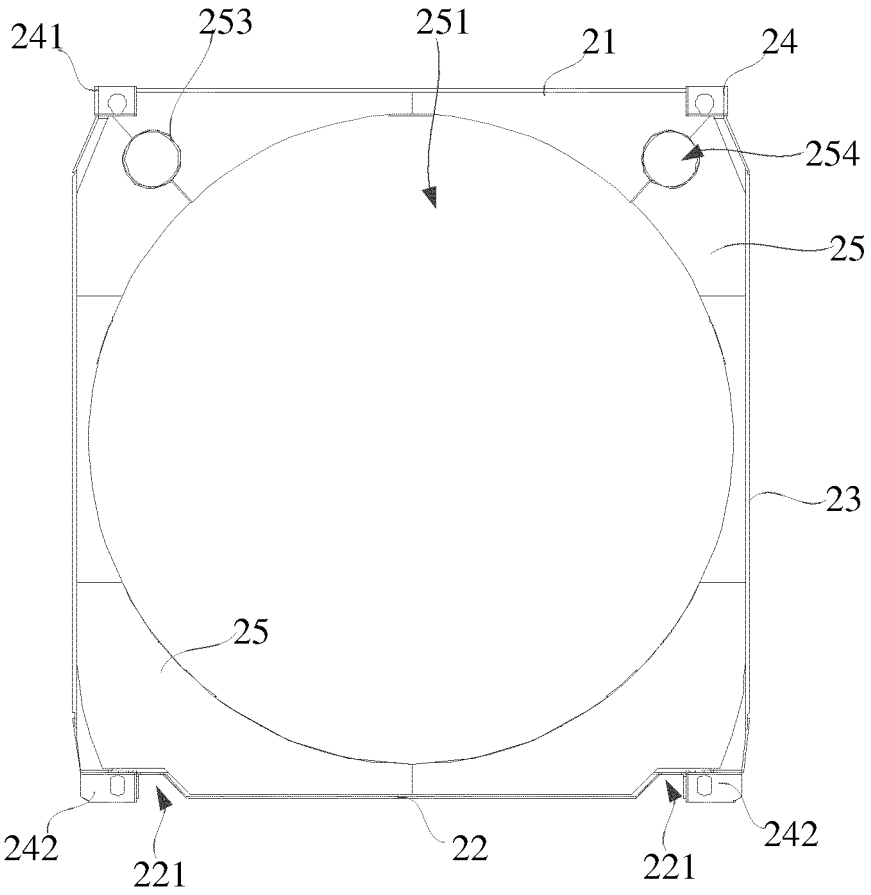

FIG.2

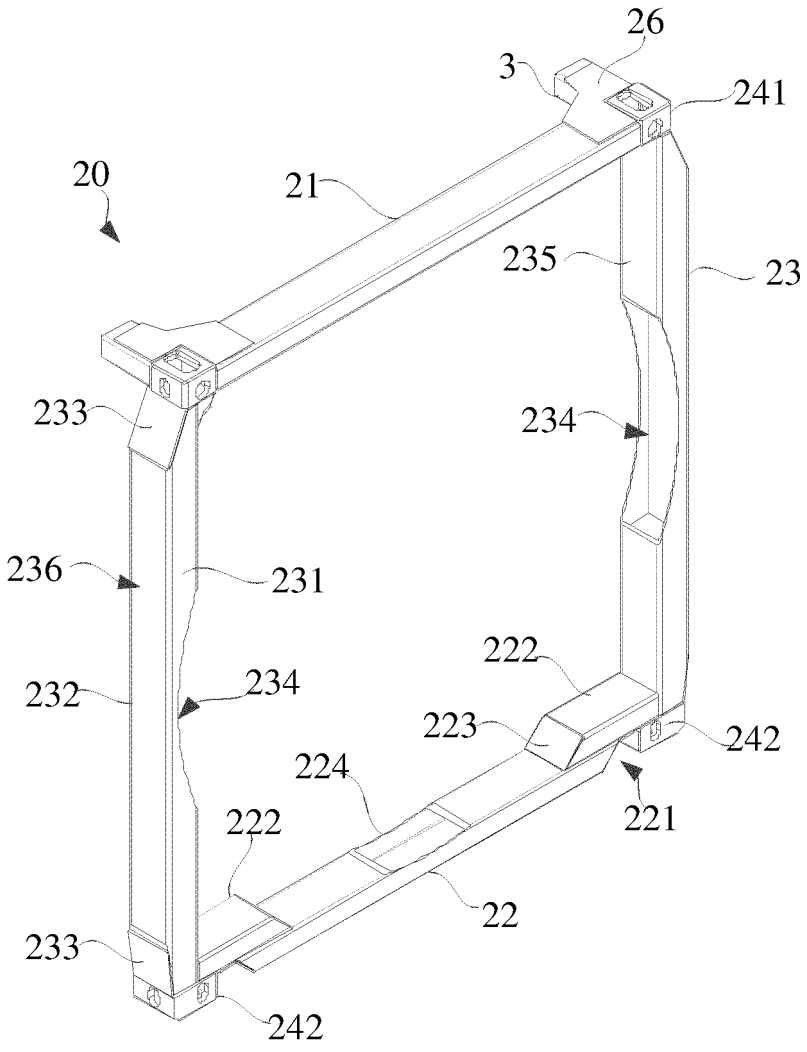
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FIG.3

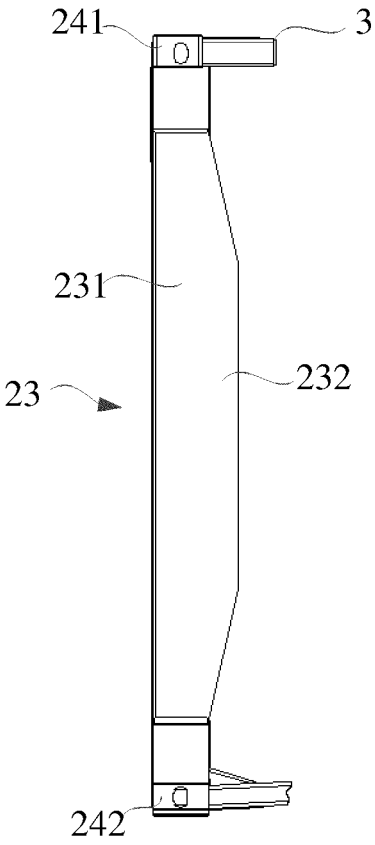

FIG.4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2019/086416

A. CLASSIFICATION OF SUBJECT MATTER

B65D 90/20(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

B65D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CNKI, CNABS, DWPI, SIPOABS: 罐, 集装箱, 角柱, 加强, 增强, tank, container, corner, post, column, reinforc+

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 208199434 U (NANTONG CIMC TANK EQUIPMENT MANUFACTURING CO., LTD. ET AL.) 07 December 2018 (2018-12-07) claims 1-10, description, paragarphs 0001-0058, and figures 1-4	1-10
Y	CN 107226291 A (NANTONG CIMC TANK EQUIPMENT MANUFACTURING CO., LTD. ET AL.) 03 October 2017 (2017-10-03) description, paragraphs 0001-0055, and figures 1-4	1-10
Y	CN 203268747 U (NANTONG CIMC TANK EQUIPMENT MANUFACTURING CO., LTD. ET AL.) 06 November 2013 (2013-11-06) description, paragraphs 0001-0022, and figures 1-3	1-10
A	CN 202186654 U (GUANGDONG XINHUI CIMCI SPECIAL TRANSPORTATION EQUIPMENT CO., LTD. ET AL.) 11 April 2012 (2012-04-11) entire document	1-10
A	CN 101259907 A (CHINA INTERNATIONAL MARINE CONTAINERS (GROUP) LTD.) 10 September 2008 (2008-09-10) entire document	1-10
A	CN 104760781 A (MMD OFFSHORE ENGINEERING LTD.) 08 July 2015 (2015-07-08) entire document	1-10

☑ Further documents are listed in the continuation of Box C. ☑ See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
18 July 2019	**08 August 2019**
Name and mailing address of the ISA/CN **State Intellectual Property Office of the P. R. China (ISA/CN)** **No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088** **China** Facsimile No. **(86-10)62019451**	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2019/086416

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	CN 202912202 U (NANTONG CIMC TANK EQUIPMENT MANUFACTURING CO., LTD. ET AL.) 01 May 2013 (2013-05-01) entire document	1-10
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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2019/086416

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
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CN 107226291 A	03 October 2017	None	
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