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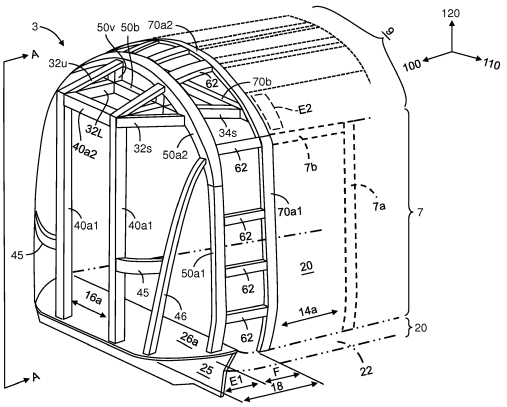
(54) RAILWAY VEHICLE PROVIDED WITH COLLISION ENERGY ABSORPTION STRUCTURE

(57) A collision energy absorption device that absorbs a large collision energy has a drawback in that a large collapse load tends to occur, and that passengers tends to receive impact during initial collapse of the collision energy absorption device.

A railway vehicle provided with a collision energy absorption structure configured to absorb collision energy is provided, wherein a body of the railway vehicle includes an underframe constituting a floor surface, side structure bodies having entrances on both end portions in a width direction of the underframe, a first end portion floor disposed at an end portion in a longitudinal direction of the underframe, a gangway frame standing on an upper surface at a front end portion of the first end portion floor, a horseshoe-shaped first frame standing on an upper surface of the first end portion floor at a center portion side in the longitudinal direction of the underframe of the gangway frame, and a horseshoe-shaped second frame standing on an upper surface of the underframe at a center portion side in the longitudinal direction of the underframe of the first frame, wherein the railway vehicle includes an entrance provide on the side structure body adjacent to the second frame, a first beam group connecting an upper portion of the gangway frame and an upper portion of the first frame, a second beam connecting an upper portion of the first frame and an upper portion of the second frame, and a collapse area provided on the side structure body on an upper portion of the entrance.

FIG. 2



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Description

Technical Field

[0001] The present invention relates to a railway vehicle provided with a collision energy absorption structure that absorbs collision energy by plastic deformation of a part of the railway vehicle when the railway vehicle collides against an obstacle.

Background Art

[0002] A body of a railway vehicle includes an underframe constituting a floor surface, side structure bodies standing on both end portions in a width direction of the underframe and forming side walls of the body, an end structure body standing on both end portions in a longitudinal direction of the underframe, and a roof structure body arranged on an upper end portion of the side structure bodies and the end structure body and constituting a roof of the body.

[0003] The underframe includes a pair of side beams disposed along a longitudinal direction on both end portions in the width direction of the underframe, and side beams disposed along a width direction on both end portions in the longitudinal direction of the underframe. A body bolster is provided at a position separated by a predetermined distance from the side beam toward the center portion in the longitudinal direction of the underframe in a manner bridged between the pair of side beams and along the end beam. A pair of center beams having a coupler is disposed between the side beams and the center portion of the body bolster.

[0004] A bogie that moves along a track is disposed on a lower surface on both end portions in the longitudinal direction of the body, and a center pin being the center of revolution of the bogie is disposed in a manner suspended downward from the center portion in the width direction of the body bolster. The bogie and the center pin are connected via a traction device, and traction force during acceleration or brake force during deceleration are transmitted via the center pin to the body bolster. Further, when multiple railway vehicles are connected to form a train formation, tensile load and compressive load from an adjacent railway vehicle are transmitted via the coupler to the center beams constituting the underframe, so that the underframe including the body bolster and the center beams has a strong rigidity.

[0005] When the railway vehicle collides against an obstacle, since the underframe constituting the floor surface of the body has a high rigidity, plastic deformation of the underframe absorbing the collision energy and relieving the impact to the passengers and crew (hereinafter referred to as passengers and the like) cannot be expected, and impact may be applied on the passengers and the like.

[0006] Therefore, patent literature 1 (Japanese Patent Application Laid-Open Publication No. 2007-326550) teaches a technique for reliving the impact applied on the passengers and the like caused by collision, by providing a collision energy absorption device for absorbing collision energy by plastic deformation when the railway collides against an obstacle on the end beam of the underframe.

Summary of Invention

Technical Problem

[0007] An amount of absorption of collision energy of a collision energy absorption device (Patent Literature 1: Japanese Patent Application Laid-Open Publication No. 2007-326550) is given by the product of collapse load and collapse quantity (collapse dimension in the longitudinal direction). Therefore, in a collision energy absorption device absorbing a large amount of collision energy, the collapse load becomes large, and the passengers and the like may receive impact during initial collapse of the collision energy absorption device.

[0008] The object of the present invention is to provide a railway vehicle having a collision energy absorption structure capable of relieving the impact during collision.

Solution to Problem

[0009] The above object can be realized by a railway vehicle provided with a collision energy absorption structure configured to absorb collision energy, a body of the railway vehicle including an underframe constituting a floor surface, side structure bodies having entrances on both end portions in a width direction of the underframe, a first end portion floor disposed on an end portion in a longitudinal direction of the underframe, a gangway frame standing on an upper surface at a front end portion of the first end portion floor, a horseshoe-shaped first frame standing on an upper surface of the first end portion floor at a center portion side in the longitudinal direction of the underframe of the gangway frame, and a horseshoe-shaped second frame standing on an upper surface of the underframe at a center portion side in the longitudinal direction of the underframe of the first frame, wherein the railway vehicle includes an entrance provide on the side structure body adjacent to the second frame, a first beam group connecting an upper portion of the gangway frame and an upper portion of the first frame, a second beam connecting an upper portion of the first frame and an upper portion of the second frame, and a collapse area provided on the side structure body on an upper portion of the entrance.

Advantageous Effects of Invention

[0010] The present invention enables to provide a railway vehicle having a collision energy absorption structure capable of relieving impact during collision. Brief Description of Drawings

FIG. 1 is a side view of one example of a railway vehicle having a gangway disposed at a head portion.

FIG. 2 is a perspective view of a framework of a railway vehicle (refer to FIG. 1) having a collision energy absorption structure disposed at the head portion.

FIG. 3 is a vertical cross-sectional view (A-A cross-section of FIG. 2) of a direction along a longitudinal direction of the railway vehicle having the collision energy absorption structure disposed at the head portion.

FIG. 4 is a horizontal cross-sectional view (B-B cross-section of FIG. 1) at a floor surface height of the railway vehicle having the collision energy absorption structure disposed at the head portion.

FIG. 5 is a vertical cross-sectional view (C-C cross-section of FIG. 3) along a width direction of the head portion of the railway vehicle having the collision energy absorption structure.

FIG. 6 is a horizontal cross-sectional view (D-D cross-section of FIG. 5) of an upper end portion height of a gangway frame of the railway vehicle having the collision energy absorption structure disposed at the head portion.

Description of Embodiments

[0011] Now, an embodiment of a railway vehicle according to the present invention will be described with reference to the drawings. At first, directions related to the railway vehicle referred to in the present description are defined as a longitudinal direction (rail direction) 100 of a railway vehicle 1, a width direction (sleeper direction) 110 of the railway vehicle 1, and a height direction 120 of the railway vehicle 1 intersecting with the longitudinal direction 100 and the width direction 110. The above-defined directions are referred to as the longitudinal direction 100, the width direction 110 and the height direction 120 in the following description.

[0012] Further, a direction toward a center portion in the longitudinal direction 100 from an end portion (side having a coupler 4) in the longitudinal direction 100 of the railway vehicle 1 is referred to as rearward, and similarly, a displacement (movement) toward the center portion in the longitudinal direction 100 of the railway vehicle 1 is referred to as retreat.

[0013] FIG. 1 is a side view illustrating one example of a railway vehicle having a gangway provided on a head portion. A body 3 of the railway vehicle 1 includes an underframe 20 constituting a floor surface, a side structure body 7 standing on both end portions in the width direction 100 of the underframe 20, a rounded end structure body 18 standing on one end portion in the longitudinal direction 100 of the underframe 20 and including a driver's cab, a (flat) end structure body (not shown) standing on the other end portion, and a roof structure body 9 mounted on an upper end portion of the end structure bodies (18) and the side structure body 7.

[0014] The rounded end structure body 18 includes a collapse area (crushable zone) E1 as a range collapsed during collision, and a non-collapse area (survival zone) F that is not collapsed during collision and tries to retain the form prior to collision (refer to FIGs. 2 and 3).

[0015] The rounded end structure body 18 including a driver's seat (crew's room) is also equipped with a gangway 16a (refer to FIG. 2) configured for example of a gangway frame 40 through which passengers and the like move to an adjacent car, and a bellows-shaped gangway hood 16b. The side structure body 7 includes windows providing lighting and natural ventilation, a crew entrance 14a through which the crew board and alight the vehicle, and a passenger entrance 14b through which passengers board and alight the vehicle. Further, the railway vehicle 1 includes a bogie 5 disposed below both end portions in the longitudinal direction 100 of the body 3 that moves along a track.

[0016] FIG. 2 is a perspective view of a framework of the railway vehicle (refer to FIG. 1) having a collision energy absorption structure disposed at the head portion, and FIG. 3 is a vertical cross-sectional view (A-A cross-section of FIG. 2) in a direction along the longitudinal direction of the railway vehicle having the collision energy absorption structure disposed at the head portion. FIG. 4 is a horizontal cross-sectional view (B-B cross-section of FIG. 1) of a floor surface height of the railway vehicle having the collision energy absorption structure disposed at the head portion, and FIG. 5 is a vertical cross-sectional view (C-C cross-section of FIG. 3) along the width direction at the head portion of the railway vehicle having the collision energy absorption structure. Further, FIG. 6 is a horizontal cross-sectional view (D-D cross-section of FIG. 5) taken at an upper end portion height of the gangway frame of the railway vehicle having the collision energy absorption structure disposed at the head portion.

[0017] The underframe 20 (refer to FIG. 4) is mainly composed of of side beams 22 arranged along the longitudinal direction 100 at both end portions in the width direction 110, an end beam 25 arranged along the width direction 110 at one end portion in the longitudinal direction 100, a body bolster 21 having the bogie 5 (refer to FIG. 1) arranged therebelow, a pair of center-portion center beams 23 connecting the center portion in the width direction 110 of the end beam 25 and the center portion in the width direction 110 of the body bolster 21, a pair of end-portion center beams 24 connecting both end portions in the width direction 110 of the end beam 25 and both end portions in the width direction 110 of the body bolster 21, and a second end-portion floor 26b laid between the side beams 22.

[0018] The coupler 4 (refer to FIG. 1) disposed below the gangway 16a and an impact absorber (not shown) connected to the coupler 4 are provided on the center-portion center beam 23, relieving the impact caused when the railway vehicle 1 connects to other cars or the vibration in the longitudinal direction 100 when the railway vehicle 1 accelerates or decelerates.

[0019] On both end portions in the width direction 110 of the end beam 25 (refer to FIG. 4) are disposed a pair of energy absorption devices 90 in a cantilever state along the longitudinal direction 100. Similarly, on the center portion in the width direction 110 of the end beam 25 are disposed a pair of lower beams 30 in a cantilever state along the longitudinal direction 100. The lower beams 30 are fixed for example by welding to the end beam 25 in a continuous manner to the center-portion center beams 23. A substantially semicircular first end floor 26a is disposed on the upper surface of the lower beams 30 and an upper edge of the end beam 25 (refer to FIGs. 3 and 4).

[0020] The gangway frame 40 (a gangway frame column 40a1) to which the gangway hood 16b (refer to FIG. 1) is fixed is disposed on an upper surface at the end portion (front end edge) in the longitudinal direction 100 of the first end floor 26a, and horseshoe-shaped first frame 50 and second frame 70 are disposed in the named order toward the center portion in the longitudinal direction 100 (refer to FIG. 2). The first frame 50 is disposed on an upper surface of the first end floor 26a, and the second frame 70 is disposed on an upper surface of the second end-portion floor 26b (refer to FIG. 3).

[0021] The gangway frame 40 is composed of a pair of gangway frame columns 40a1 standing on an end portion (front end edge) in the longitudinal direction 100 of the first end floor 26a and a gangway frame horizontal beam 40a2 bridged between upper end portions of the gangway frame columns 40a1.

[0022] The first frame 50 is composed of first frame columns 50a1 standing on both end portions in the width direction 110 of the first end floor 26a, and an arch-shaped first frame arc beam 50a2 bridged across the upper end portions of the first frame columns 50a1. Similarly, the second frame 70 is composed of second frame columns 71a1 standing on both end portions in the width direction 110 of a second end floor (underframe) 26b, and an arch-shaped second frame arc beam 70a2 bridged across the upper end portion of the second frame columns 71a1 (refer to FIGs. 2 and 3).

[0023] The first frame arc beam 50a2 includes a first frame horizontal beam 50b with a form similar to a bowstring stretched substantially horizontally in an arc, wherein a pair of first frame upper columns 50v standing in the height direction 120 on the upper surface of the first frame horizontal beam 50b connects the lower surface of the first frame arc beam 50a2 and the upper surface of the first frame horizontal beam 50b. Similarly, the second frame arc beam 70a2 has a second frame horizontal beam 70b with a form similar to a bowstring stretched substantially horizontally in an arc (refer to FIG. 2).

[0024] An upper portion of the gangway frame 40 and an upper portion of the first frame 50 are connected by a first beam group, wherein the first beam group consists of a pair of first vertical oblique beams 32u, a pair of first longitudinal beams 32L, and a pair of first horizontal oblique beams 32s. The first vertical oblique beams 32u connect the upper end portion of the gangway frame column 40a1 (both end portions of the gangway frame horizontal beam 40a2) and the connection portions between the first frame arc beam 50a2 and the first frame upper columns 50v in an obliquely arranged manner within a substantially vertical plane.

[0025] The first longitudinal beams 32L connect upper end portions of the gangway frame columns 40a1 (both end portions of the gangway frame horizontal beam 40a2) and the connection portions between the first frame horizontal beam 50b and the first frame upper columns 50v in a manner arranged along the longitudinal direction 100.

[0026] The first horizontal oblique beams 32s connect upper end portions of the gangway frame columns 40a1 (both end portions of the gangway frame horizontal beam 40a2) and the connection portions between the first frame arc beam 50a2 and the first frame horizontal beam 50b in an oblique arrangement within a substantially horizontal plane.

[0027] The first frame 50 and the second frame 70 are connected by a plurality of beams 62 arranged along an outer side surface of the vehicle of the roof structure body 9 and the side structure body 7 in the longitudinal direction 100 (refer to FIGs. 2 and 3). Moreover, the connection portion between the first frame horizontal beam 50b and the first frame upper columns 50v (upper portion of the first frame 50) and the connection portions between the second frame arc beam 70a2 and the second frame horizontal beam 70b (upper portion of the second frame 70) are connected by second beams (second horizontal oblique beams 34s) in an oblique arrangement within a substantially horizontal plane (refer to FIGs. 2 and 6).

[0028] Further, a pair of corner posts 46 standing on the first end floor 26a on both sides in the width direction 110 of the gangway frame 40 in the rounded end structure body 18 and connected to both end portions in the width direction 110 of the first frame arc beam 50a2 are disposed. At the center portions in the height direction 120 of the corner posts 46 are disposed reinforcement members 45 connecting the corner posts 46 and the gangway frame columns 40a1, and constituting a curved surface of the rounded end structure body 18. The driver's cab windows 43 (refer to FIG. 5) is provided above the reinforcement members 45.

[0029] A crew entrance 14a disposed on the side structure body 7 is disposed within a range surrounded by the second frame columns 71a1 constituting the second frame 70, an entrance frame 7b arranged at a distance from the second frame columns 71a1 along the longitudinal direction 100 and standing on the second end-portion floor 26b, and an entrance frame 7a bridged between an upper end portion of the entrance frame 7b and an upper end portion of the second frame columns 71a1 (FIG. 2, FIG. 3).

[0030] A process will now be described where the rounded end structure body 18 collapses while absorbing

impact when the railway vehicle 1 collides against an obstacle on the track or the like. It is assumed that the obstacle is a large-sized road vehicle, such as a truck stalled in a crossing.

[0031] When the railway vehicle 1 collides against an obstacle, the impact is transmitted to the coupler 4 and the folded gangway hood 16b. The impact absorbing mechanism (not shown) connected to the coupler 4 is compressed, and the coupler 4 is retreated toward the center portion in the longitudinal direction 100 of the railway vehicle 1 while absorbing impact.

[0032] Next, along with the retreating of the gangway frame 40 to which the gangway hood 16b is fixed, the energy absorption devices 90 and the lower beams 30 collapse, and the first end floor 26a is subjected to plastic deformation, absorbing the collision energy. At this time, impact force H (refer to FIG. 6) causes the first longitudinal beams 32L bridged between the upper portion of the gangway frame 40 and the first frame horizontal beam 50b, and the first horizontal oblique beams 32s and the first vertical oblique beams 32u bridged between the upper portion of the gangway frame 40 and the first frame arc beam 50a2 to collapse, and the impact force H is transmitted to the first frame 50. The behavior of the respective portions related to the rounded end structure body 18 during collision mentioned above is a phenomenon observed within the range of a collapse area E1 (refer to FIGs. 2 and 4).

[0033] Further, the impact force H transmitted from the upper portion of the gangway frame 40 via the first longitudinal beams 32L and the like to the first frame horizontal beam 50b is further transmitted via the second horizontal oblique beam 34s bridged between the first frame horizontal beam 50b and the second frame horizontal beam 70b (both end portions) to the second frame horizontal beam 70b. The second frame horizontal beam 70b pressed against the second horizontal oblique beams 34s and both end portions in the width direction 110 of a second frame arc floor 70a2 to which the second frame horizontal beam 70b connects causes plastic deformation of collapse areas E2 (refer to FIGs. 2 and 3) disposed at a portion of the side structure bodies 7 on the upper portion of the crew entrances 14a, absorbing the collision energy caused when the railway vehicle 1 collides against an obstacle.

[0034] In other words, the impact force H accompanying the collision with the obstacle is transmitted from the upper portion of the gangway frame 40 via the first beam group to the upper portion of the first frame 50, and further transmitted from the upper portion of the first frame via the second beam to the upper portion of the second frame 70, by which the upper portion of the second frame 70 is strongly pressed rearward. As a result, impact force H is absorbed in the process of plastic deformation of the collapse areas E2 positioned rearward of the upper portion of the second frame 70 and disposed on the side structure bodies 7 above the crew entrances.

[0035] Although not illustrated, the lower beams 30, the first horizontal oblique beams 32s, the first longitudinal beams 32L and the first vertical oblique beams 32u can be formed of extruded shape members formed of aluminum alloy. Further, cuts or slits can be formed to the side surfaces of these beams to facilitate collapse and relieve the impact force (adjust the collapse load).

[0036] Based on the above-mentioned configuration, impact caused by the railway vehicle 1 colliding against an obstacle can be relieved, not only by the process in which a collision energy absorption device 90 collapses, but also by the process in which the member constituting the collapse area E1 formed of components forming the rounded end structure body 18 collapses, so that a railway vehicle having a collision energy absorption structure capable of absorbing a large impact energy and relieving the impact without increasing the collapse load (peak load) can be provided.

[0037] By providing the collapse areas E2 on a portion of the side structure bodies 7 above the crew entrances 14a, the impact (collision energy) when the railway vehicle collides against an obstacle can be absorbed effectively, so that a railway vehicle having a collision energy absorption structure capable of relieving impact acting on the passengers and the like can be provided.

[0038] Further, by providing the collapse areas E2 on a portion of the side structure bodies 7 above the crew entrances 14a, the crew entrances 14a can be prevented from being damaged during collision and evacuation routes can be ensured, so that the crew and the like can evacuate easily through the crew entrances 14a.

Reference Signs List

[0039]

1	Railway vehicle
3	Body
4	Coupler
5	Underframe
7	Side structure body
8	End structure body
9	Roof structure body
14a	Crew entrance
14b	Passenger entrance
16a	Gangway
16b	Gangway hood
18	Rounded end structure body (driver's cab)
20	Underframe
21	Body bolster
22	Side beam
23	Center-portion center beam
24	End-portion center beam
25	End beam
26a	First end floor
26b	Second end floor
30	Lower beam
32L	First longitudinal beam
32s	First horizontal oblique beam

32u	First vertical oblique beam
34s	Second horizontal oblique beam
40	Gangway frame
40a1	Gangway frame column
40a2	Gangway frame horizontal beam
43	Driver's cab window
45	Reinforcement member
46	Corner post
50	First frame
50a1	First frame column
50a2	First frame arc beam
50b	First frame horizontal beam
50v	First frame upper column
62	Beam
70	Second frame
70a1	Second frame column
70a2	Second frame arc beam
70b	Second frame horizontal beam
80a, 80b	Entrance frame
90	Energy absorption device
100	Longitudinal direction
110	Width direction
120	Height direction
H	Impact force

Claims

1. A railway vehicle provided with a collision energy absorption structure configured to absorb collision energy,
a body of the railway vehicle comprising:

an underframe constituting a floor surface;
side structure bodies having entrances on both end portions in a width direction of the underframe;
a first end portion floor disposed at an end portion in a longitudinal direction of the underframe;
a gangway frame standing on an upper surface at a front end portion of the first end portion floor;
a horseshoe-shaped first frame standing on an upper surface of the first end portion floor at a center portion side in the longitudinal direction of the underframe of the gangway frame; and
a horseshoe-shaped second frame standing on an upper surface of the underframe at a center portion side in the longitudinal direction of the underframe of the first frame;

wherein the railway vehicle comprises
an entrance provide on the side structure body adjacent to the second frame,
a first beam group connecting an upper portion of the gangway frame and an upper portion of the first frame,
a second beam connecting an upper portion of the first frame and an upper portion of the second frame, and
a collapse area provided on the side structure body on an upper portion of the entrance.

2. The railway vehicle provided with a collision energy absorption structure according to claim 1,
wherein the first end portion floor is fixed to an end beam provided at an end portion in the longitudinal direction of the underframe and supported by a pair of lower beams provided along the longitudinal direction of the body.

3. The railway vehicle provided with a collision energy absorption structure according to claim 1,
wherein the gangway frame comprises a pair of gangway frame columns standing on an upper surface of the first end portion floor, and a gangway frame horizontal beam bridged between upper end portions of the gangway frame columns,
the first frame comprises a pair of first frame columns standing on an upper surface of the first end portion floor, and a first frame arc beam bridged between upper end portions of the first frame columns, and
the second frame comprises a pair of second frame columns standing on an upper surface of the underframe, and a second frame arc beam bridged between upper end portions of the second frame columns.

4. The railway vehicle provided with a collision energy absorption structure according to claim 3,
wherein the first frame comprises a first frame horizontal beam bridged substantially horizontally below the first frame arc beam, both end portions of the first frame horizontal beam connected to the first frame arc beam, and
a second frame horizontal beam bridged substantially horizontally below the second frame arc beam, both end portions of the second frame horizontal beam connected to the second frame arc beam.

5. The railway vehicle provided with a collision energy absorption structure according to claim 4, comprising
a pair of first frame upper columns standing on an upper surface of the first frame horizontal beam and connected to a lower surface of the first frame arc beam.

6. The railway vehicle provided with a collision energy absorption structure according to claim 5,
wherein the first beam group comprises
a pair of first longitudinal beams connecting upper end portions of the gangway frame columns and connection portions between the first frame horizontal beams and the first frame upper columns,
a pair of first vertical oblique beams connecting the upper end portions of the gangway frame columns

and connection portions between the first frame arc beam and the first frame upper columns in an oblique arrangement within a substantially vertical plane, and

a first horizontal oblique beam connecting upper end portions of the gangway frame columns and connection portions between the first frame arc beam and the first frame horizontal beam in an oblique arrangement within a substantially horizontal plane.

7. The railway vehicle provided with a collision energy absorption structure according to claim 5,
wherein the second beam is a second horizontal oblique beam connecting a connection portion between the first frame horizontal beam and the first frame upper columns and a connection portion between the second frame arc beam and the second frame horizontal beam in an oblique arrangement within a substantially horizontal plane.

FIG. 1

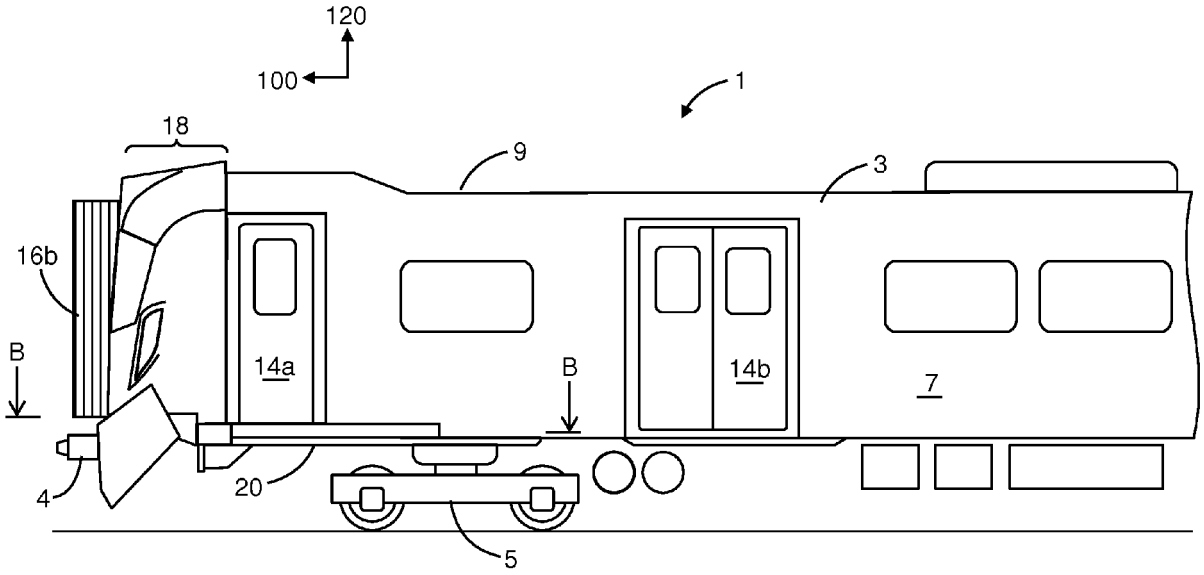


FIG. 2

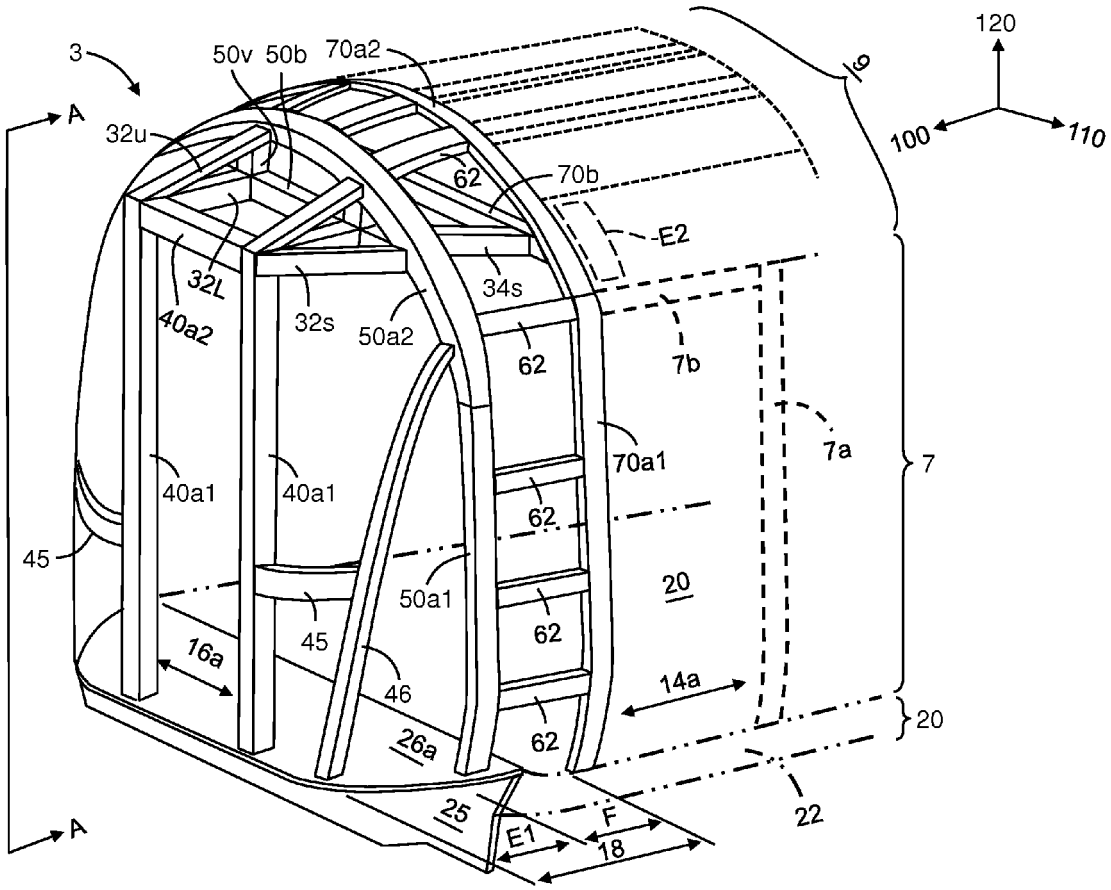

3
50v
50b
70a2
69
120
100
110
A
32u
62
70b
E2
32L
40a2
32s
50a2
34s
62
7b
7a
7
70a1
40a1
40a1
62
45
20
50a1
62
45
16a
46
14a
20
62
26a
22
25
E1
F
18
A

FIG. 3 A-A cross-section

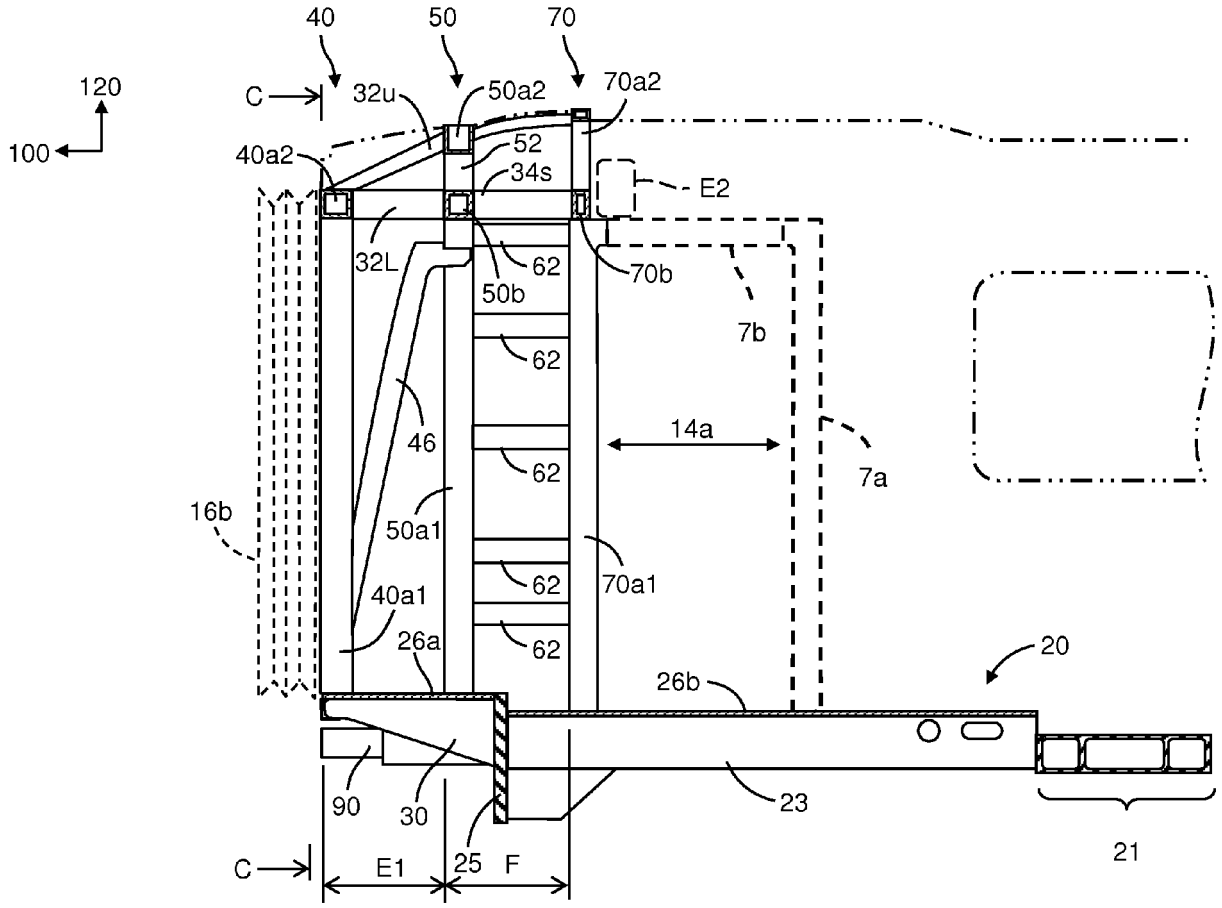


FIG. 4 B-B cross-section

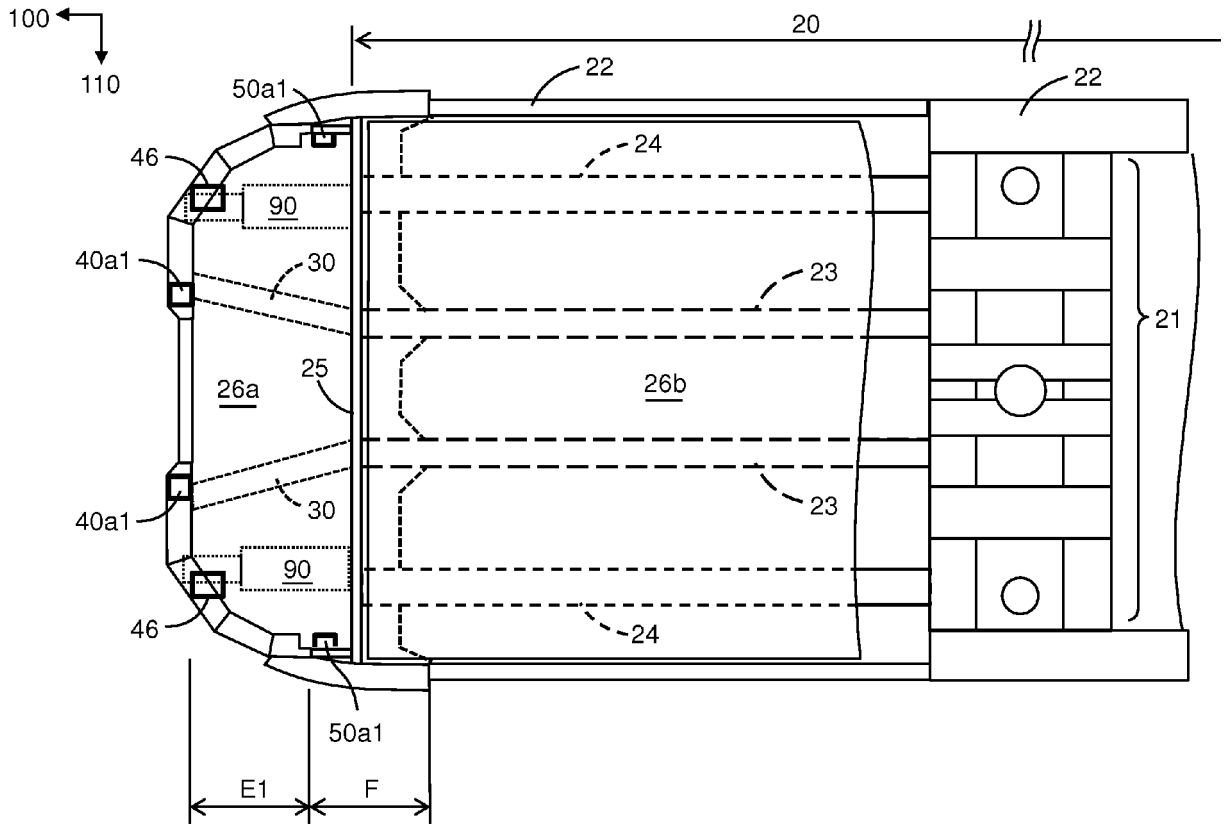


FIG. 5 C-C cross-section

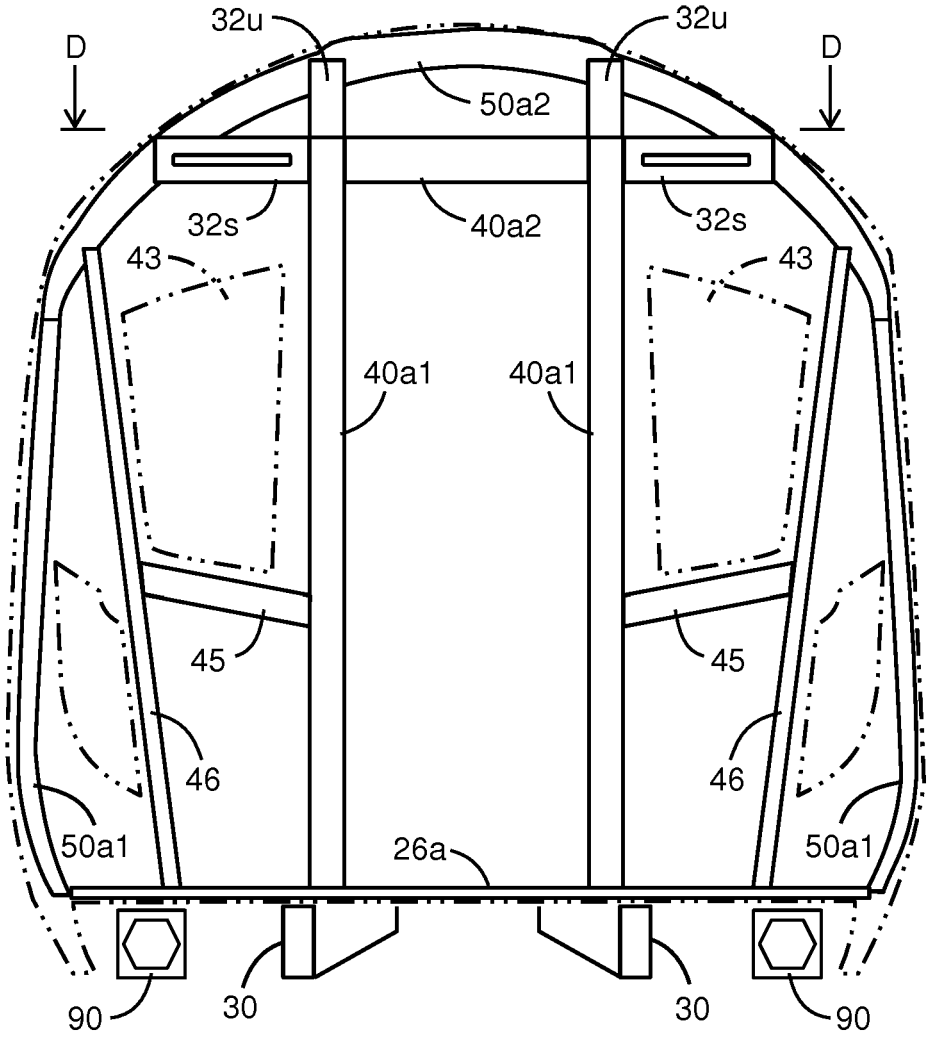
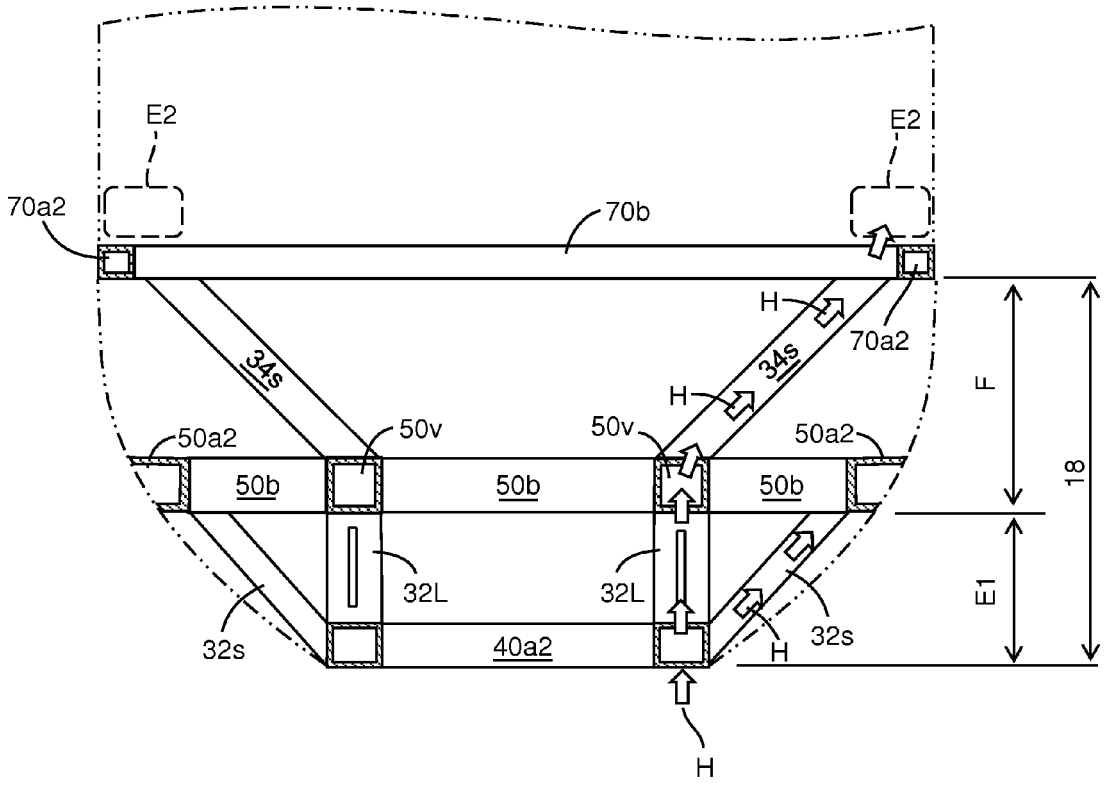


FIG. 6 D-D cross-section



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EUROPEAN SEARCH REPORT

Application Number
EP 16 20 2162

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 0 655 565 A1 (GEC ALSTHOM TRANSPORT SA [FR]) 31 May 1995 (1995-05-31) * figures 8,11 *	1-7	INV. B61D15/06
X	EP 0 802 100 A1 (ALSTOM DDF [FR]) 22 October 1997 (1997-10-22) * figures 1,2 *	1	
A	EP 1 854 694 A2 (HITACHI LTD [JP]) 14 November 2007 (2007-11-14) * figure 1 *	1	
A	CN 101 817 350 A (SOUTH LOCOMOTIVE ZHUZHOU ELECTRIC LOCOMOTIVE CO LTD) 1 September 2010 (2010-09-01) * figure 2 *	1	
A	DE 10 2006 044397 A1 (BOMBARDIER TRANSP GMBH [DE]) 27 March 2008 (2008-03-27) * figures 1,2 *	1	
			TECHNICAL FIELDS SEARCHED (IPC) B61D B61F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	10 May 2017	Lorandi, Lorenzo

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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