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(54) **RAILWAY MODULAR ASSEMBLING UNDERFRAME AND FULL VEHICLE STRUCTURE COMPRISING SAME**

(57) The present invention discloses a railway modular assembled underframe and a complete-vehicle structure including the underframe. The underframe includes a center beam module, a first crossbeam module, a sleeper beam module, and an edge beam module. The center beam module is at a middle position on the entire underframe, runs through the entire underframe along a longitudinal direction of the underframe, and is to be connected to a coupler buffer apparatus and a bogie. There are at least two first crossbeam modules respectively located at two ends of the entire underframe, disposed

along a transverse direction of the underframe, and fixed to the center beam module through fasteners. There are at least two sleeper beam modules located near the two ends of the underframe, disposed along the transverse direction of the underframe, and fixed to the center beam module through fasteners, and the sleeper beam module is to be connected to the bogie. There are at least two edge beam modules respectively located on two sides of the center beam module and configured to connect two adjacent modules through fasteners.

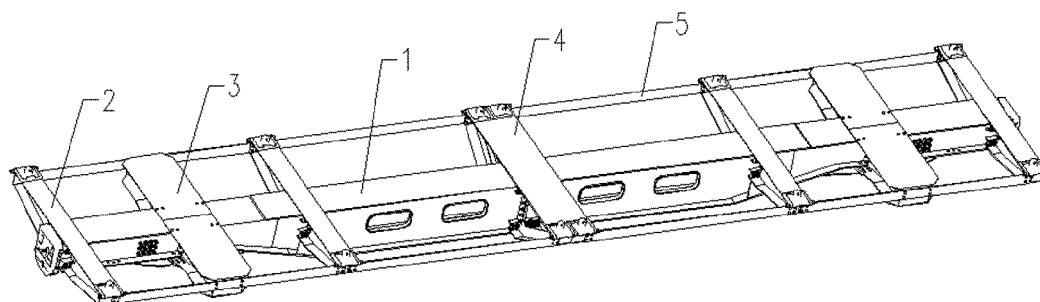


FIG. 1

Description

BACKGROUND

Technical Field

[0001] The present invention relates to an underframe for a railway freight flatcar, and in particular, to a flatcar underframe that may be assembled in a modular manner and a complete-vehicle structure including the underframe.

Related Art

[0002] The inventor found that an underframe of an existing railway flatcar adopts a welded integral structure, and the underframe of the vehicle after completion of production of the underframe has a fixed size and cannot be disassembled and adjusted. For cargo containers of different sizes, when a vehicle with a fixed underframe is used for transportation, the underframe may be incapable of loading as a result of a relatively short transportation space, or a waste of transportation space may be caused as a result of an ample transportation space of the underframe, seriously affecting transportation efficiency and a transportation volume of railway transportation.

[0003] For railway flatcars to be exported, because the underframe cannot be disassembled, long-distance sea transportation can be achieved through only complete-vehicle transportation, resulting in a large space occupied by the vehicle and high transportation costs.

SUMMARY

[0004] The present invention is intended to provide a flatcar underframe for railway freight and a complete-vehicle structure including the underframe, to resolve problems in the prior art that a length of a railway vehicle cannot be adjusted according to a cargo size during running of the railway vehicle and that disassembling cannot be performed during transportation and a large space is occupied and transportation costs are high. In the present invention, the underframe is disassembled into smaller standardized modules, and the modules may be assembled into a complete underframe through riveting or bolting when necessary, helping increase an underframe manufacturing speed and reduce vehicle manufacturing and transportation costs.

[0005] A first inventive purpose of the present invention is to provide a flatcar underframe for railway freight that may be assembled in a modular manner. In order to achieve the purpose, the present invention provides the following technical solutions:

a flatcar underframe for railway freight, including a center beam module, a first crossbeam module, a sleeper beam module, and an edge beam module.

[0006] The center beam module is at a middle position

on the entire underframe, runs through the entire underframe along a longitudinal direction of the underframe, and is to be connected to a coupler buffer apparatus and a bogie.

5 [0007] There are at least two first crossbeam modules respectively located at two ends of the entire underframe, disposed along a transverse direction of the underframe, and fixed to the center beam module through fasteners.

10 [0008] There are at least two sleeper beam modules located near the two ends of the underframe, disposed along the transverse direction of the underframe, and fixed to the center beam module through fasteners, and the sleeper beam module is connected to the bogie.

15 [0009] There are at least two edge beam modules respectively located on two sides of the center beam module and configured to connect two adjacent modules through fasteners.

20 [0010] In further technical solutions, a first crossbeam module is further provided at a middle part of the underframe and is located between the two sleeper beam modules.

25 [0011] In further technical solutions, the flatcar underframe for railway freight further includes a second crossbeam module located at a middle part of the underframe and fixed to the center beam module. A number of second crossbeam modules is determined according to a length of the vehicle and a need of mounting a container.

30 [0012] In further technical solutions, the center beam module includes an impact seat, a center beam, and an upper center pan. The center beam is provided with a sleeper beam module interface and a first crossbeam module interface, and a length of the center beam is adjustable as required. The upper center pan is located at a lower part of the center beam and is to be connected to the bogie. The impact seat is located at two ends of the center beam and is to be connected to the coupler buffer apparatus.

35 [0013] Further, a second crossbeam module interface is further provided on the center beam for connection to the second crossbeam module.

40 [0014] In further technical solutions, a container lock is disposed on the top of the first crossbeam module, the container lock being located near an end of the crossbeam module, and a standard interface is disposed at a middle part of the first crossbeam module for connection to the center beam module.

45 [0015] In further technical solutions, the sleeper beam module is assembled and welded into a box-shaped structure by using plates, and a standard interface is disposed at a middle part of the sleeper beam module for connection to the center beam module.

50 [0016] In further technical solutions, a container lock is disposed on the top of the second crossbeam module, the container lock being located near an end of the crossbeam module, and a standard interface is disposed at a middle part of the second crossbeam module for connection to the center beam module.

55 [0017] A second inventive purpose of the present in-

vention is to provide a complete-vehicle structure, including the above flatcar underframe for railway freight, bogie, and coupler buffer apparatus. The coupler buffer apparatus is mounted on two ends of the underframe, and the bogie is disposed at a lower part of the underframe and connected to the underframe.

[0018] Advantages of the present invention are as follows:

The modular assembled underframe provided in the present invention means to design a railway wagon underframe into five smaller standardized modules: a center beam module, a first crossbeam module, a sleeper beam module, a second crossbeam module, and an edge beam module.

[0019] During vehicle transportation, the underframe may be disassembled into smaller standard modules, to facilitate transportation and reduction of costs.

[0020] The modules are connected by using a uniform interface size and fasteners that may be repeatedly assembled and disassembled, to achieve interchange between modules of a same type and modular assembly of the underframe.

[0021] A length of the underframe may be adjusted by adjusting a length of the center beam module, so as to meet transportation needs of cargo or containers of different lengths.

[0022] The underframe is assembled with standard modules after production, helping increase an underframe manufacturing speed and reduce vehicle manufacturing costs.

[0023] Compared with the prior art, the mechanism has a novel structure, a light weight, and a simple structure, and is easily operated and maintained.

BRIEF DESCRIPTION OF THE DRAWINGS

[0024] The drawings of the specification forming a part of this application are used to provide further understanding of this application, and the exemplary embodiments and descriptions of this application are used to explain this application but do not constitute an improper limitation on this application.

FIG. 1 is a schematic structural diagram of a modular assembled underframe according to the present invention;

FIG. 2, FIG. 3, and FIG. 4 are schematic diagrams of modular assembled underframe of different assembly lengths according to the present invention; FIG. 5 is a schematic structural diagram of a complete vehicle adopting a modular assembled underframe according to the present invention;

FIG. 6 is a schematic structural diagram of a center beam module shown in FIG. 1;

FIG. 7 is a schematic structural diagram of a first crossbeam module shown in FIG. 1;

FIG. 8 is a schematic structural diagram of a sleeper beam module shown in FIG. 1;

FIG. 9 is a schematic structural diagram of a second crossbeam module shown in FIG. 1; and

FIG. 10 is a schematic structural diagram of interface assembling between modules.

[0025] In the figures: 1: Center beam module; 2: First crossbeam module; 3: Sleeper beam module; 4: Second crossbeam module; 5: Edge beam module; 6: Coupler buffer apparatus; 7: Bogie;

101: Center beam; 102: Upper center pan; 103: Impact seat; 104: Module interface; 105: Module interface;

201: Support frame; 202: Container lock; 203: First crossbeam module interface; 204: Module interface; 401: Support frame; 402: Second crossbeam module interface; 403: Container lock.

DETAILED DESCRIPTION

[0026] It should be pointed out that the following detailed descriptions are all illustrative and are intended to provide further descriptions of this application. Unless otherwise indicated, all technical terms and scientific terms used herein have the same meaning as commonly understood by those of ordinary skill in the art to which this application belongs.

[0027] It should be noted that the terms used herein are merely for describing specific implementations, and are not intended to limit exemplary implementations according to this application. Unless clearly indicated in the context, singular forms used herein are also intended to include plural forms. In addition, it should be further understood that terms "including" and/or "comprising" used in this specification indicate that there are features, steps, operations, devices, assemblies, and/or combinations thereof.

[0028] For ease of description, words "up", "down", "left", and "right" appearing in the present invention merely mean that they are consistent with the up, down, left, and right directions of the drawings themselves, and do not limit the structure. They are merely for the convenience of describing the present invention and simplifying the description, rather than indicating or implying that the device or the element referred to needs to have a specific orientation, be constructed and operated in a specific orientation, and therefore cannot be understood as a limitation on the present invention.

[0029] Term explanation: terms such as "mounted", "connected", and "fixed", etc. in the present invention should be understood in a broad sense, for example, fixed connection, detachable connection, integral connection, mechanical connection, electrical connection, direct connection, indirect connection through an intermediation, internal connection between two elements, or an interaction relationship between two elements. In other words, specific meaning of the above terms in the present invention may be understood according to a spe-

cific situation.

[0030] As described in the background, an underframe of an existing railway flatcar adopts a welded integral structure, and the underframe of the vehicle after completion of production of the underframe has a fixed size and cannot be disassembled and adjusted. For cargo containers of different sizes, when a vehicle with a fixed underframe is used for transportation, the underframe may be incapable of loading as a result of a relatively short transportation space, or a waste of transportation space may be caused as a result of an ample transportation space of the underframe, seriously affecting transportation efficiency and a transportation volume of railway transportation. For railway flatcars to be exported, because the underframe cannot be disassembled, long-distance sea transportation can be achieved through only complete-vehicle transportation, resulting in a large space occupied by the vehicle and high transportation costs. In order to resolve the above technical problems, this application discloses a railway modular assembled underframe and a whole vehicle structure. The underframe mainly includes a center beam module, a first crossbeam module, a sleeper beam module, a second crossbeam, and an edge beam module. The center beam module is at a middle position on the entire underframe, runs through the entire underframe, and is connected to a coupler buffer apparatus and a bogie. The coupler buffer apparatus and the bogie are mature technologies of railway freight wagon. The first crossbeam module is located at two ends of the underframe and is fixed to the center beam module through fasteners. The sleeper beam module is located at two ends of the center beam module, fixed to the center beam module through fasteners, and connected to the bogie. The second crossbeam module is located at the middle part of the underframe and is fixed to the center beam module. A number of second crossbeam modules is determined according to a length of the vehicle and a need of mounting a container. The edge beam module connects two adjacent modules through fasteners.

Embodiment 1

[0031] In a typical implementation of this present application, as shown in FIG. 1, the modular assembled underframe provided in the embodiment of the present invention includes a center beam module 1, a first crossbeam module 2, a sleeper beam module 3, a second crossbeam module 4, and an edge beam module 5; The center beam module 1 is at a middle position on the entire underframe, runs through the entire underframe along a longitudinal direction of the underframe, and is to be connected to a coupler buffer apparatus and a bogie.

[0032] There are at least two first crossbeam modules 2 respectively located at two ends of the entire underframe, disposed along a transverse direction of the underframe, and fixed to the center beam module 1 through

fasteners.

[0033] There are at least two sleeper beam modules 3 located near the ends of the entire underframe, disposed along the transverse direction of the underframe, and fixed to the center beam module through fasteners, and the sleeper beam module is connected to the bogie.

[0034] There are at least two edge beam modules 5 respectively located on two sides of the center beam module and configured to connect two adjacent modules through fasteners.

[0035] The second crossbeam module 4 is located at the middle part of the underframe and is transversely fixed to the center beam module. A number of second crossbeam modules is determined according to a length of the vehicle and a need of mounting a container.

[0036] As shown in FIG. 2, a complete modular assembled underframe consists of at least one center beam module 1, two first crossbeam modules 2, and two sleeper beam modules 3, which form a rigid entirety after connection to support weights of the vehicle and to-be-transported cargo.

[0037] Further, center beam modules 1 of different lengths may be selected based on FIG. 2, and second crossbeam modules 4 of a specific number and edge beam modules 5 of a specific number are connected to adjust an overall length of the underframe. Specifically, as shown in FIG. 3 and FIG. 4, in FIG. 3, two edge beam modules 5 and one second crossbeam module 4 are added, and one first crossbeam module 2 is also added between the second crossbeam module 4 and the sleeper beam module 3, and in FIG. 4, two edge beam modules 5 and three second crossbeam module 4 are added, and one first crossbeam module 2 is also added between the second crossbeam module 4 and the sleeper beam module 3.

[0038] As shown in FIG. 6, the above center beam module 1 includes a center beam 101, an upper center pan 102, an impact seat 103, a module interface 104, and a module interface 105. The center beam 101 adopts a steel plate-welded box structure. The upper center pan 102 is fixed at a lower part of the center beam 101 for connection to the bogie 4. Further, there are two upper center pans 102 symmetrically arranged at the bottom of the center beam 101 and near two ends of the center beam. One impact seat 103 is fixed at each of the two ends of the two center beams 101. The impact seat 103 is to be connected to the coupler buffer apparatus 6.

[0039] The upper center pan 102 and the impact seat 103 are detachably mounted on the center beam 101. For specific structures of the upper center pan 102 and the impact seat 103, refer to the prior art, and the specific structures are not an innovation point of this application. Therefore, details are not described herein again. Further, alternatively, the upper center pan 102 and the impact seat 103 are directly welded on the center beam 101, which may be specifically selected according to an actual situation.

[0040] Moreover, the module interface 104 and the

module interface 105 are generally directly welded on the center beam 101, and may be detachably connected to the center beam in a special case. The module interface 104 and the module interface 105 are fixed on two sides of the center beam 101. The module interface 105 is configured to fix the second crossbeam module 4. The module interface 104 is configured to fix the first crossbeam module 2 and the sleeper beam module 3.

[0041] As shown in FIG. 7, the first crossbeam module 2 includes a support frame 201, a container lock 202, and a first crossbeam module interface 203. Two ends of the support frame 201 are each provided with one container lock 202. The container lock 202 is configured to fix a container. The container lock 202 is connected to the end of the support frame 201 through one pin.

[0042] The first crossbeam module interface 203 matches the module interface 104, and the two are connected through fasteners. The fasteners herein may be selected as existing bolt connection or may adopt other fastener connection, as long as a connection function is implemented.

[0043] The first crossbeam module interface 203 is generally directly welded on the support frame 201, and may be detachably connected to the support frame 201 in a special case.

[0044] In addition, for a shape and a structure of the support frame 201, refer to an existing structure.

[0045] As shown in FIG. 8, the sleeper beam module 3 is formed by a steel plate-welded box structure, or is formed in other forming manners, for example, is integrally formed, and is connected to the center beam module 1 through fasteners. For a shape and a structure of the sleeper beam module 3, refer to an existing structure.

[0046] Further, the fasteners herein may be selected as existing bolt connection or may adopt other fastener connection, as long as a connection function is implemented.

[0047] As shown in FIG. 9, the second crossbeam module 4 includes a support frame 401, a container lock 403, and a second crossbeam module interface 402. The top of the support frame 401 is provided with two container locks 403, and the container locks 403 are located near two ends of the support frame. The container lock 402 is connected to the end of the support frame 401 through one pin. For details, refer to the drawings.

[0048] The second crossbeam module interface 402 matches the module interface 105 of the center beam module 1, and the two are connected through fasteners to connect the second crossbeam module and the center beam module. The second crossbeam module interface 402 is generally directly welded on the support frame 401, and may be detachably connected to the support frame 401 in a special case.

[0049] Further, the fasteners herein may be selected as existing bolt connection or may adopt other fastener connection, as long as a connection function is implemented.

[0050] As shown in FIG. 10, the center beam module

1 and the second crossbeam module 4, and the second crossbeam module 4 and the edge beam module 5 are all connected through fasteners to ensure that the modules can be repeatedly assembled. A module interface structure between the center beam module 1 and the first crossbeam module 2 is similar to a module interface structure between the center beam module 1 and the sleeper beam module 3, and details are not described herein again.

[0051] Further, in this embodiment, the coupler buffer apparatus and the bogie are existing mature railway wagon technologies, and therefore are not described in detail in this embodiment again.

Embodiment 2

[0052] This embodiment provides a complete-vehicle structure including the railway modular assembled underframe in Embodiment 1. Specifically, as shown in FIG. 5, the complete-vehicle structure includes a center beam module 1, four first crossbeam modules 2, two sleeper beam modules 3, one second crossbeam module 4, two bogies 7, and two coupler buffer apparatuses 6. The second crossbeam module 4 is mounted at the middle part of the center beam module 1. The two first crossbeam modules 2 are disposed on two ends of the center beam module 1, the two sleeper beam modules 3 are disposed near the end of the center beam module 1, and one first crossbeam module 2 is provided between each of the sleeper beam modules 3 and the second crossbeam module 4. The first crossbeam module 2, the sleeper beam module 3, and the second crossbeam module 4 are connected to the center beam module 1 through each module interface.

[0053] One coupler buffer apparatus 6 is respectively mounted on each of the two ends of the center beam module 1, and a lower part of the center beam module 1 and the sleeper beam module 3 are both connected to the bogie 7.

[0054] It should be noted herein that the coupler buffer apparatus 6 and the bogie 7 are existing mature railway wagon technologies, and therefore are not described in this patent.

[0055] Finally, it should be noted that the above embodiments are merely for describing and not intended to limit the technical solutions of the present invention. Although the present invention has been described in detail with reference to the above embodiments, those of ordinary skill in the art should understand that they can still make modifications to the technical solutions recited in the above embodiments or make equivalent replacements to a part or all of the technical features thereof; and the modifications or replacements do not cause essence of the corresponding technical solutions to depart from the scope of the technical solutions of the embodiments of the present invention.

[0056] The above descriptions are merely exemplary embodiments of this application and are not intended to

limit this application. For those skilled in the art, this application may have various modifications and changes. Any modification, equivalent replacement, and improvement made without departing from the scope and the principle of this application shall fall within the protection scope of this application.

Claims

1. A flatcar underframe for railway freight, comprising: a center beam module, a first crossbeam module, a sleeper beam module, and an edge beam module, wherein the center beam module is at a middle position on the entire underframe, runs through the entire underframe along a longitudinal direction of the underframe, and is to be connected to a coupler buffer apparatus and a bogie; there are at least two first crossbeam modules respectively located at two ends of the entire underframe, disposed along a transverse direction of the underframe, and fixed to the center beam module through fasteners; there are at least two sleeper beam modules located near the two ends of the underframe, disposed along the transverse direction of the underframe, and fixed to the center beam module through fasteners, wherein the sleeper beam module is to be connected to the bogie; and there are at least two edge beam modules respectively located on two sides of the center beam module and configured to connect two adjacent modules through fasteners.
2. The flatcar underframe for railway freight according to claim 1, wherein a first crossbeam module is further provided at a middle part of the underframe and is located between the two sleeper beam modules.
3. The flatcar underframe for railway freight according to claim 1, further comprising a second crossbeam module located at a middle part of the underframe and fixed to the center beam module.
4. The flatcar underframe for railway freight according to claim 3, wherein a number of second crossbeam modules is determined according to a length of the vehicle and a need of mounting a container.
5. The flatcar underframe for railway freight according to claim 1, wherein the center beam module comprises an impact seat, a center beam, and an upper center pan; and the center beam is provided with a sleeper beam module interface and a first crossbeam module interface, and a length of the center beam is adjustable as required, wherein the upper center pan is located at a lower part of the center

beam and is to be connected to the bogie; and the impact seat is located at two ends of the center beam and is to be connected to the coupler buffer apparatus.

- 5
6. The flatcar underframe for railway freight according to claim 5, wherein a second crossbeam module interface is further provided on the center beam.
- 10
7. The flatcar underframe for railway freight according to claim 1, wherein a container lock is disposed on the top of the first crossbeam module, the container lock being located near an end of the crossbeam module, and a standard interface is disposed at a middle part of the first crossbeam module for connection to the center beam module.
- 15
8. The flatcar underframe for railway freight according to claim 1, wherein the sleeper beam module is assembled and welded into a box-shaped structure by using plates, and a standard interface is disposed at a middle part of the sleeper beam module for connection to the center beam module.
- 20
9. The flatcar underframe for railway freight according to claim 1, wherein a container lock is disposed on the top of the second crossbeam module, the container lock being located near an end of the crossbeam module, and a standard interface is disposed at a middle part of the second crossbeam module for connection to the center beam module.
- 25
- 30
10. A complete-vehicle structure, comprising: the above flatcar underframe for railway freight, bogie, and coupler buffer apparatus, wherein the coupler buffer apparatus is mounted on two ends of the underframe, and the bogie is disposed at a lower part of the underframe and connected to the underframe.
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- 40
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- 55

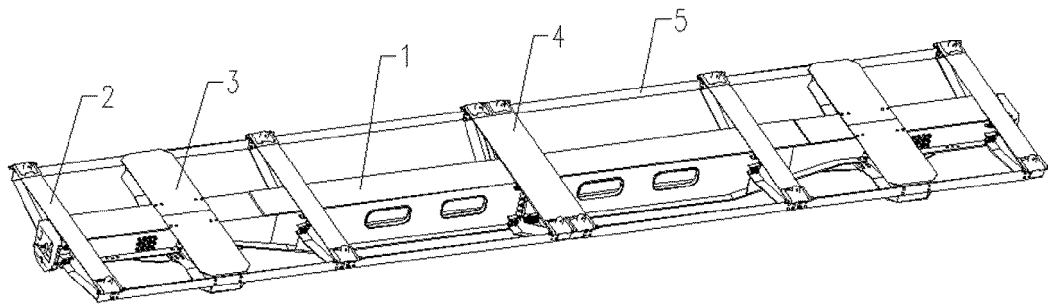


FIG. 1

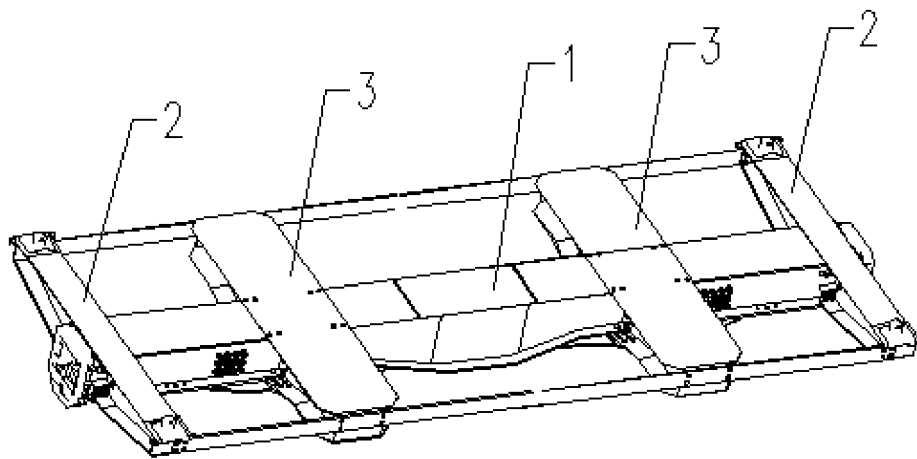


FIG. 2

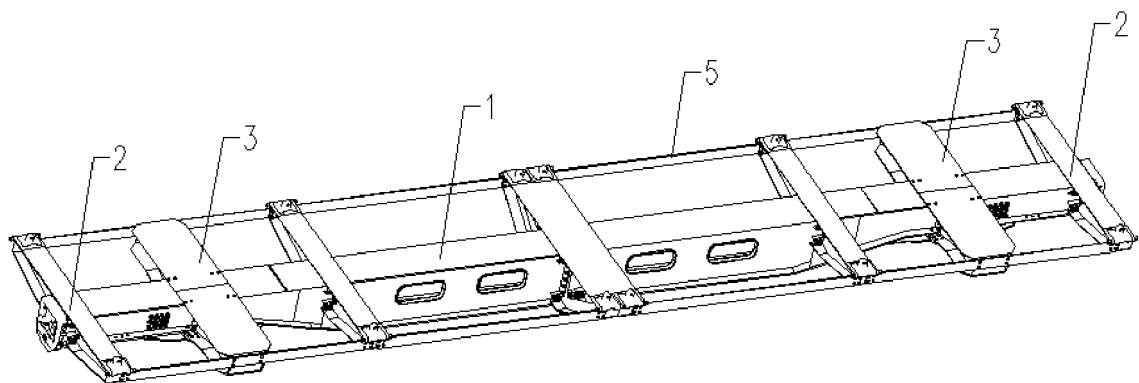


FIG. 3

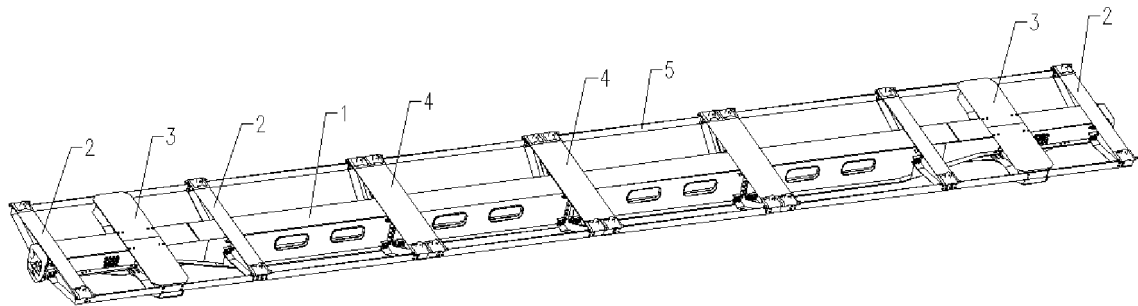


FIG. 4

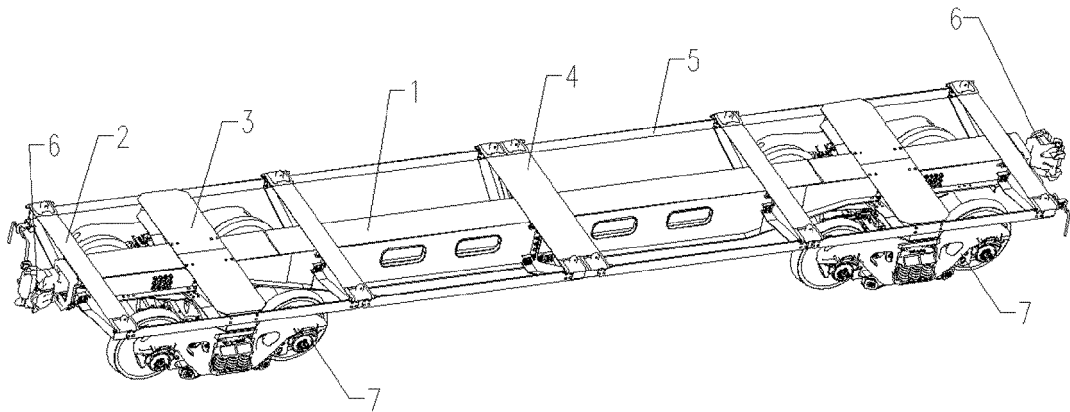


FIG. 5

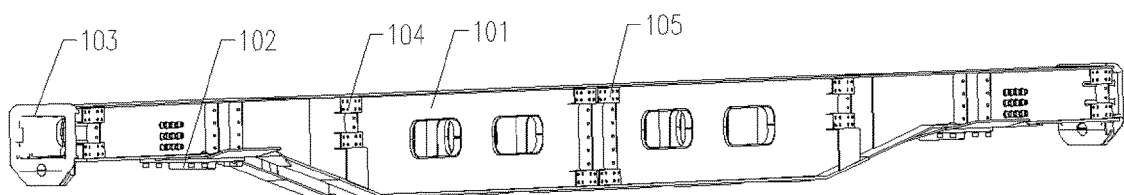


FIG. 6

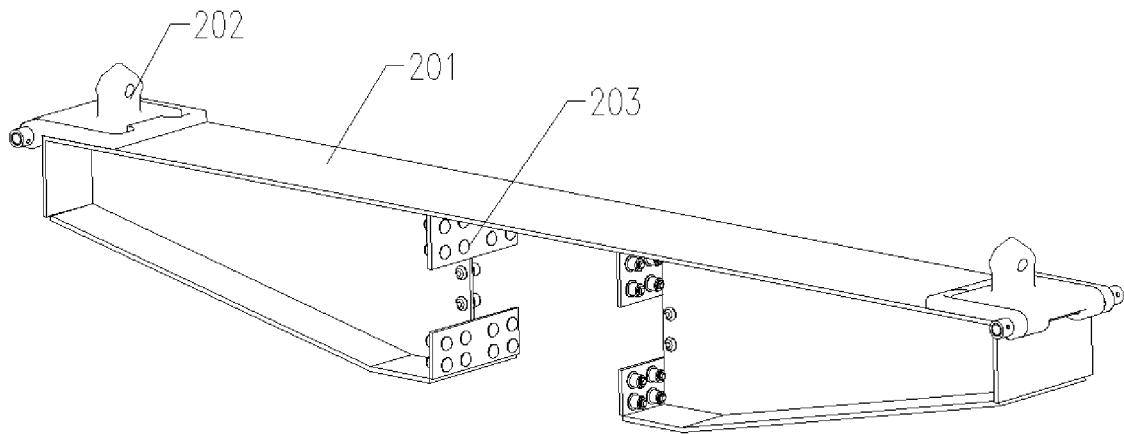


FIG. 7

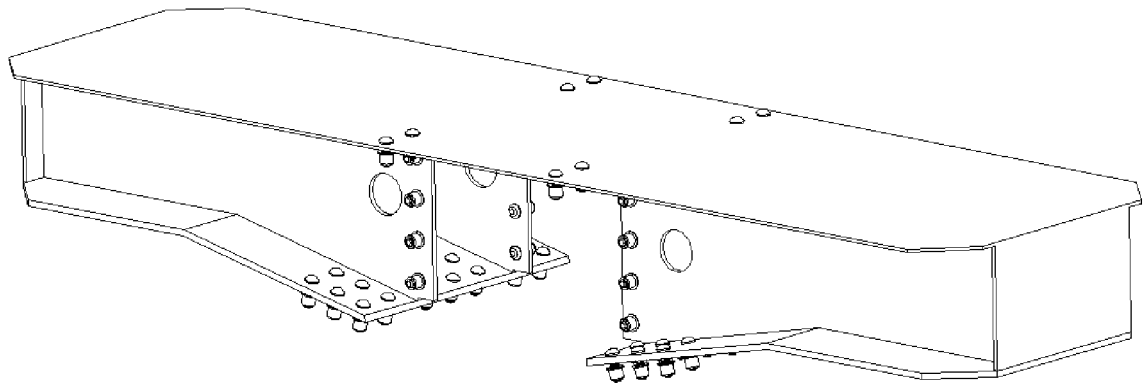


FIG. 8

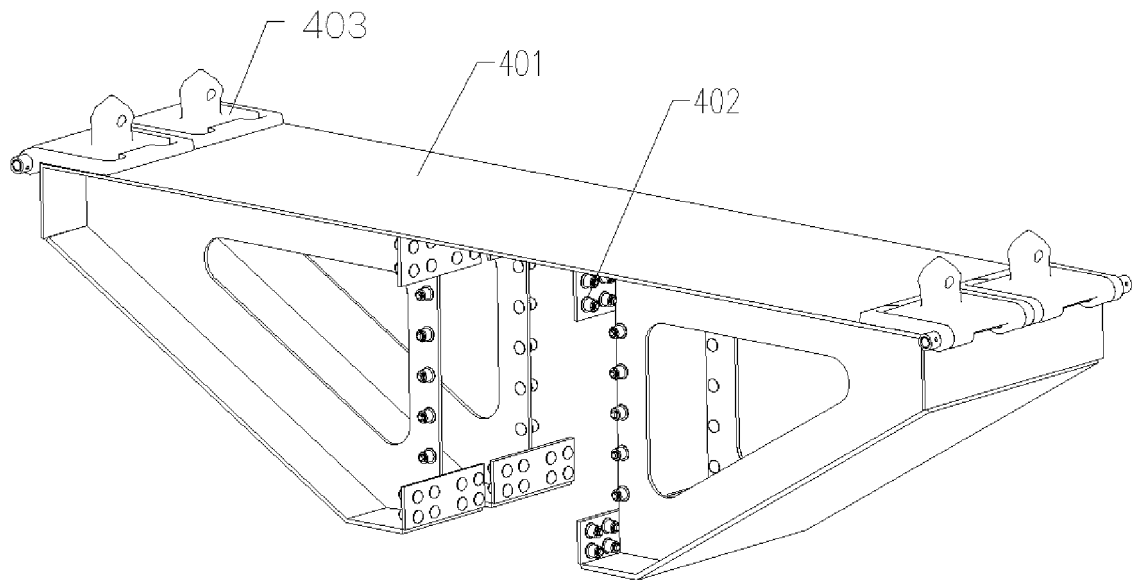


FIG. 9

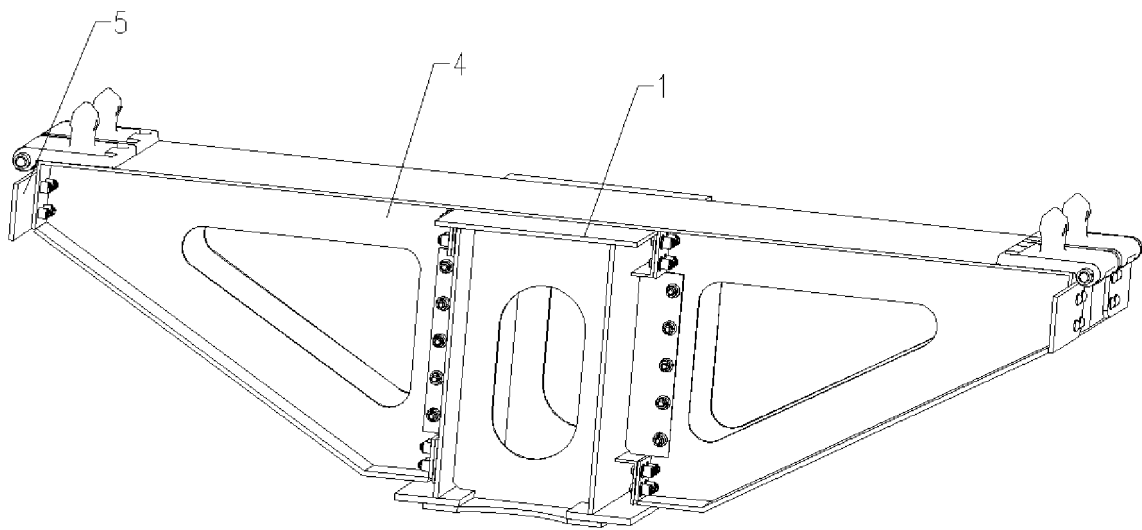


FIG. 10

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2019/087155

A. CLASSIFICATION OF SUBJECT MATTER

B61F 1/02(2006.01)i; B61D 3/16(2006.01)n; B61D 3/20(2006.01)n

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 B61D

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; CNTXT; USTXT; EPTXT; WOTXT; CNKI: 中车, 紧固件, 平车, 底架, 模块, 拼装, 拆解, 拆分, 调节, fastener, flat, car, platform, underframe, module, tinertoy, separat+, adjust+

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	CN 106740908 A (CRRC SHANDONG CO., LTD.) 31 May 2017 (2017-05-31) description, paragraphs [0025]-[0040], figures 1-10	1-10
Y	CN 109229121 A (CRRC QIQIHAR CO., LTD.) 18 January 2019 (2019-01-18) description, paragraphs [0041]-[0045], figures 1-4	1-10
A	CN 103465921 A (CSR ERQI CO., LTD.) 25 December 2013 (2013-12-25) entire document	1-10
A	US 2788750 A (UNITED STATES STEEL CORP) 16 April 1957 (1957-04-16) entire document	1-10
A	US 3003436 A (PULLMAN INC) 10 October 1961 (1961-10-10) entire document	1-10

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

* Special categories of cited documents:

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Date of the actual completion of the international search

02 July 2019

Date of mailing of the international search report

09 January 2020

Name and mailing address of the ISA/CN

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/CN2019/087155

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
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