



(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
08.04.2020 Bulletin 2020/15

(51) Int Cl.:
B61F 1/06 (2006.01)

(21) Application number: **17912173.6**

(86) International application number:
PCT/CN2017/118290

(22) Date of filing: **25.12.2017**

(87) International publication number:
WO 2018/218941 (06.12.2018 Gazette 2018/49)

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
MA MD TN

- **WANG, Zhaohua**
Zhuzhou
Hunan 412001 (CN)
- **LI, Tao**
Zhuzhou
Hunan 412001 (CN)
- **SU, Ke**
Zhuzhou
Hunan 412001 (CN)
- **ZHANG, Haibo**
Zhuzhou
Hunan 412001 (CN)

(30) Priority: **02.06.2017 CN 201710409019**

(71) Applicant: **CRRC Zhuzhou Locomotive Co., Ltd**
Zhuzhou, Hunan 412001 (CN)

(72) Inventors:

- **SU, Yongzhang**
Zhuzhou
Hunan 412001 (CN)

(74) Representative: **Kramer Barske Schmidtchen**
Patentanwälte PartG mbB
European Patent Attorneys
Landsberger Strasse 300
80687 München (DE)

(54) **END PORTION STRUCTURE OF HINGED MULTIPLE UNIT TRAIN BODY CHASSIS**

(57) An end structure of articulated multiple unit vehicle body underframe, comprising two side beams (5), two traction beams (2) being provided between the two side beams which are parallel to the side beams, and bolster beams (3) being provided between one traction beam and one side beam at a vehicle end connection area, and between the other traction beam and the other side beam at the vehicle end connection area; ends of the two side beams and the traction beams, which are located in a passenger compartment passage area, are perpendicularly connected to a partition wall (6) such that the overall vehicle body underframe forms a frame structure having a shape of three same rectangles arranged side-by-side; the two bolsters are provided thereon with air spring mounting holes (31), respectively; bottoms of ends of the two traction beams, which are located at the vehicle end connection area, are provided with a hinge seat (1); bottom surfaces of the traction beams and the bolster beams are fixedly connected to a hinge support structure (4), and an end of the hinge support structure is connected to rear sides of the hinge seat, while the other end is connected to the partition wall; an upper portion of the hinge support structure is provided with an

intermediate floor (41), and side floors (8) are provided between an upper part of one traction beam and an upper part of the side beam at a corresponding side, and between an upper part of the other traction beam and an upper part of the side beam at the corresponding side, such that the cross section direction of the vehicle body underframe forms a downward concave structure.

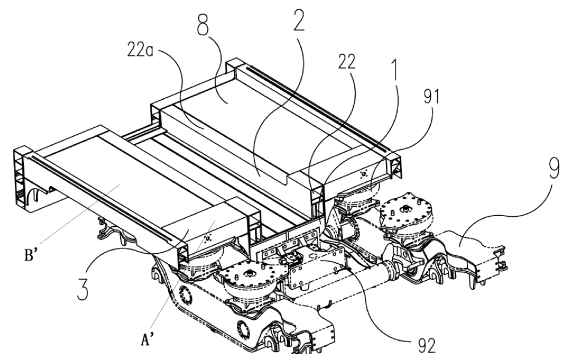


Fig. 4

Description

Technique field

[0001] This invention relates to an underframe structure of rail vehicles, in particular to an end structure of articulated multiple unit vehicle body underframe.

Background technique

[0002] At present, a hook connection device is generally used for the connection between vehicles of domestic multiple unit. However, there are many countries with small land areas, the speed requirements for multiple unit are not too high, and the focus is on the lines with smaller turning radii. Therefore, some foreign vehicle operators require using articulated bogies for the multiple unit.

[0003] The most successful case of articulated bogies abroad is the French TGV and AGV high-speed vehicles, wherein the bogies are 2-point suspension bolster-free articulated bogies, but height of floor of this articulated-bogie vehicle is relative high. Therefore, considering the convenience of boarding and alighting, an intermediate passage in the vehicle is required by the operator, the intermediate passage has a lower height, and can only be achieved by designing a concave structure in the middle, which is not conducive to the bearing and transmission of the vehicle body, thus raising the design difficulty of the vehicle body.

[0004] In China, there are few studies on articulated multiple unit vehicles, and articulated connections are mainly used on low-floor vehicles and light rail vehicles, and ram-armed bogies are mainly used. Vehicles with ram-armed bogies have the characteristics of strong ability to pass a small labyrinth radius, but the axle weight is small, generally around 10 tons.

[0005] In order to satisfy the axle load requirement of the multiple unit vehicles, the 4-point suspension bolster-free articulated bogie can be used, that is, articulated traction devices are used and the vehicle body is carried by four air springs. At the same time, the conventional underframe structure cannot suit the installation and connection of the new bogie, therefore it is urgent to develop a new end structure of vehicle body underframe.

Summary of the invention

[0006] The technical problem to be solved by the present invention is that, in view of the deficiencies of the prior art, providing an end structure of articulated multiple unit vehicle body underframe that can be mounted and connected with a 4-point suspension bolster-free articulated bogie.

[0007] In order to solve the above technical problem, the technical solution adopted by the present invention is: an end structure of articulated multiple unit vehicle body underframe, includes two parallel longitudinally dis-

posed side beams, a traction beam parallel to the side beams is disposed between the two side beams, bolster beams are laterally disposed between the traction beam and one side beam at a vehicle end connection area, and between the traction beam and the other side beam at the vehicle end connection area, and ends of the two side beams and the traction beam, which are located at a passenger compartment passage area, are vertically connected to the partition wall; there are two traction beams, and the two traction beams are longitudinally symmetrically arranged; there are two bolster beams, and the two bolster beams are respectively arranged outside the two traction beams, so that the overall structure of the vehicle body underframe forms a frame structure having a shape of three same rectangles arranged side-by-side; air spring mounting holes, which are connected to air springs of the bogie, are respectively provided in the two bolster beams; bottoms of two traction beams, which are located at the vehicle end connection area, are provided with a hinge seat for connecting a hinge device of the bogie; lower surfaces of the two traction beams and the two bolster beams are fixedly connected to a hinge support structure, and one end of the hinge support structure is connected to the rear of the hinge seat, and the other end is connected to the partition wall; an intermediate floor is directly disposed at the upper surface of the hinge support structure, side floors are provided between an upper part of one traction beam and an upper part of the side beams at the corresponding side, and between an upper part of the other traction beam and an upper part of the side beam at the corresponding side, so that the vehicle body underframe forms a concave-downward structure in a cross-section direction.

[0008] In the above solution, the hinge seat, the traction beam, the bolster beam, the side beam and the partition wall are all made of hollow aluminum profiles, so that not only the weight of the vehicle body underframe is reduced, but also the partial cavity of the traction beam and the side beam can be removed, which provides the possibility to set different heights for the upper surface of the passenger compartment passage area and the vehicle end connection area, and lays a foundation for the equipment installation at the bottom of the vehicle body underframe.

[0009] In the above solution, the inside of the traction beam is provided with a second traction beam cavity and a first traction beam cavity from top to bottom; the second traction beam cavities at the passenger compartment passage area are all removed, thus a U-shaped gap with a U-shaped cross section is formed at a top portion of the first traction beam cavity, the side floor is located behind the bolster beam, and it is aligned with the lower surface of the second traction beam cavity, so that the upper surface of the traction beam, the upper surface of the bolster beam and the upper surface of the side beam at the vehicle end connection area are all aligned, and an upper surface of the passenger compartment passage area is lower than an upper surface of the vehicle end

connection area.

[0010] In the above solution, the bottom of the first traction beam cavity is provided with a vertical plate connector connected to the hinge support structure, so that the weld seam of the important force transmitting portion will not appear at rigidity abrupt change position.

[0011] In the above solution, the first traction beam cavity is machined with an L-shaped gap with an L shape in the cross-sectional direction.

[0012] In the above solution, the hinge support structure is assembly welded by an intermediate floor located at the middle of the upper surface of the hinge support structure, a connecting floor located at both sides of the upper surface of the hinge support structure, a supporting vertical plate located under the intermediate floor and the connecting floor, and a supporting cover plate located at the lower surface of the hinge support structure.

[0013] In the above solution, a connecting plane of the hinge seat and the hinge device mounting hole (11) in the connecting plane of the hinge seat and the mounting plane of the bolster beam and the air spring mounting hole (31) in the mounting plane are holistically machined after the frame structure having the shape of three same rectangles arranged side-by-side and the side floor are assembly welded, to reduce negative influence on perpendicularity of the welding deformation to the mounting plane of the hinge seat and the ground, and reduce negative influence on parallelism between the bolster beam mounting plane and the side floor.

[0014] In the above solution, the middle portion of the side beam of the end structure of articulated multiple unit vehicle body underframe is machined with a side beam cavity gap, so as to ensure that the bogie frame and the wheelset have sufficient working space during the vehicle operating..

[0015] In the above solution, a cavity boss is arranged between the partition wall and the hinge support structure for transitioning the longitudinal impact force of the hinge support structure, and the cavity can provide a connection space and a passage space for brake pipe and cable line.

[0016] In the above solution, transitional ribs are provided at the joint of the side beam and the partition wall under the frame structure, and at the joint of the traction beam and the bolster beam, so that the rigidity of the end structure of the underframe is more coordinated.

[0017] In the above solution, the upper surface of the side beam lower cavity of the side beam is aligned with the lower surface of the bolster beam, and the upper surface of the second traction beam cavity of the traction beam is aligned with the upper surface of the bolster beam, so that the upper surface of the passenger compartment passage area is lower than the upper surface of the vehicle end connection area.

[0018] In the above solution, the lower height of the hinge support structure is lower than the height of at least one row of hinge mounting holes in the hinge seat to facilitate the installation of the hinge device.

[0019] In the above solution, a vertical plate connector provided horizontally and a vertical plate connector provided vertically are protruded below the traction beam, the vertical plate connector provided horizontally is connected with a connecting floor of the hinge support structure, and the vertical plate connector provided vertically is connected with a support vertical plate of the hinge support structure. The length of the vertical plate connectors are at least 30 mm, so that the weld seam of the important force transmitting portion will not appear at rigidity abrupt change position. The intermediate floor of the hinge support structure and the connecting floor are arranged in a non-integral structure, thereby providing a welding space for the connecting floor and the supporting cover plate, the structure is assembly welded after the welding of the connecting floor and the support cover is completed.

[0020] In the present invention, the hinge seat and the bolster beam at the vehicle end connection area are used for connecting the bogie; the upper part of the hinge seat is connected with the traction beam, and the hinge support structure is arranged below the traction beam and behind the hinge seat to resist the large longitudinal impact force of the running vehicle; the bolster beam is located between the side beam and the traction beam for connecting the air spring, and transmits the external force on the hinge seat to the side beam; the traction beam, the hinge support structure and the side beam are all connected to the rear partition wall, and form a frame structure having a shape of three same rectangles arranged side-by-side, so that the overall bearing performance is good, which lays a good foundation for the body strength to meet the EN12663 standard to resist a compression force of 1500kN.

[0021] The upper surface of the passenger compartment passage area is slightly lower than the upper surface of the vehicle end connection area. By connecting the lower surface of the traction beam to the intermediate floor, and connecting the upper surface to the floor on both sides, the cross-section of the vehicle body is designed to be a concave shape structure, which not only provides an intermediate passage in the vehicle and a plane for installing equipment such as seats, but also meets the working space requirements of the bogie under the vehicle, making full use of limited space and maintaining strength.

[0022] Profiles of the bolster beam, the traction beam, the side beam and the partition wall are all large-section hollow structure, wherein a redundant cavity is arranged under the side beam profile and the traction beam profile, and the cavity is partially milled out in the working area of the bogie, while the rest of the profile still has sufficient strength and functional integrity; the span of the rib in the middle of the bolster beam profile is large enough to be used to mount the plug structure of the air spring; the partition wall profile is provided with a boss structure for transit the longitudinal impact force of the hinge support structure, and provides a connection space for the brake

pipe and the cable at the same time.

[0023] The aluminum alloy end structure of the vehicle body underframe in the present invention can meet the installation requirements of the 4-point suspension articulated bogie. The biggest advantage of using the hinge structure is to reduce the use of the bogie, and reduce the weight of the whole vehicle and the running resistance of the vehicle at the same time, and significant improve the curve passing performance of the vehicle.

[0024] The vehicle body in the present invention has good strength performance, meets the requirements that the hinge seat area can withstand 1500 kN of longitudinal compression force; providing a lower height intermediate passage, which provides great convenience for passengers, and is particularly suitable for passenger vehicles which has lower floor in some areas.

[0025] In addition, the end structure of underframe of the present invention has a high degree of modularity and good processability, and is suitable for mass production.

DRAWINGS

[0026]

Figure 1 is a block diagram showing the components of an end structure of underframe of the present invention.

Figure 2 is an axial view of the end structure of underframe of the present invention.

Figure 3 is a drawing of the traction beam profile.

Figure 4 is a schematic diagram of the end structure of underframe with the bogie.

Figure 5 is a front view of the end structure of underframe with bogie.

Figure 6 is A-A view of Figure 5.

Figure 7 is B-B view of Figure 5.

Figure 8 is C-C view of Figure 5.

[0027] In the figure: hinge seat (1), hinge device mounting hole (11), traction beam (2), first traction beam cavity (21), L-shaped gap (21a), second traction beam cavity (22), U-shaped gap (22a), vertical plate connector (23), bolster beam (3), air spring mounting hole (31), hinge support structure (4), intermediate floor (41), connecting floor (42), support plate (43), support cover (44), side beam (5), side beam lower cavity (51), side beam cavity gap (51a), partition wall (6), cavity boss (61), transitional rib (7), side floor (8), articulated bogie (9), air spring (91), hinge device(92).

Detailed description

[0028] As shown in FIG. 1 and FIG. 2, an embodiment of an end structure of the vehicle body underframe of the present invention is composed of a hinge seat 1, two traction beams 2, two bolster beams 3, two side beams 5 and a partition wall 6, to form a holistic frame structure

having a shape of three same rectangles arranged side-by-side, these components all are large-section hollow aluminum profiles, providing a basis for bearing the vehicle's own weight and transmitting longitudinal forces.

5 The front end of the holistic frame structure is provided as a vehicle end connection area A', and the rear end is provided as a passenger compartment passage area B'. The bottoms of the two bolster beams 3 and the two traction beams 2 are provided with a hinge support structure 4. The front and rear of the hinge support structure 4 are respectively connected to the hinge seat 1 and the partition wall 6, and the upper surface of the hinge seat 1 is smoothly transit to the upper surface of the partition wall 6 by the upper surface of the hinge support structure 4, and the lower surface of the hinge seat 1 is smoothly transit to the lower surface of the partition wall 6 by the lower surface of the hinge support structure 4, to avoid excessive stress concentration. The hinge support structure 4 is assembly welded by an intermediate floor 41 located in the middle of the upper surface of the hinge support structure 4, a connecting floor located at both sides of the upper surface of the hinge support structure 4, a supporting vertical plate located under the intermediate floor and the connecting floor, and a supporting cover 44 located at the lower surface of the hinge support structure, and the hinge support structure 4 is used for supporting the hinge seat 1.

[0029] Above the holistic frame structure having a shape of three same rectangles arranged side-by-side, a side floor 8 is provided between the traction beam 2 and the side beam 5 for supporting the load inside the vehicle; at the connection portion with large height fluctuation, such as the joint of the side beam 5 and the partition wall 6 and the joint of the traction beam 2 and the bolster beam 3, are provided with transitional ribs 7, so that the structural rigidity of the end structure of the underframe is more coordinated.

[0030] The plane of the hinge seat 1 and the hinge device mounting hole 11 thereof, and the plane of the bolster beam 3 and the air spring mounting hole 31 thereof are holistically machined after the frame structure having a shape of three same rectangles arranged side-by-side and the side wall 8 are assembly welded, to reduce negative influence on perpendicularity between the plane of the hinge seat 1 and the ground caused by the welding deformation, and reduce negative influence on parallelism between the plane of the bolster beam 3 and the side floor 8 caused by the welding deformation.

[0031] Figure 3 is a drawing of a traction beam profile. The traction beam 2 is a large-section hollow structure, there are redundant cavities arranged in the lower cavity of the profile, that is, a first traction beam cavity 21 and a second traction beam cavity 22, and a L-shaped gap 21a with a L-shaped cross-section and an U-shaped gap 22a with an U-shaped cross-section are processed respectively; a vertical plate connector 23 is provided on one side of the first traction beam cavity 21 for connecting the hinge support structure 4.

[0032] Figure 4 is a schematic diagram of the end structure of underframe with the bogie. The hinge seat 1 and the bolster beam 3 located at the vehicle body connection area are respectively connected to the hinge device 92 of the bogie 9 and the air spring 91; the bolster beam 3 is located between the side beam 5 and the traction beam 2, mainly for bearing the vertical load of the vehicle; The nonlinear elastic characteristics of the air spring 91 are utilized to enhance the comfort of the passenger, while transmitting the longitudinal force on the hinge seat 1 to the side beam 5. The upper surface of the passenger compartment passage area B' is slightly lower than the upper surface of the vehicle end connection area A'. The second traction beam cavity 22 that retained at the junction of the traction beam 2 and the bolster beam 3, whose rear section that connected with the side floor 8 is completely milled, and the U-shaped gap 22a is machined here to provide plane for mounting a seat and other equipment.

[0033] Figure 5 is a front view of the end structure of underframe with bogie. The bogie 9 is fixed under the end structure of underframe of the present invention, and the hinge device 92 is connected to the hinge seat 1 by fixing bolts to the hinge device mounting hole 11 in the hinge seat 1; the air spring 91 is connected to the bolster beam 3 by fixing bolts to the air spring mounting hole 31 in the bolster beam 3.

[0034] The L-shaped gap 21a is machined in the first traction beam cavity 21, and the side beam cavity gap 51a is machined in the middle section of the side beam 5, thus ensure enough working space for the frame of the bogie 9 and the wheelset during vehicle operation.

[0035] Figure 6 is an A-A view of Figure 5. One end of the traction beam 2 is connected to the bolster beam 3 and the hinge seat 1, and the other end is connected to the partition wall 6. The hinge seat 1 is connected to two traction beams 2 and is located below them, and the upper surface of the bolster beam 3 is aligned with the upper surface of the traction beam 2. The hinge support structure 4 is located below the traction beam 2 for supporting the hinge seat 1 at front, to resist the large longitudinal impact forces of the hinge device 92 during vehicle operation.

[0036] The bolster beam 3 is a large section hollow profile, the span of the intermediate rib plate is large enough to be used to mount the insert structure of the air spring 91; the partition wall 6 is provided with a cavity boss 61 for transitioning the longitudinal impact force of the hinge support structure 4, and its cavity can provide the connection and passage space for the brake pipe and cable at the same time.

[0037] Figure 7 is a B-B view of Figure 5. The hinge seat 1 and the bolster beam 3 located at the vehicle end connection area are used for connecting the bogie 9; the upper part of the hinge seat 1 is connected with the traction beam 2. A hinge support structure 4 is provided below the traction beam 2 and behind the hinge seat 1 for resisting the large longitudinal impact force during operation

of the vehicle; the bolster beam 3 is located between the side beam 5 and the traction beam 2 for connecting the air spring 91 and transmitting the external force on the hinge seat 1 to the side beam 5. The traction beam 2, the hinge support structure 4, and the side beam 5 are all connected with the partition wall 6 behind to form a frame structure having a shape of three same rectangles arranged side-by-side. The side beam 5 and the traction beam 2 are vertically symmetrically arranged, therefore the force is uniform, and the overall bearing performance is good, which lays a good foundation for the vehicle body strength to meet the EN12663 standard to resist a compression force of 1500kN.

[0038] The upper surface of the bolster beam 3 located at the vehicle end connection area is aligned with the side beam 5 and the traction beam 2. Considering the strength, the upper surface of the side beam lower cavity 51 of the side beam 5 is aligned with the lower surface of the bolster beam 3 at the joint, the upper surface of the second traction beam cavity 22 of the traction beam 2 is aligned with the upper surface of the bolster beam 3 at the joint, and a transitional rib 7 is provided at the position where the height difference between the traction beam 2 and the bolster beam 3 is large, thereby ensuring the overall strength and stiffness coordination of this area.

[0039] In the passenger compartment passage area, the second traction beam cavity 22 of the traction beam 2 is machined so that its upper surface is slightly lower than the vehicle end connection area. The side floor 8 between the traction beam 2 and the side beam 5 adopts a plate-beam structure, and the height is controlled within 30 mm, ensuring sufficient running safety clearance of h2, which is the distance between the lower surface of the side floor 8 and the upper surface of the frame; and the side beam lower cavity 51 of the side beam 5 is machined with a side beam cavity gap 51a, and the first traction beam cavity 21 of the traction beam 2 is machined with a L-shaped gap 21a, ensuring that the lower surface of the traction beam 2 has a sufficient safety clearance to the upper surface of the frame within the motion range of the bogie 9. At the same time, the section area of the side beam 5 and the traction beam 2 are large, therefore the fundamental strength of the vehicle body will not be affected after the redundant cavity is machined.

[0040] In the middle of the passenger compartment passage area, a hinge support structure 4 is provided below the traction beam 2, which is concave-downward in the cross section direction of the vehicle body. The hinge support structure 4 is welded to the hinge seat 1 in its front, and the lower portion of the hinge support structure 4 is lower than at least one row of hinge mounting holes 11 to prevent the hinge seat 1 from being subjected to excessive bending moments by longitudinal forces and disabled.

[0041] By designing a concave-downward structure in the cross-sectional direction, the intermediate passage

is provided in the vehicle, and the requirement of working space of the bogie under the vehicle is satisfied, and the limited space is fully utilized and the strength is maintained.

[0042] Figure 8 is a C-C view of Figure 5. In the passenger compartment passage area, the upper surface of the traction beam 2 is aligned with the side floor 8, and a vertical plate connector 23 provided horizontally and a vertical plate connector 23 provided vertically extending under the traction beam 2 are respectively connected to the connection floor 42 and the support vertical plate 43 of the hinge support structure 4. The vertical plate connector 23 is at least 30 mm away from the closed cavity of the traction beam 2, so that the weld seam of the important force transmitting portion will not appear at rigidity abrupt change position. The intermediate floor 41 is connected to two connecting floors 42. The intermediate floor 41 is not integrally formed with the connecting floor 42, mainly for providing welding space for the connecting floor 42 and the support cover 44, the whole structure is welded after the welding of the connecting floor 42 and the support cover 44 is completed.

[0043] The partition wall 6 is a hollow profile structure with an oversized section, and a cavity boss 61 is provided at a joint portion of the hinge support structure 4 and the partition wall 6 to increase local strength, and a transitional rib 7 is provided at a portion where the height difference between the side beam 5 and the partition wall 6 is large, thereby ensuring the stiffness coordination in this region.

Claims

1. An end structure of articulated multiple unit vehicle body underframe, includes two parallel side beams (5) which are longitudinally disposed, a traction beam (2) parallel to the side beams is disposed between the two side beams, bolster beams (3) are laterally disposed between the traction beam and one side beam at a vehicle end connection area, and between the traction beam and the other side beam at the vehicle end connection area, and ends of the two side beams and the traction beam, which are located at a passenger compartment passage area, are vertically connected to the partition wall (6), **characterized in that** there are two traction beams, and the two traction beams are longitudinally symmetrically arranged; there are two bolster beams, and the two bolster beams are respectively arranged outside the two traction beams, so that the overall structure of the vehicle body underframe forms a frame structure having a shape of three same rectangles arranged side-by-side; bottoms of two bolster beams are respectively connected to an air spring (91) of a bogie (9); bottoms of ends of the two traction beams, which are located at the vehicle end connection area, are provided with a hinge seat (1) for connecting a

hinge device (92) of the bogie (9); lower surfaces of the two traction beams and the two bolster beams are fixedly connected to a hinge support structure (4), and one end of the hinge support structure is connected to the rear of the hinge seat, and the other end is connected to the partition wall; an intermediate floor (41) is directly disposed at the upper part of the hinge support structure, side floors are provided between an upper part of one traction beam and an upper part of the side beam at the corresponding side, and between an upper part of the other traction beam and an upper part of the side beam at the corresponding side, so that the vehicle body underframe forms a concave-downward structure in a cross-section direction.

2. The end structure of articulated multiple unit vehicle body underframe according to claim 1, wherein the hinge seat (1), the traction beam (2), the bolster beam (3), the side beam (5) and the partition wall (6) are all made of hollow aluminum profiles.

3. The end structure of articulated multiple unit vehicle body underframe according to claim 2, wherein the inside of the traction beam is provided with a second traction beam cavity (22) and a first traction beam cavity (21) from top to bottom; a U-shaped gap (22a) with a U-shaped cross section is formed at a top portion, located at the passenger compartment passage area, of the first traction beam cavity (21), the side floor is located behind the bolster beam and is aligned with the lower surface of the second traction beam cavity (22), so that the upper surface of the traction beam, the upper surface of the bolster beam and the upper surface of the side beam are all aligned, and an upper surface of the passenger compartment passage area is lower than an upper surface of the vehicle end connection area.

4. The end structure of articulated multiple unit vehicle body underframe according to claim 3, wherein the bottom of the first traction beam cavity is provided with a vertical plate connector (23) connected to the hinge support structure.

5. The end structure of articulated multiple unit vehicle body underframe according to claim 3, wherein the first traction beam cavity (21) is provided with an L-shaped gap (21a) with an L-shaped cross section.

6. The end structure of articulated multiple unit vehicle body underframe according to claim 1, wherein the hinge support structure is assembly welded by an intermediate floor (41) located in the middle of the upper surface of the hinge support structure, a connecting floor (42) located at both sides of the upper surface of the hinge support structure, a supporting vertical plate (43) located under the intermediate

floor and the connecting floor, and a supporting cover (44) located at the lower surface of the hinge support structure.

7. The end structure of articulated multiple unit vehicle body underframe according to claim 1, wherein a connecting plane of the hinge seat and a hinge device mounting hole (11) in the hinge seat, and a mounting plane of the bolster beam and the air spring mounting hole (31) in the bolster beam are holistically machined after the frame structure having the shape of three same rectangles arranged side-by-side and the side floor are assembly welded. 5
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8. The end structure of articulated multiple unit vehicle body underframe according to claim 3, wherein the middle portion of the side beam of the end structure of articulated multiple unit vehicle body underframe is machined with a side beam cavity gap (51a). 15
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9. The end structure of articulated multiple unit vehicle body underframe according to claim 1, wherein a cavity boss (61) is disposed between the partition wall and the hinge support structure. 25
10. The end structure of articulated multiple unit vehicle body underframe according to claim 1, wherein transitional ribs are provided at the joint of the side beam and the partition wall under the frame structure, and at the joint of the traction beam and the bolster beam. 30

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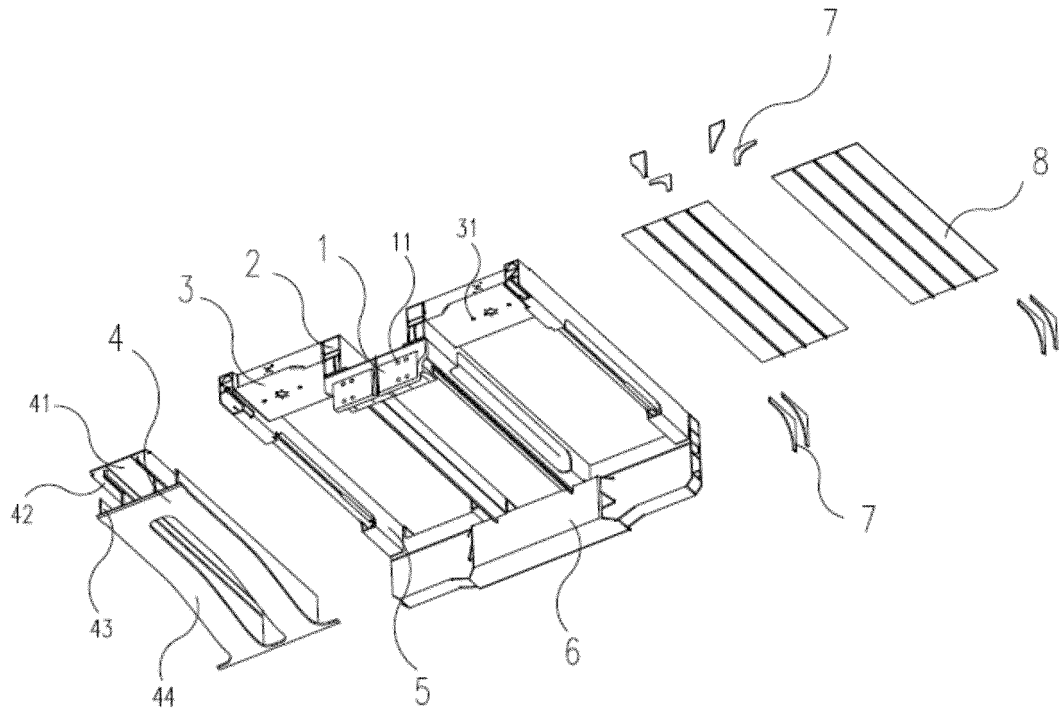


Fig. 1

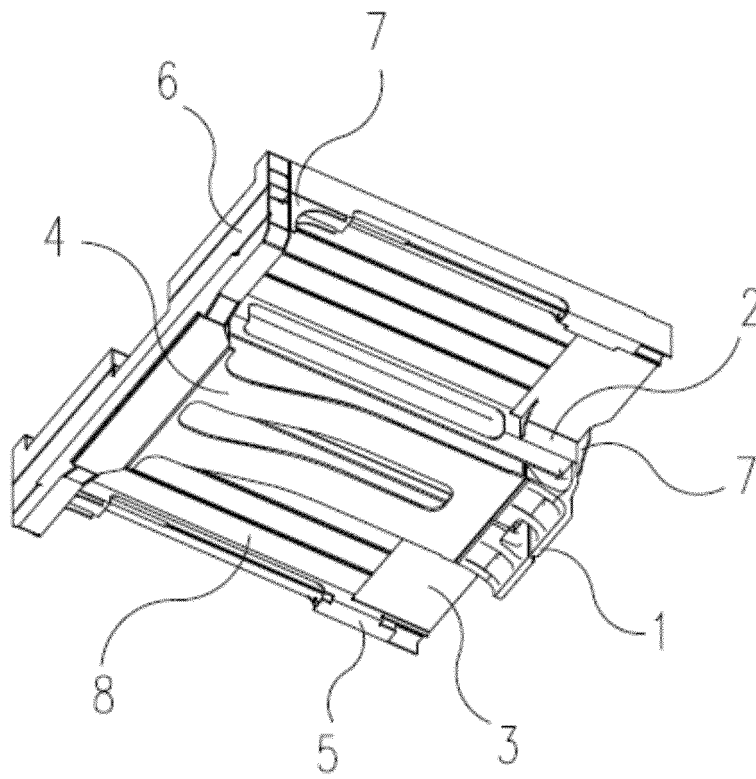


Fig. 2

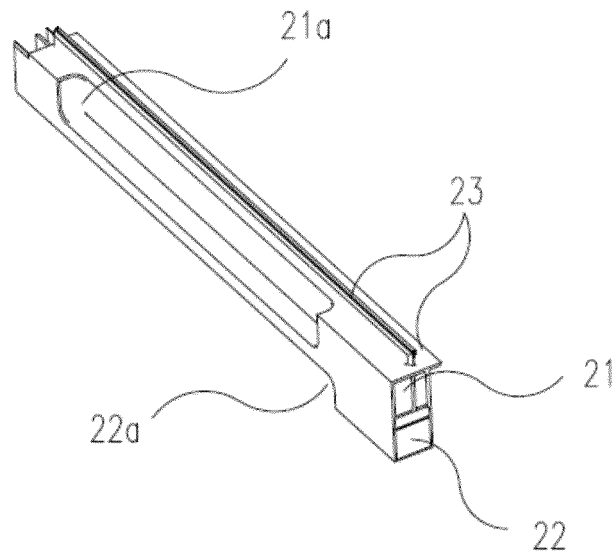


Fig. 3

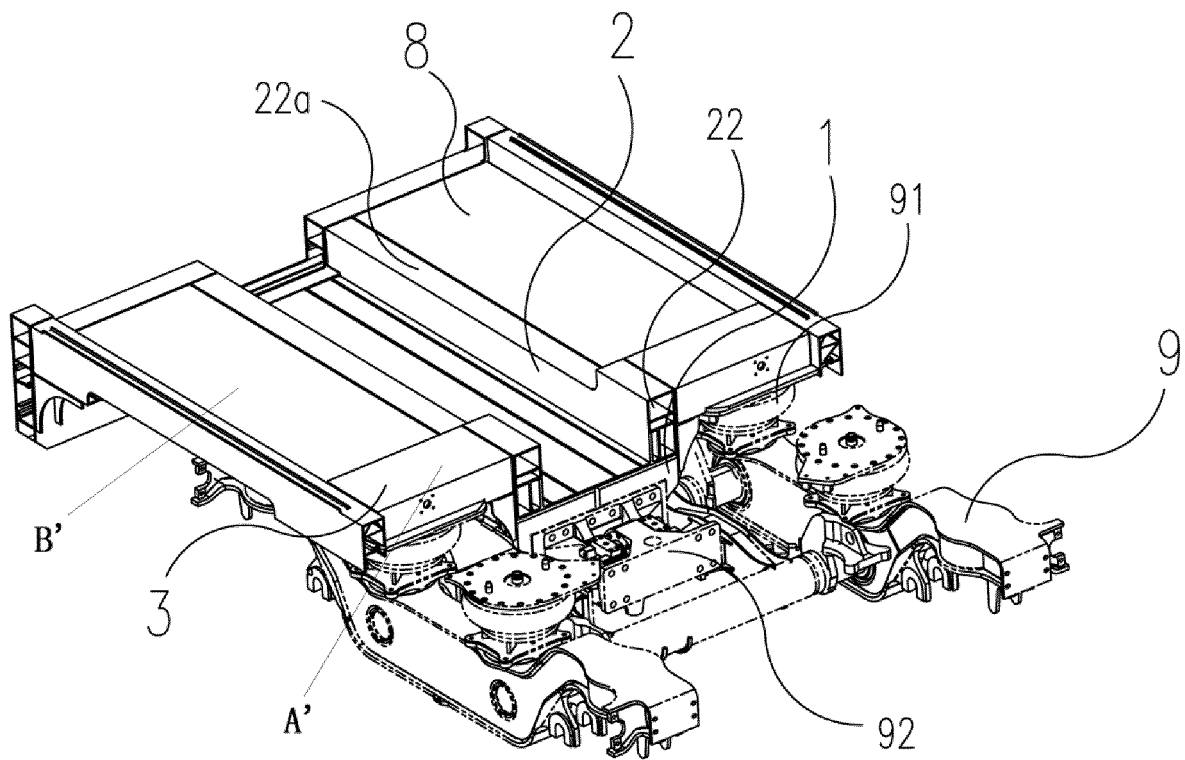


Fig. 4

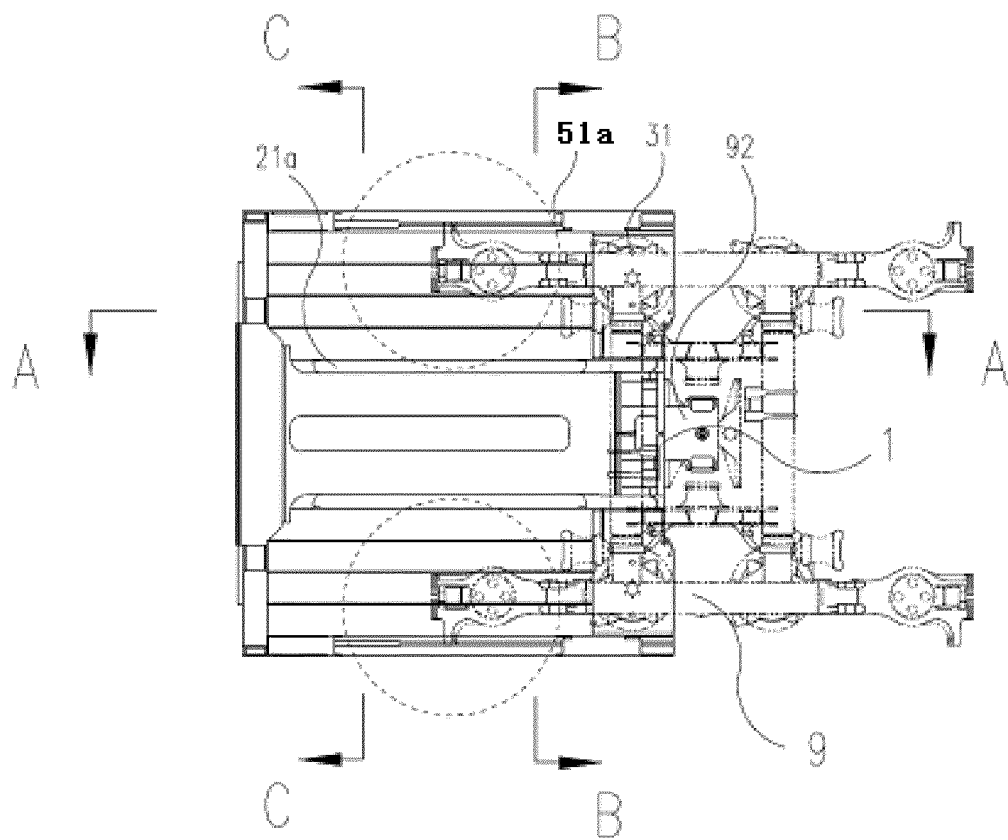


Fig. 5

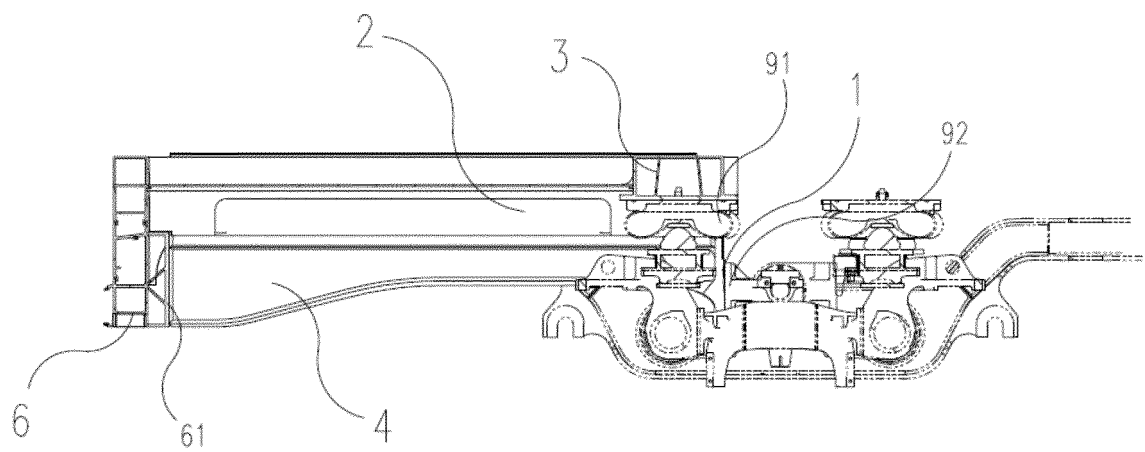


Fig. 6

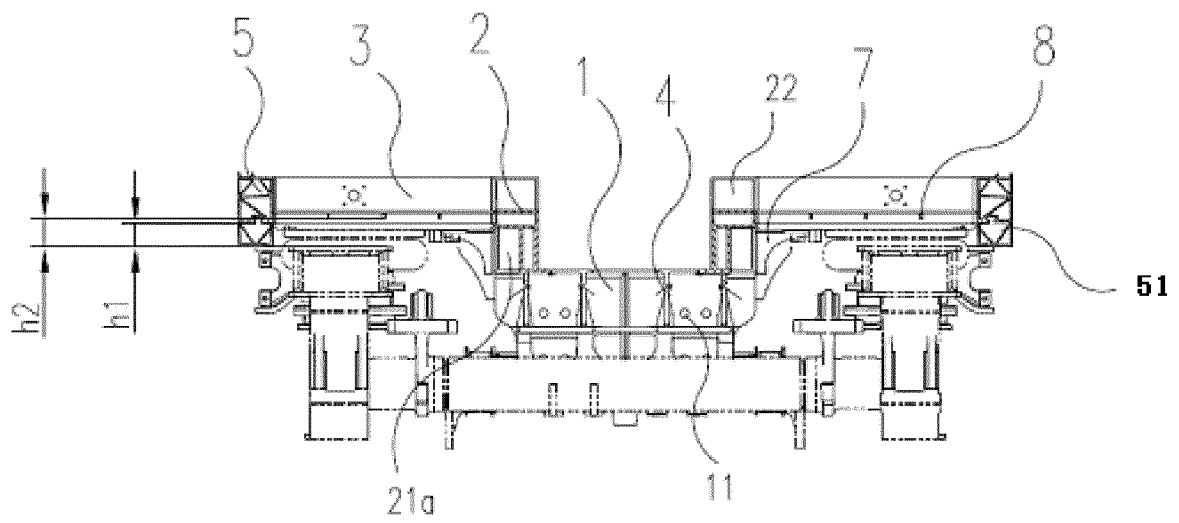


Fig. 7

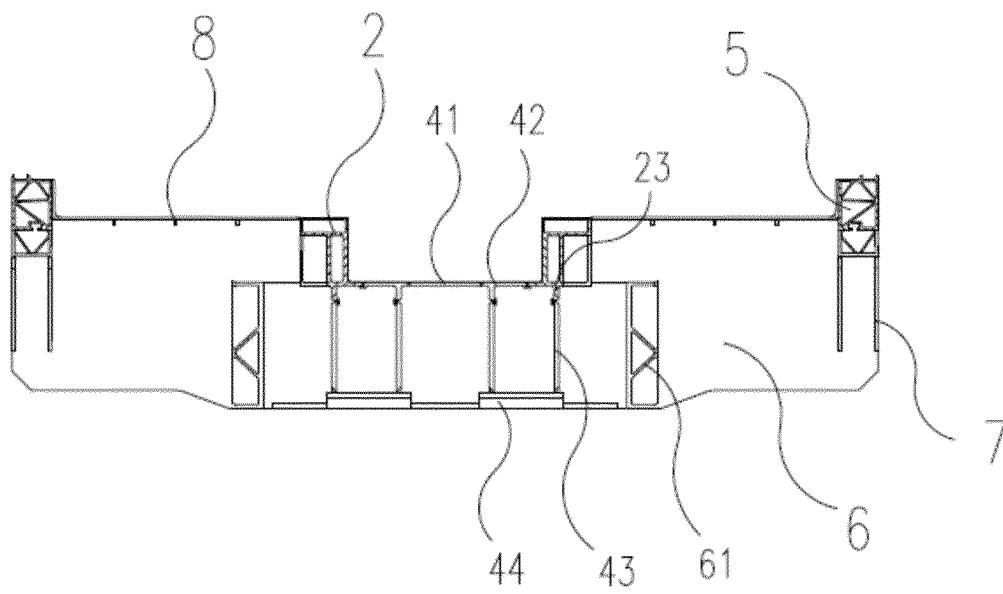


Fig. 8

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2017/118290

A. CLASSIFICATION OF SUBJECT MATTER

B61F 1/06 (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)

CNMED; CPRSABS; CNABS; VEN: 机车, 转向架, 铰接, 动车组, 端部, rain, turn, bogie, link

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN 105539480 A (CRRC ZHUZHOU LOCOMOTIVE CO., LTD.), 04 May 2016 (04.05.2016), entire document	1-10
A	CN 204978655 U (CHANGCHUN RAILWAY VEHICLES CO., LTD.), 20 January 2016 (20.01.2016), entire document	1-10
A	CN 1663861 A (GENERAL MOTORS CORPORATION), 07 September 2005 (07.09.2005), entire document	1-10
A	WO 2012053248 A1 (HITACHI LTD.), 26 April 2012 (26.04.2012), entire document	1-10
PX	CN 107187458 A (CRRC ZHUZHOU LOCOMOTIVE CO., LTD.), 22 September 2017 (22.09.2017), 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

18 January 2018

Date of mailing of the international search report

25 January 2018

Name and mailing address of the ISA
State Intellectual Property Office of the P. R. China
No. 6, Xitucheng Road, Jimenqiao
Haidian District, Beijing 100088, China
Facsimile No. (86-10) 62019451

Authorized officer

ZOU, Diqiu

Telephone No. (86-10) 62019451

INTERNATIONAL SEARCH REPORT
 Information on patent family members

 International application No.
 PCT/CN2017/118290

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Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
CN 105539480 A	04 May 2016	None	
CN 204978655 U	20 January 2016	None	
CN 1663861 A	07 September 2005	CN 101219670 A	16 July 2008
		BR PI0500588 A	18 October 2005
		CN 101219670 B	29 February 2012
		CN 100404341 C	23 July 2008
		US 2005183625 A1	25 August 2005
		ZA 200500339 B	31 August 2005
		ZA 200500339 A	13 June 2005
WO 2012053248 A1	26 April 2012	JP 2012086737 A	10 May 2012
CN 107187458 A	22 September 2017	None	

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