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(54) **MULTIPLE UNIT AND VEHICLE BODY END CHASSIS STRUCTURE THEREOF**

(57) A vehicle body end underframe structure of a multiple-unit train is disclosed by the present application, which includes a coupler seat plate (3), a traction beam assembly (6), a front end plate (1) and a coupler case (7). The coupler seat plate (3) is configured to install the coupler. The coupler case (7) and the traction beam assembly (6) are respectively connected to the coupler seat plate (3) from the front and rear sides of the coupler seat plate (3), and tops of the traction beam assembly (6) and the coupler case (7) are configured to fixedly connect with the vehicle body underframe floor (2). A front end plate (1) is provided on an end of the coupler case (7)

away from the coupler seat plate (3), and the front end plate (1) is provided with a through hole (104) allowing the coupler to pass through to work. A hoisting interface (8) for hoisting external attached equipment is provided on the traction beam assembly (6) and/or the coupler case (7). In application, the vehicle body end underframe structure is mounted to the vehicle body underframe floor. The vehicle body end underframe structure avoids the stress concentration at the coupler installation position, provides hoisting function, and is helpful for the layout of the vehicle body lower structure.

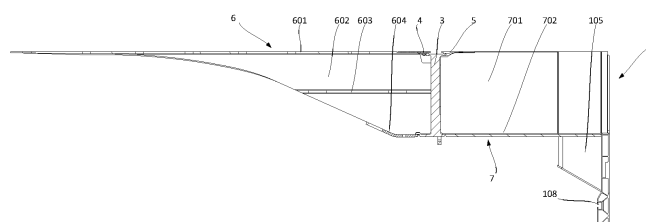


Figure 2

Description

[0001] This application claims the benefit of priorities to the following two Chinese patent applications, both of which are incorporated herein by reference,

1) Chinese Patent Application No. 201910141782.3, titled "MULTIPLE-UNIT TRAIN AND VEHICLE BODY END UNDERFRAME STRUCTURE THEREOF", filed with the China National Intellectual Property Administration on February 26, 2019, and

2) Chinese Patent Application No. 201920243949.2, titled "MULTIPLE-UNIT TRAIN AND VEHICLE BODY END UNDERFRAME STRUCTURE THEREOF", filed with the China National Intellectual Property Administration on February 26, 2019.

FIELD

[0002] The present application relates to the technical field of rail vehicles, and in particular to a multiple-unit train and a vehicle body end underframe structure thereof.

BACKGROUND

[0003] The vehicle body underframe is the main portion for bearing the vehicle body. The underframe end structure, in addition to participating in the vertical bearing of the underframe, mainly undertakes the longitudinal bearing of the underframe, to evenly transmit the traction and braking force coming from the longitudinal direction of the vehicle to the whole underframe or even the vehicle body. In addition to serving as the transmission interface of the longitudinal force between the vehicles, the underframe end structure is further provided with electric and other connection interfaces between the vehicles. Therefore, the installation structure of the underframe end structure is relatively complex, which needs to have sufficient strength and can be well connected with the underframe as a whole, and also needs to be reasonably provided with corresponding installation interfaces. Therefore, an important technical problem to be solved by those skilled in the art is how to provide a vehicle body end underframe structure.

SUMMARY

[0004] In view of this, a first object of the present application is to provide a vehicle body end underframe structure of a multiple-unit train, and a second object of the present application is to provide a multiple-unit train including the vehicle body end underframe structure.

[0005] In order to achieve the above objects, the following technical solutions are provided according to the present application.

[0006] A vehicle body end underframe structure of a multiple-unit train includes:

a coupler seat plate for installing a coupler;

a traction beam assembly provided at a rear side of the coupler seat plate and connected with the coupler seat plate, wherein the top of the traction beam assembly is configured to fixedly connect with a vehicle body underframe floor;

a coupler case provided at a front side of the coupler seat plate and connected with the coupler seat plate, wherein the top of the coupler case is configured to fixedly connect with the vehicle body underframe floor, a front end plate is provided on an end of the coupler case away from the coupler seat plate, and the front end plate is provided with a through hole allowing the coupler to pass through to work; and

a hoisting interface for hoisting external attached equipment, wherein the hoisting interface is provided on the traction beam assembly and/or the coupler case.

[0007] Preferably, the traction beam assembly includes a traction beam. The traction beam includes a traction beam top plate and two traction beam side plates. The traction beam top plate and the two traction beam side plates form a groove structure, and the traction beam top plate is configured to fixedly connect with the vehicle body underframe floor.

[0008] Preferably, the traction beam further includes a lateral partition plate. Two sides of the lateral partition plate are respectively connected with the two traction beam side plates, and the lateral partition plate extends along a length

direction of the traction beam.

[0009] Preferably, the traction beam top plate is provided with a through groove for increasing a welding position between the traction beam top plate and the vehicle body underframe floor.

[0010] Preferably, the coupler seat plate is of an I-shaped structure. The traction beam top plate is connected with an upper wing plate of the coupler seat plate. The two traction beam side plates are connected with a web plate of the coupler seat plate.

[0011] Preferably, the traction beam top plate is connected with the upper wing plate of the coupler seat plate through a first transition connecting plate. The first transition connecting plate is configured to fixedly connect with the vehicle body underframe floor.

[0012] Preferably, a side, away from the traction beam, of the upper wing plate of the coupler seat plate is connected with a second transition connecting plate. The second transition connecting plate is configured to fixedly connect with the vehicle body underframe floor.

[0013] Preferably, a lower wing plate of the coupler seat plate is connected with a traction beam cover plate. The traction beam cover plate is connected with the two traction beam side plates from bottom to top.

[0014] Preferably, the coupler case includes a coupler case bottom plate and two coupler case side plates. The coupler case bottom plate is connected with the lower wing plate of the coupler seat plate. The two coupler case side plates are connected with the web plate of the coupler seat plate. The coupler case bottom plate, the coupler seat plate, the front end plate and the two coupler case side plates can cooperate with the vehicle body underframe floor to form an accommodating chamber that is in communication with the outside only through the through hole.

[0015] Preferably, the front end plate includes a main body and two T-shaped connectors. The through hole is arranged in the main body. The two T-shaped connectors are respectively arranged on two sides of the main body. A transverse plate of each T-shaped connector is connected with the main body, and a vertical plate of each T-shaped connector is connected with the corresponding coupler case side plate.

[0016] Preferably, the front end plate further includes a transverse installing plate, and the transverse installing plate is connected with a lower end of the main body and the two T-shaped connectors. A C-shaped sliding groove for installing a vehicle body underframe end bottom plate is provided on an inner side of the transverse installing plate.

[0017] Preferably, the traction beam assembly includes multiple traction beams, and the multiple traction beams are connected to the rear side of the coupler seat plate side by side and are spaced apart from each other.

[0018] Preferably, the hoisting interface is at least arranged on the traction beam side plates, away from each other, of the two traction beams on two sides of the traction beam assembly.

[0019] Preferably, an installation surface, for cooperating with the external attached equipment, of the hoisting interface is arranged downward, and a sliding groove corresponding to the installation surface is provided in the hoisting interface. The sliding groove is configured to place a sliding block. A hoisting bolt extends into the sliding groove to cooperate with the sliding block to hoist the external attached equipment at the hoisting interface.

[0020] Preferably, an outer surface of the front end plate and an outer surface of an end wall of the vehicle body underframe are the same end surface.

[0021] Preferably, the front end plate is provided with an electrical connector installation structure on two sides of the through hole. The electrical connector installation structure includes a case-shaped box which is in parallel with the through hole. An upper top wall of the case-shaped box is provided with a wiring hole and an installing hole provided around the wiring hole.

[0022] Preferably, the upper top wall of the case-shaped box tilts downward from an end thereof on the outer surface of the front end plate to form an inclination angle.

[0023] Preferably, a stepped boss structure for cooperating with a vehicle body end side skirt plate to press a sealing rubber strip is provided on each of two ends of an inner side surface of the front end plate.

[0024] A multiple-unit train includes the vehicle body end underframe structure of the multiple-unit train according to any one of the above aspects.

[0025] In summary, the vehicle body end underframe structure of the multiple-unit train is provided by the present application, which includes the coupler seat plate, the traction beam assembly and the coupler case. The coupler seat plate is configured to install the coupler and is perpendicular to the length direction of the vehicle body to transmit the longitudinal force of the coupler. The traction beam assembly is arranged at the rear side of the coupler seat plate and connected with the coupler seat plate. The rear side of the coupler seat plate herein refers to a side, facing away from the vehicle body end, of the coupler seat plate. The top of the traction beam assembly is configured to fixedly connect with the vehicle body underframe floor. The coupler case is provided at the front side of the coupler seat plate and connected with the coupler seat plate. The top of the coupler case is configured to fixedly connect with the vehicle body underframe floor, the front end plate is provided on an end of the coupler case away from the coupler seat plate, and the front end plate is provided with the through hole allowing the coupler to pass through to work. When the through hole is provided, the swing of the coupler during vehicle operation shall be considered. The hoisting interface for hoisting external attached equipment is provided on the traction beam assembly and/or the coupler case. The external attached

equipment includes but is not limited to a sewage tank, an electrical component and the like.

[0026] In application, the vehicle body end underframe structure is mounted to the vehicle body underframe floor. The coupler is mounted to the coupler seat plate and extends out through the through hole in the front end plate to cooperate and connect with the coupler structure on another vehicle body. The coupler seat plate is laterally arranged, that is, the coupler seat plate is perpendicular to the length direction of the vehicle body. Thus, the longitudinal force on the coupler can be transmitted to the vehicle body under the combined action of components such as the traction beam assembly connected with the coupler seat plate, so as to improve the stress and avoid the stress concentration at the coupler installation position. Besides, the hoisting interface integrated on the vehicle body end underframe structure can provide hoisting function for the sewage tank, the electrical component and the like, which is helpful for the layout of the vehicle body lower structure.

[0027] A multiple-unit train is further provided by the present application, which includes the vehicle body end underframe structure of the multiple-unit train as described above. Since the above vehicle body end underframe structure of the multiple-unit train has the above technical effects, the multiple-unit train having the vehicle body end underframe structure of the multiple-unit train also has the corresponding technical effects.

BRIEF DESCRIPTION OF THE DRAWINGS

[0028] For more clearly illustrating embodiments of the present application or technical solutions in the conventional technology, the drawings referred to for describing the embodiments or the conventional technology will be briefly described hereinafter. Apparently, the drawings in the following description are only some examples of the present application, and for those skilled in the art, other drawings may be obtained based on the provided drawings without any creative efforts.

Figure 1 is a front view of a vehicle body end underframe structure of a multiple-unit train according to an embodiment of the present application;

Figure 2 is a sectional view taken along line A-A in Figure 1;

Figure 3 is a top view of the vehicle body end underframe structure of the multiple-unit train according to an embodiment of the present application;

Figure 4 is a sectional view taken along line B-B in Figure 3;

Figure 5 is a sectional view taken along line C-C in Figure 3;

Figure 6 is a sectional view taken along line D-D in Figure 3;

Figure 7 is a schematic structural view of a coupler seat plate of the vehicle body end underframe structure of the multiple-unit train according to an embodiment of the present application;

Figure 8 is a schematic structural view of a traction beam with a hoisting interface according to an embodiment of the present application;

Figure 9 is a schematic structural view of a traction beam without the hoisting interface according to an embodiment of the present application;

Figure 10 is a schematic structural view of a transverse installing plate of the vehicle body end underframe structure of the multiple-unit train according to an embodiment of the present application;

Figure 11 is a schematic structural view of a T-shaped connector of the vehicle body end underframe structure of the multiple-unit train according to an embodiment of the present application;

Figure 12 is a front view of the vehicle body end underframe structure of the multiple-unit train provided equipped with a windshield according to an embodiment of the present application;

Figure 13 is a sectional view taken along line E-E in Figure 12;

Figure 14 is a schematic structural view showing that the traction beam of the vehicle body end underframe structure

of the multiple-unit train according to an embodiment of the present application is hoisting a sewage tank; and

Figure 15 is a schematic structural view showing that a coupler case of the vehicle body end underframe structure of the multiple-unit train according to an embodiment of the present application is hoisting a sewage tank.

[0029] Reference numerals in Figures 1 to 15 are listed as follows:

1 front end plate;	101 main body;
102 transverse installing plate;	103 T-shaped connector;
104 through hole;	105 case-shaped box;
106 wiring hole;	107 installing hole;
108 C-shaped sliding groove;	109 stepped boss structure;
110, 111 thickened area;	2 vehicle body underframe floor;
3 coupler seat plate;	301 upper wing plate;
302 web plate;	303 lower wing plate;
4 first transition connecting plate;	5 second transition connecting plate;
6 traction beam;	601 traction beam top plate;
602 traction beam side plate;	603 lateral partition plate;
604 traction beam cover plate;	605 through groove;
7 coupler case;	701 coupler case side plate;
702 coupler case bottom plate;	8 hoisting interface;
9 cable;	10 windshield;
11 sewage tank.	

DETAILED DESCRIPTION OF EMBODIMENTS

[0030] The technical solutions according to the embodiments of the present application will be described clearly and completely as follows in conjunction with the drawings in the embodiments of the present application. It is apparent that the described embodiments are only a part of the embodiments according to the present application, rather than all of the embodiments. Any other embodiments obtained by those skilled in the art based on the embodiments of the present disclosure without any creative work fall within the protection scope of the present disclosure.

[0031] Referring to Figures 1 to 3, Figure 1 is a front view of a vehicle body end underframe structure of a multiple-unit train according to an embodiment of the present application; Figure 2 is a sectional view taken along line A-A in Figure 1; and Figure 3 is a top view of the vehicle body end underframe structure of the multiple-unit train according to an embodiment of the present application.

[0032] A vehicle body end underframe structure of a multiple-unit train is provided by an embodiment of the present application, which includes a coupler seat plate 3, a traction beam assembly and a coupler case 7.

[0033] The coupler seat plate 3 is configured to install the coupler and is perpendicular to the length direction of the vehicle body to transmit the longitudinal force of the coupler. The traction beam assembly is arranged at the rear side of the coupler seat plate 3 and connected with the coupler seat plate 3. The rear side of the coupler seat plate 3 herein refers to a side, facing away from the vehicle body end, of the coupler seat plate 3. The top of the traction beam assembly is configured to fixedly connect with a vehicle body underframe floor 2. The coupler case 7 is provided at the front side of the coupler seat plate 3 and connected with the coupler seat plate 3. The top of the coupler case 7 is configured to fixedly connect with the vehicle body underframe floor 2, a front end plate 1 is provided on an end of the coupler case 7 away from the coupler seat plate 3, and the front end plate 1 is provided with a through hole 104 allowing the coupler to pass through to work. When the through hole 104 is provided, the swing of the coupler during vehicle operation shall be considered. The hoisting interface 8 for hoisting external attached equipment is provided on the traction beam assembly and/or the coupler case 7. As shown in Figures 3 to 5, the external attached equipment includes but is not limited to a sewage tank 11, an electrical component and the like.

[0034] Compared with the conventional technology, in application, the vehicle body end underframe structure of the multiple-unit train provided by the embodiment of the present application is mounted to the vehicle body underframe floor 2. The coupler is mounted to the coupler seat plate 3 and extends out through the through hole 104 in the front end plate 1 to cooperate and connect with the coupler structure on another vehicle body. The coupler seat plate 3 is laterally arranged, that is, the coupler seat plate is perpendicular to the length direction of the vehicle body. Thus, the longitudinal force on the coupler can be transmitted to the vehicle body under the combined action of components such as the traction beam assembly connected with the coupler seat plate 3, so as to improve the stress and avoid the stress

concentration at the coupler installation position. Besides, the hoisting interface 8 integrated on the vehicle body end underframe structure can provide hoisting function for the sewage tank 11, the electrical component and the like, which is helpful for the layout of the vehicle body lower structure.

[0035] The traction beam assembly may be formed by one traction beam 6 or multiple traction beams 6. Preferably, in an embodiment of the present application, the traction beam assembly includes multiple traction beams 6, and the multiple traction beams 6 are connected to the rear side of the coupler seat plate 3 side by side and are spaced apart from each other.

[0036] Furthermore, as shown in Figures 2 to 4, the traction beam 6 includes a traction beam top plate 601 and two traction beam side plates 602. The traction beam top plate 601 and the two traction beam side plates 602 form a groove structure, that is, the two traction beam side plates 602 are symmetrically connected to two sides of the traction beam top plate 601. The traction beam top plate 601 is configured to fixedly connect with the vehicle body underframe floor 2. In application, an opening of the groove structure faces downward towards the ground.

[0037] In order to enhance the strength of the traction beam 6, in the embodiment of the present application, the traction beam 6 further includes a lateral partition plate 603. Two sides of the lateral partition plate 603 are respectively connected with the two traction beam side plates 602, and the lateral partition plate 603 extends along a length direction of the traction beam 6.

[0038] For further optimizing the above technical solutions, in the embodiment of the present application, as shown in Figure 3, the traction beam top plate 601 is provided with a through groove 605, and multiple through grooves 605 are arranged along the length direction of the traction beam top plate 601. The through groove 605 functions to increase the welding position between the traction beam top plate 601 and the vehicle body underframe floor 2. During use, in addition to the welding between an edge of the traction beam top plate 601 and the vehicle body underframe floor 2, the traction beam top plate 601 can be welded to the vehicle body underframe along the edge of the through groove 605, so as to improve the connection strength between the traction beam 6 and the vehicle body underframe floor 2.

[0039] As shown in Figure 3, the shape of the through groove 605 is oblong-shaped. Apparently, in other embodiments, the through groove 605 may be in other shapes, such as rectangle, diamond, circle, oval and the like, which are not limited here.

[0040] Preferably, in the embodiment of the present application, as shown in Figure 7, the coupler seat plate 3 is of an I-shaped structure. The traction beam top plate 601 is connected with an upper wing plate 301 of the coupler seat plate 3, and the two traction beam side plates 602 are connected with a web plate 302 of the coupler seat plate 3.

[0041] In order to enhance the connection strength between the coupler seat plate 3 and the vehicle body underframe floor 2, in the embodiment of the present application, the traction beam top plate 601 is connected with the upper wing plate 301 of the coupler seat plate 3 through a first transition connecting plate 4, and the first transition connecting plate 4 is configured to fixedly connect with the vehicle body underframe floor 2.

[0042] Furthermore, one side, away from the traction beam 6, of the upper wing plate 301 of the coupler seat plate 3 is connected with a second transition connecting plate 5. The second transition connecting plate 5 is configured to fixedly connect with the vehicle body underframe floor 2. The first transition connecting plate 4 and the second transition connecting plate 5 may have a separated structure or an integral structure. During use, the first transition connecting plate 4 and the second transition connecting plate 5 are configured to transmit the longitudinal force on the coupler seat plate 3 to the vehicle body underframe floor 2 and the traction beam assembly.

[0043] In an embodiment, a lower wing plate 303 of the coupler seat plate 3 is connected with a traction beam cover plate 604. The traction beam cover plate 604 is connected with the two traction beam side plates 602 from bottom to top. Only one traction beam cover plate 604 may be provided to seal and strengthen the whole traction beam assembly, or multiple traction beam cover plates 604 may be provided according to the number of traction beams 6 in the traction beam assembly to improve the strength of the traction beam 6.

[0044] On the premise that the traction beam assembly includes multiple traction beams 6, the hoisting interface 8 does not need to be arranged on each traction beam 6, and the hoisting interface 8 only needs to be arranged on the corresponding traction beam 6 based on the size of the sewage tank 11. In an embodiment, the hoisting interface 8 is at least arranged on the traction beam side plates 602, away from each other, of the two traction beams 6 on two sides of the traction beam assembly, as shown in Figures 4, 8 and 9.

[0045] The coupler case 7 mainly functions to separate the coupler in the coupler case 7 from other accommodating chambers of the vehicle body end and form a protective shield around the coupler to enable the other accommodating chambers, especially the accommodating chambers provided with electrical interfaces therein, and the coupler case to be independent of each other, so as to separate the water vapor or the sewage outside the vehicle from other accommodating chambers of the vehicle body end and avoid that the water vapor or the sewage enters the chamber and adversely affects and damages the equipment. Therefore, in the embodiment of the present application, as shown in Figures 2 and 3, the coupler case 7 includes a coupler case bottom plate 702 and two coupler case side plates 701. The coupler case bottom plate 702 is connected with the lower wing plate 303 of the coupler seat plate 3, and the two coupler case side plates 701 are connected with the web plate 302 of the coupler seat plate 3. The coupler case bottom

plate 702, the coupler seat plate 3, the front end plate 1 and the two coupler case side plates 701 can cooperate with the vehicle body underframe floor 2 to form an accommodating chamber that is in communication with the outside only through the through hole 104. Furthermore, the coupler case 7 may further be provided with a drainage structure communicating with the accommodating chamber to drain the sewage, rainwater and the like entering the coupler case 7 through the coupler.

[0046] It can be easily understood by those skilled in the art that the welding at a corner is easy to crack due to the stress concentration, which affects the welding strength. In order to avoid this problem, in the embodiment of the present application, the front end plate 1 includes a main body 101 and two T-shaped connectors 103. The through hole 104 allowing the coupler to pass through is arranged in the main body 101, and the two T-shaped connectors 103 are respectively arranged on two sides of the main body 101. A transverse plate of each T-shaped connector 103 is connected with the main body 101, and a vertical plate of each T-shaped connector 103 is connected with the corresponding coupler case side plate 701, as shown in Figures 3 and 11. By providing the T-shaped connectors 103, the position of the welding seam between the front end plate 1 and the coupler case side plate 701 can be changed and kept away from the corner, thereby avoiding the stress concentration.

[0047] For further optimizing the above technical solutions, as shown in Figures 1 and 10, the front end plate 1 further includes a transverse installing plate 102, and the transverse installing plate 102 is connected with a lower end of the main body 101 and the two T-shaped connectors 103. A C-shaped sliding groove 108 for installing a vehicle body underframe end bottom plate is provided on an inner side of the transverse installing plate 102.

[0048] Since a windshield 10 needs to be installed on the front end plate 1, as shown in Figures 12 and 13, the strength requirements of the installation position of the windshield 10 on the front end plate 1 are high. Therefore, as shown in Figures 10 and 11, thickened areas 110 and 111 are respectively provided at the positions, for installing the windshield 10, of the transverse installing plate 102 and the T-shaped connector 103.

[0049] In an embodiment, for ease of the installation of the external attached equipment, an installation surface, for cooperating with the external attached equipment, of the hoisting interface 8 is arranged downward, and a sliding groove corresponding to the installation surface is provided in the hoisting interface 8. The sliding groove is configured to place a sliding block. A hoisting bolt extends into the sliding groove to cooperate with the sliding block to hoist the external attached equipment at the hoisting interface 8. For the hoisting structure, reference can be made to Figures 14 and 15.

[0050] For further optimizing the above technical solutions, the outline of the front end plate 1 matches with the outline of an end wall of the vehicle body underframe, and an outer surface of the front end plate 1 and an outer surface of the end wall of the vehicle body underframe are the same end surface.

[0051] Referring to Figures 1, 3, 4 and 6, the front end plate 1 is provided with an electrical connector installation structure on two sides of the through hole 104. The electrical connector installation structure includes a case-shaped box 105 which is in parallel with the through hole 104, and the case-shaped box 105 provides space for a winding path of a cable 9. An upper top wall of the case-shaped box 105 is provided with a wiring hole 106 and an installing hole 107 provided around the wiring hole 106.

[0052] In an embodiment, the upper top wall of the case-shaped box 105 tilts downward from an end thereof on the outer surface of the front end plate 1 to form an inclination angle, so as to provide the inclination angle for the winding of the cable 9 and facilitate the connection of the cable 9 between two adjacent vehicle bodies.

[0053] As shown in Figure 3, in the embodiment of the present application, a stepped boss structure 109 for cooperating with a vehicle body end side skirt plate to press a sealing rubber strip is provided on each of two ends of an inner side surface of the front end plate 1.

[0054] A multiple-unit train is further provided by the embodiment of the present application, which includes the vehicle body end underframe structure of the multiple-unit train according to any one of the above embodiments. Since the vehicle body end underframe structure of the multiple-unit train has the above technical effects, for the technical effects of the multiple-unit train, reference can be made to the above embodiments.

[0055] In the present specification, the embodiments are described in a progressive manner. Each embodiment mainly focuses on an aspect different from other embodiments, and reference can be made to these similar parts among the embodiments.

[0056] According to the above description of the disclosed embodiments, those skilled in the art can implement or practice the present application. Various modifications to these embodiments are obvious to a person skilled in the art, the general principles defined herein may be implemented in other embodiments without departing from the spirit and scope of the present application. Hence, the present application is not limited to the embodiments disclosed herein, but is to conform to the widest scope in accordance with the principles and novel features disclosed herein.

Claims

1. A vehicle body end underframe structure of a multiple-unit train, comprising

a coupler seat plate for installing a coupler;

a traction beam assembly provided at a rear side of the coupler seat plate and connected with the coupler seat plate, wherein the top of the traction beam assembly is configured to fixedly connect with a vehicle body underframe floor;

a coupler case provided at a front side of the coupler seat plate and connected with the coupler seat plate, wherein the top of the coupler case is configured to fixedly connect with the vehicle body underframe floor, a front end plate is provided on an end of the coupler case away from the coupler seat plate, and the front end plate is provided with a through hole allowing the coupler to pass through to work; and

a hoisting interface for hoisting external attached equipment, wherein the hoisting interface is provided on the traction beam assembly and/or the coupler case.

2. The vehicle body end underframe structure of the multiple-unit train according to claim 1, wherein the traction beam assembly comprises a traction beam, the traction beam comprises a traction beam top plate and two traction beam side plates, the traction beam top plate and the two traction beam side plates form a groove structure, and the traction beam top plate is configured to fixedly connect with the vehicle body underframe floor.

3. The vehicle body end underframe structure of the multiple-unit train according to claim 2, wherein the traction beam further comprises a lateral partition plate, two sides of the lateral partition plate are respectively connected with the two traction beam side plates, and the lateral partition plate extends along a length direction of the traction beam.

4. The vehicle body end underframe structure of the multiple-unit train according to claim 2 or 3, wherein the traction beam top plate is provided with a through groove for increasing a welding position between the traction beam top plate and the vehicle body underframe floor.

5. The vehicle body end underframe structure of the multiple-unit train according to claim 2 or 3, wherein the coupler seat plate is of an I-shaped structure, the traction beam top plate is connected with an upper wing plate of the coupler seat plate, and the two traction beam side plates are connected with a web plate of the coupler seat plate.

6. The vehicle body end underframe structure of the multiple-unit train according to claim 5, wherein the traction beam top plate is connected with the upper wing plate of the coupler seat plate through a first transition connecting plate, and the first transition connecting plate is configured to fixedly connect with the vehicle body underframe floor.

7. The vehicle body end underframe structure of the multiple-unit train according to claim 6, wherein a side, away from the traction beam, of the upper wing plate of the coupler seat plate is connected with a second transition connecting plate, and the second transition connecting plate is configured to fixedly connect with the vehicle body underframe floor.

8. The vehicle body end underframe structure of the multiple-unit train according to claim 5, wherein a lower wing plate of the coupler seat plate is connected with a traction beam cover plate, and the traction beam cover plate is connected with the two traction beam side plates from bottom to top.

9. The vehicle body end underframe structure of the multiple-unit train according to claim 5, wherein the coupler case comprises a coupler case bottom plate and two coupler case side plates, the coupler case bottom plate is connected with a lower wing plate of the coupler seat plate, the two coupler case side plates are connected with the web plate of the coupler seat plate, the coupler case bottom plate, the coupler seat plate, the front end plate and the two coupler case side plates cooperate with the vehicle body underframe floor to form an accommodating chamber that is in communication with the outside only through the through hole.

10. The vehicle body end underframe structure of the multiple-unit train according to claim 9, wherein the front end plate comprises a main body and two T-shaped connectors, the through hole is arranged in the main body, the two T-shaped connectors are respectively arranged on two sides of the main body, a transverse plate of each T-shaped connector is connected with the main body, and a vertical plate of each T-shaped connector is connected with the corresponding coupler case side plate.

11. The vehicle body end underframe structure of the multiple-unit train according to claim 10, wherein the front end plate further comprises a transverse installing plate, the transverse installing plate is connected with a lower end of the main body and the two T-shaped connectors, and a C-shaped sliding groove for installing a vehicle body

underframe end bottom plate is provided on an inner side of the transverse installing plate.

- 5 12. The vehicle body end underframe structure of the multiple-unit train according to any one of claims 2 to 3 and 6 to 11, wherein the traction beam assembly comprises a plurality of traction beams, and the plurality of traction beams are connected to the rear side of the coupler seat plate side by side and are spaced apart from each other.
- 10 13. The vehicle body end underframe structure of the multiple-unit train according to claim 12, wherein the hoisting interface is at least arranged on the traction beam side plates, away from each other, of two traction beams on two sides of the traction beam assembly.
- 15 14. The vehicle body end underframe structure of the multiple-unit train according to any one of claims 1 to 3, 6 to 11, and 13, wherein an installation surface, for cooperating with the external attached equipment, of the hoisting interface is arranged downward, a sliding groove corresponding to the installation surface is provided in the hoisting interface, the sliding groove is configured to place a sliding block, and a hoisting bolt extends into the sliding groove to cooperate with the sliding block to hoist the external attached equipment at the hoisting interface.
- 20 15. The vehicle body end underframe structure of the multiple-unit train according to any one of claims 1 to 3, 6 to 11, and 13, wherein an outer surface of the front end plate and an outer surface of an end wall of the vehicle body underframe are a same end surface.
- 25 16. The vehicle body end underframe structure of the multiple-unit train according to any one of claims 1 to 3, 6 to 11, and 13, wherein the front end plate is provided with an electrical connector installation structure on two sides of the through hole, the electrical connector installation structure comprises a case-shaped box which is in parallel with the through hole, and an upper top wall of the case-shaped box is provided with a wiring hole and an installing hole provided around the wiring hole.
- 30 17. The vehicle body end underframe structure of the multiple-unit train according to claim 16, wherein the upper top wall of the case-shaped box tilts downward from an end of the case-shaped box on an outer surface of the front end plate to form an inclination angle.
- 35 18. The vehicle body end underframe structure of the multiple-unit train according to any one of claims 1 to 3, 6 to 11, and 13, wherein a stepped boss structure for cooperating with a vehicle body end side skirt plate to press a sealing rubber strip is provided on each of two ends of an inner side surface of the front end plate.
- 40 19. A multiple-unit train, comprising the vehicle body end underframe structure of the multiple-unit train according to any one of claims 1 to 18.

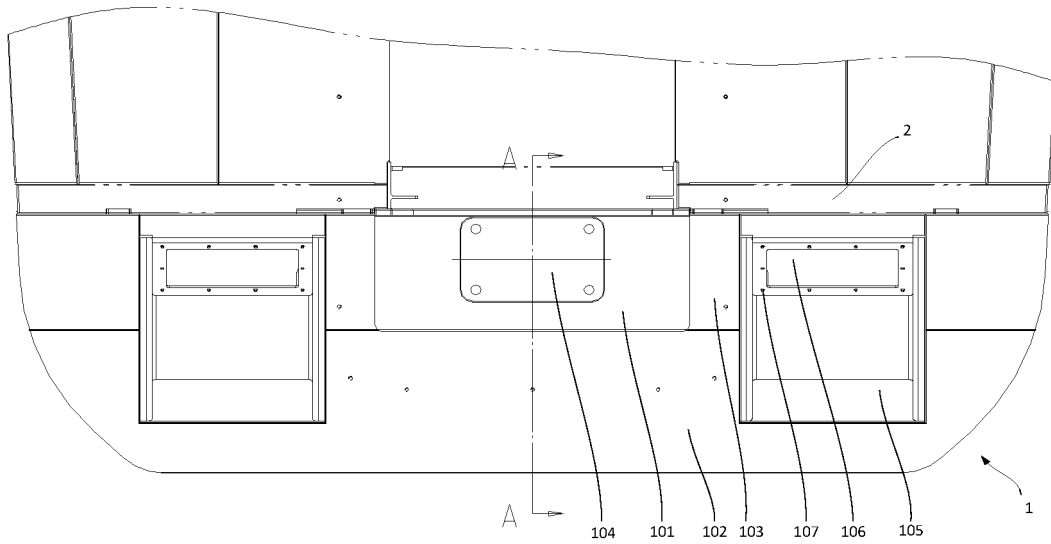


Figure 1

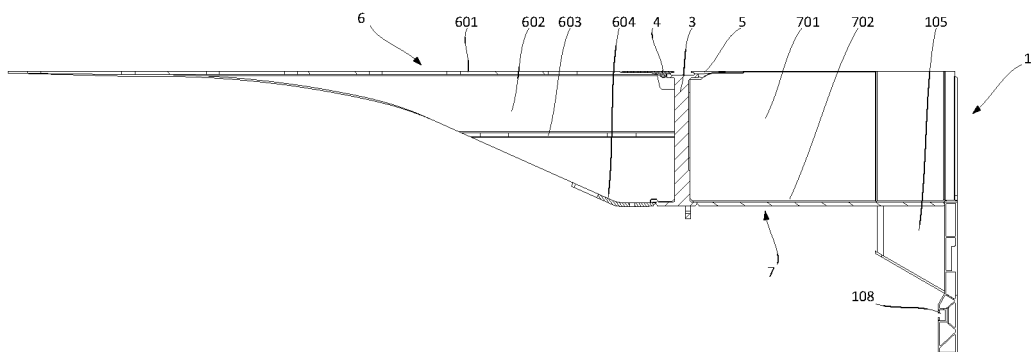


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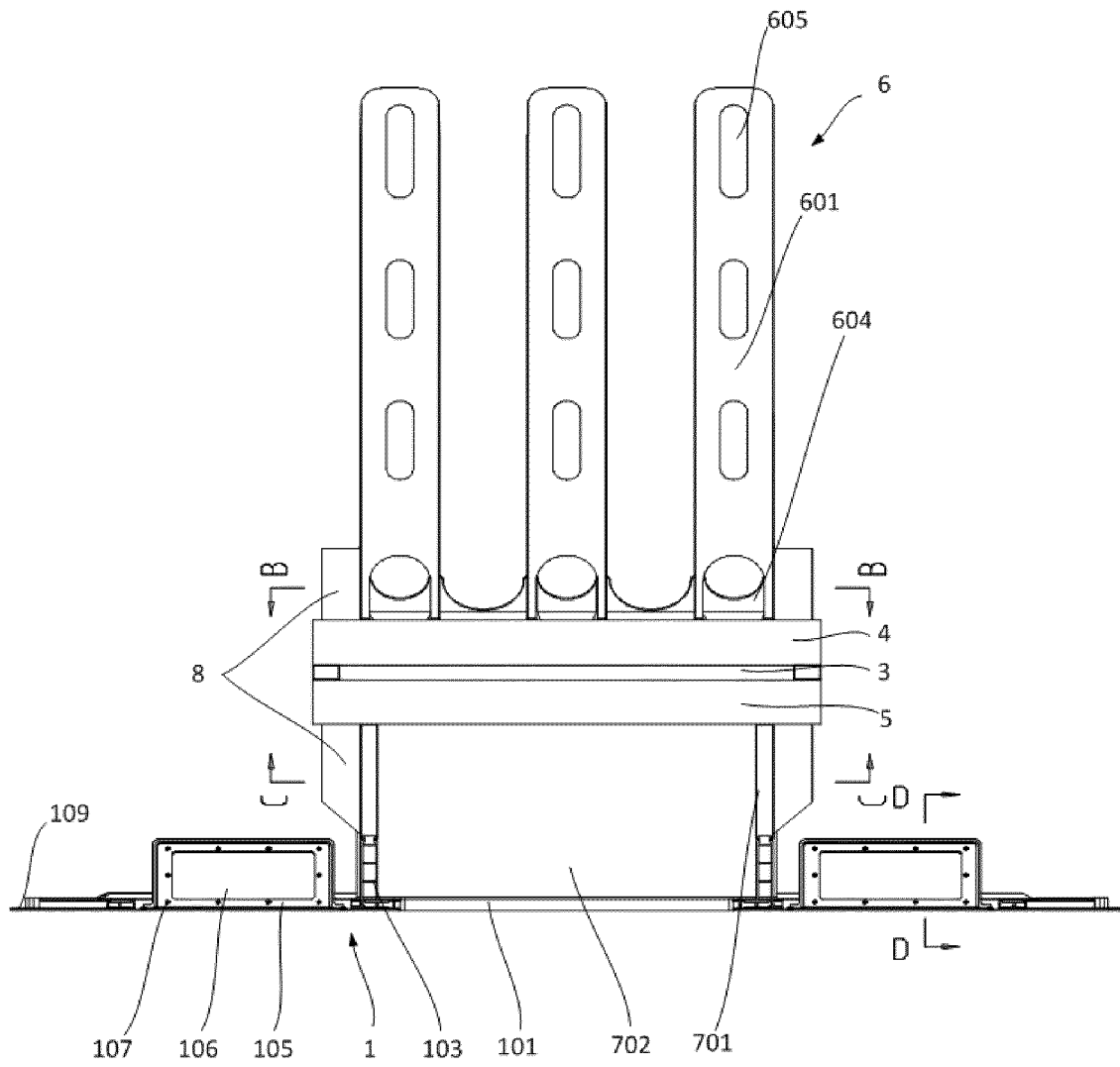


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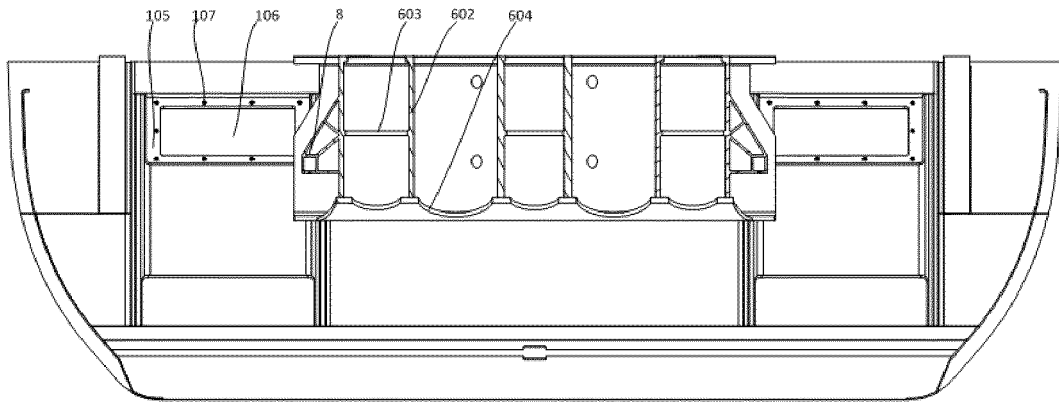


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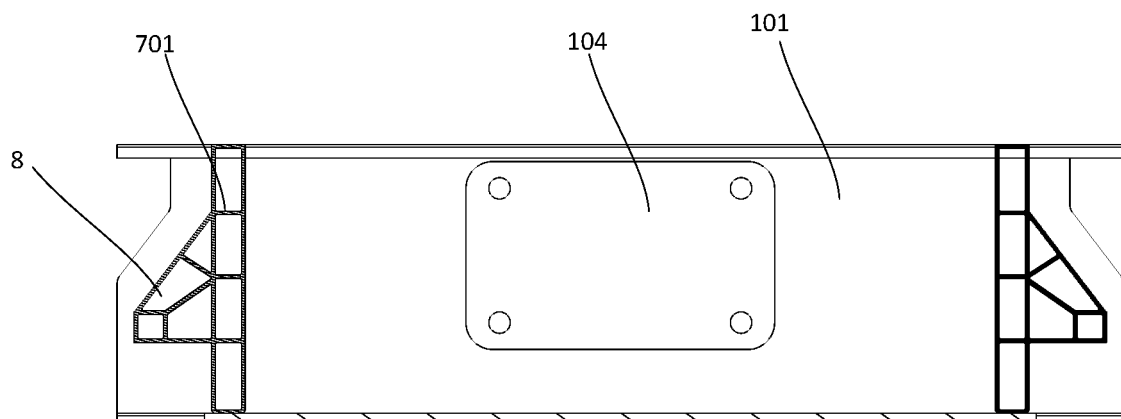


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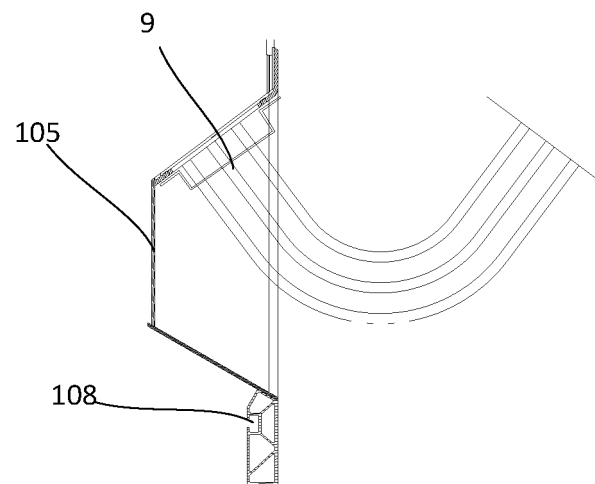


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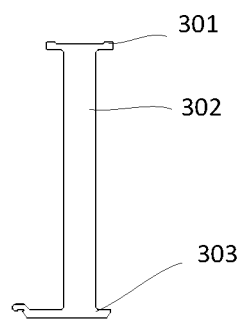


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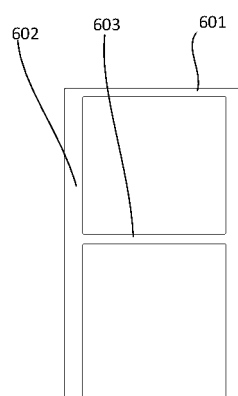


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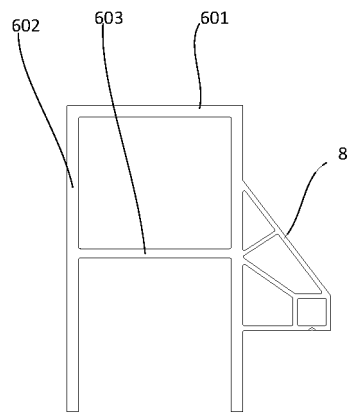


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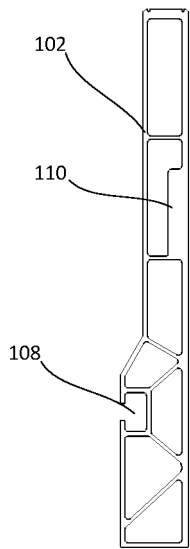


Figure 10

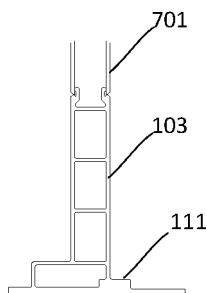


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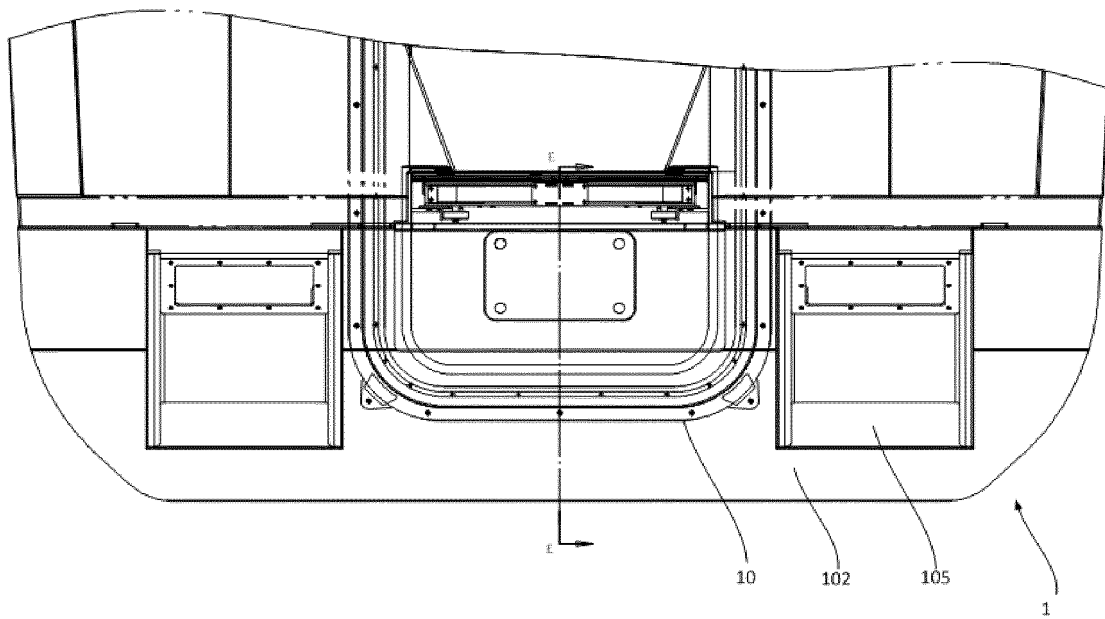


Figure 12

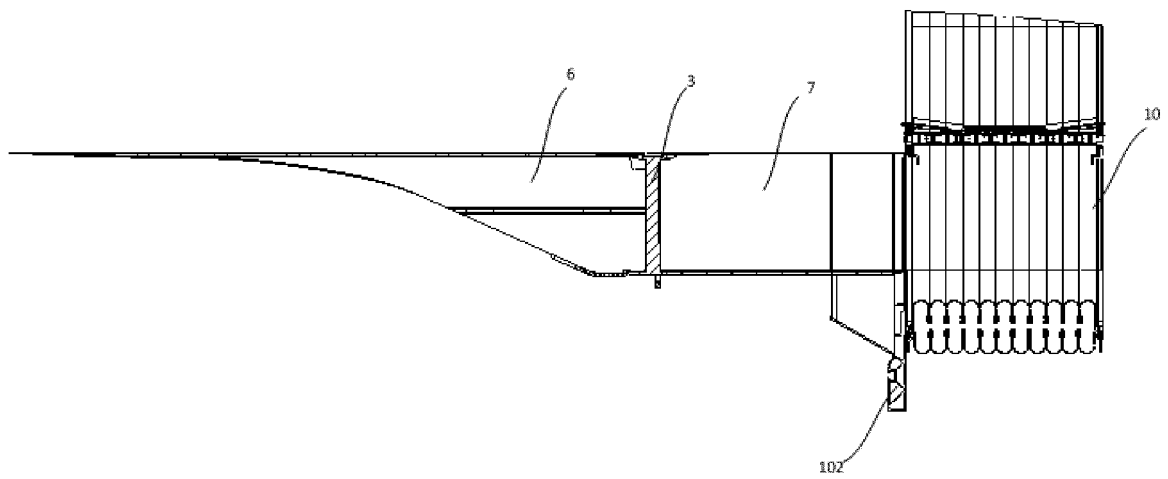


Figure 13

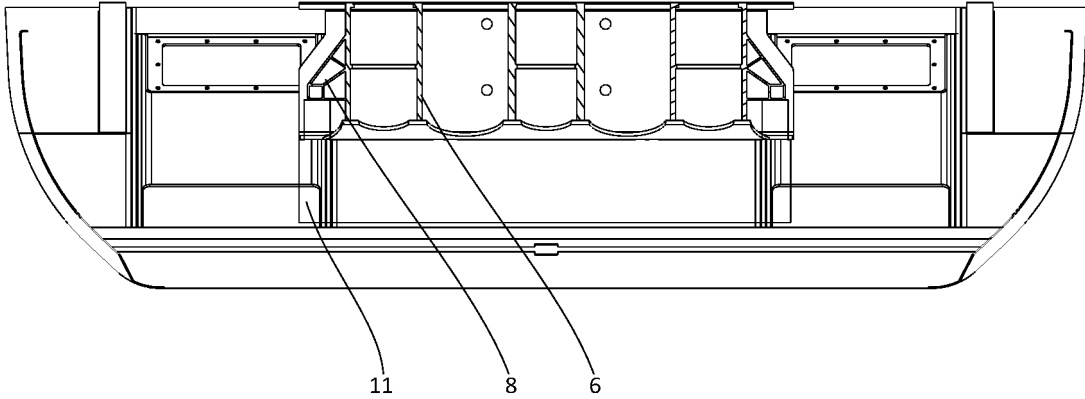


Figure 14

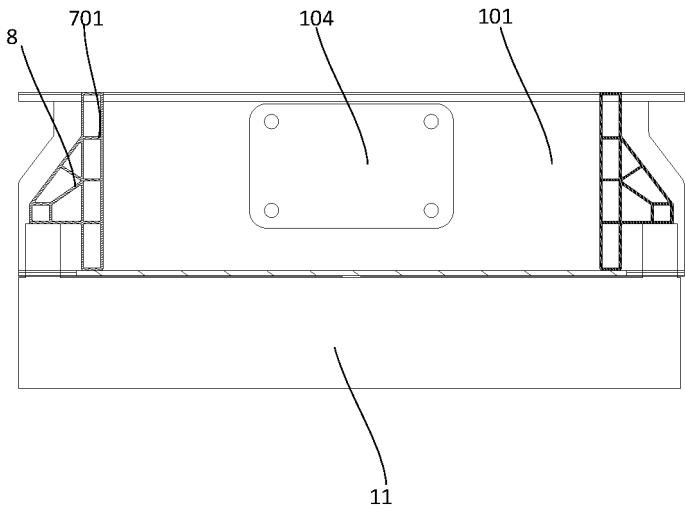


Figure 15

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2020/076539

A. CLASSIFICATION OF SUBJECT MATTER B61F 1/08(2006.01)i; B61F 1/10(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) B61F																								
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) CNABS, VEN, CNKI: 动车, 车体, 底架, 车钩, 座板, 面板, 牵引梁, 箱, 室, 孔, 悬, 吊, train, rail, vehicle, bottom, frame, coupler, hook, seat, base, plate, traction, beam, box, chamber, hole, hang																								
C. DOCUMENTS CONSIDERED TO BE RELEVANT																								
<table border="1"> <thead> <tr> <th>Category*</th> <th>Citation of document, with indication, where appropriate, of the relevant passages</th> <th>Relevant to claim No.</th> </tr> </thead> <tbody> <tr> <td>PX</td> <td>CN 109677437 A (CRRC CHANGCHUN RAILWAY VEHICLES CO., LTD.) 26 April 2019 (2019-04-26) see claims 1-19</td> <td>1-19</td> </tr> <tr> <td>PX</td> <td>CN 209700667 U (CRRC CHANGCHUN RAILWAY VEHICLES CO., LTD.) 29 November 2019 (2019-11-29) see claims 1-19</td> <td>1-19</td> </tr> <tr> <td>Y</td> <td>CN 103625500 A (CSR QINGDAO SIFANG CO., LTD.) 12 March 2014 (2014-03-12) see description, paragraphs 25-40, figures 1-2</td> <td>1-19</td> </tr> <tr> <td>Y</td> <td>CN 103978987 A (TANGSHAN RAILWAY VEHICLE CO., LTD.) 13 August 2014 (2014-08-13) see description, paragraphs 22-33, figures 3-5</td> <td>1-19</td> </tr> <tr> <td>Y</td> <td>CN 106364511 A (CRRC NANJING PUZHEN CO., LTD.) 01 February 2017 (2017-02-01) see description, paragraphs 17-24, figures 1-2</td> <td>1-19</td> </tr> <tr> <td>A</td> <td>CN 104085417 A (CSR NANJING PUZHEN CO., LTD.) 08 October 2014 (2014-10-08) see entire document</td> <td>1-19</td> </tr> <tr> <td>A</td> <td>JP 2007137350 A (HITACHI LTD.) 07 June 2007 (2007-06-07) see entire document</td> <td>1-19</td> </tr> </tbody> </table>	Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.	PX	CN 109677437 A (CRRC CHANGCHUN RAILWAY VEHICLES CO., LTD.) 26 April 2019 (2019-04-26) see claims 1-19	1-19	PX	CN 209700667 U (CRRC CHANGCHUN RAILWAY VEHICLES CO., LTD.) 29 November 2019 (2019-11-29) see claims 1-19	1-19	Y	CN 103625500 A (CSR QINGDAO SIFANG CO., LTD.) 12 March 2014 (2014-03-12) see description, paragraphs 25-40, figures 1-2	1-19	Y	CN 103978987 A (TANGSHAN RAILWAY VEHICLE CO., LTD.) 13 August 2014 (2014-08-13) see description, paragraphs 22-33, figures 3-5	1-19	Y	CN 106364511 A (CRRC NANJING PUZHEN CO., LTD.) 01 February 2017 (2017-02-01) see description, paragraphs 17-24, figures 1-2	1-19	A	CN 104085417 A (CSR NANJING PUZHEN CO., LTD.) 08 October 2014 (2014-10-08) see entire document	1-19	A	JP 2007137350 A (HITACHI LTD.) 07 June 2007 (2007-06-07) see entire document	1-19
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INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2020/076539

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2010258031 A1 (NAT STEEL CAR LTD.) 14 October 2010 (2010-10-14) see entire document	1-19

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/CN2020/076539

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
CN 109677437 A	26 April 2019	None	
CN 209700667 U	29 November 2019	None	
CN 103625500 A	12 March 2014	CN 103625500 B	07 September 2016
		AR 097955 A1	20 April 2016
CN 103978987 A	13 August 2014	CN 103978987 B	17 May 2017
CN 106364511 A	01 February 2017	CN 106364511 B	16 March 2018
CN 104085417 A	08 October 2014	CN 104085417 B	14 September 2016
JP 2007137350 A	07 June 2007	None	
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		WO 2009062317 A1	22 May 2009
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