(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 2 540 592 A1**

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
02.01.2013 Bulletin 2013/01

(51) Int Cl.:
B61F 5/10 *(2006.01)*

(21) Application number: **11171966.2**

(22) Date of filing: **29.06.2011**

(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

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(54) Running gear for a rail vehicle with an air spring device

(57) The present invention relates to a running gear for a rail vehicle comprising a running gear frame (104) and a traverse unit (107), the running gear frame (104) being supported on at least one wheel unit (103) and the traverse unit (107) being supported on the running gear frame (104) via an air spring device (106) and being adapted to support a wagon body. The traverse unit (107) forms a chamber device (108) adapted to form an air reservoir receiving pressurized air. A connector device (109) connects the chamber device (108) and the air spring device (106) for exchanging air between the chamber device (108) and the air spring device (106).

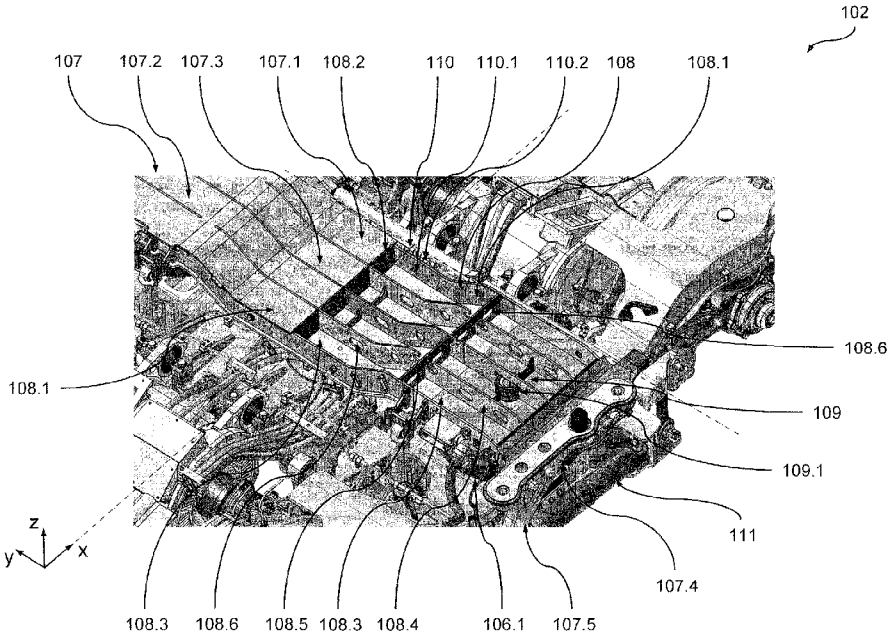

Fig. 2

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Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a running gear for a rail vehicle comprising a running gear frame and a traverse unit, the running gear frame being supported on at least one wheel unit, the traverse unit being supported on the running gear frame via an air spring device and being adapted to support a wagon body. The traverse unit forms a chamber device adapted to form an air reservoir receiving pressurized air. The present invention further relates to a rail vehicle comprising such a running gear.

[0002] Modern rail vehicles, in particular, high speed rail vehicles, typically use such running gears which have to meet a variety of different, partially contradictory requirements to meet the goal of providing good riding comfort at high speeds while consuming as few energy and building space as possible.

[0003] In this context, the secondary spring system of such a rail vehicles typically comprises air springs intended to provide appropriate spring and damping properties enhancing passenger riding comfort. Typically, a large volume of air within the respective secondary air spring provides good damping properties. However, nonetheless you to the increasing number of components to be arranged in a modern running gear, comparatively few building space is available within the running gear strictly limiting the size of the air spring and, hence, the amount of air to be received within the air spring.

[0004] A further problem to be solved when using pneumatic components in a running gear is the fact that an air reservoir of sufficient size has to be provided in the region of the running gear to allow rapid air supply to the respective pneumatic component. Here again, the problem arises that comparatively limited building space is available for arranging such an air reservoir within the running gear.

[0005] In this context it should be noted that DE 195 44 030 A1 discloses a generic running gear wherein the traverse unit forms an air reservoir for a pneumatic brake system of the running gear. However, this configuration has the disadvantage that flexible piping has to be provided compensating for relative motion between the traverse unit and the pneumatic brake units of the pneumatic brake system.

SUMMARY OF THE INVENTION

[0006] It is thus an object of the present invention to provide a running gear and a rail vehicle as outlined above that, at least to some extent, overcome the above disadvantages. It is a further object of the present invention to provide a running gear and a rail vehicle that, in a simple space-saving manner, provides improved running characteristics of the vehicle.

[0007] The above objects are achieved starting from a running gear according to the preamble of claim 1 by the features of the characterizing part of claim 1.

[0008] The present invention is based on the technical teaching that an improvement of the running characteristics of the running gear, in particular, at high speeds, may be achieved while at the same time reducing the building space required, if the chamber device is used as the reservoir for the air spring device. By this means, in a very simple and space-saving way, a connection between the reservoir and the air spring device may be achieved which exhibits very low throttling losses, thereby, in a beneficial way, increasing the effective air volume of the air spring without any necessity to increase the dimensions of the air spring itself or the traverse unit. Furthermore, a simple pneumatic connection between the air spring device and the traverse unit may be realized which also reduces the overall effort necessary for the running gear.

[0009] Hence, according to one aspect, the present invention relates to a running gear for a rail vehicle comprising a running gear frame and a traverse unit, the running gear frame being supported on at least one wheel unit, the traverse unit being supported on the running gear frame via an air spring device and being adapted to support a wagon body. The traverse unit forms a chamber device adapted to form an air reservoir receiving pressurized air. A connector device connects the chamber device and the air spring device for exchanging air between said chamber device and said air spring device.

[0010] It will be appreciated that the chamber device may be formed by one single chamber unit enclosing one continuous air volume. However, preferably, at least two chamber units are formed providing at least two separable air volumes. This has the advantage that the two air spring units typically available on both sides of the vehicle may separately be provided with air from the respective air volume, thereby increasing the flexibility of the system. Hence, with certain embodiments of the invention, the chamber device comprises a first chamber unit and a second chamber unit, the air spring device comprises a first air spring unit and a second air spring unit, and the connector device comprises a first connector unit and a second connector unit. The first connector unit connects the first chamber unit and the first air spring unit for exchanging air between the first chamber unit and the first air spring unit, while the second connector unit connects the second chamber unit and the second air spring unit for exchanging air between the second chamber unit and the second air spring unit.

[0011] It may be provided that the respective connector unit is a simple interface element providing communication between the respective chamber unit and the respective air spring unit at any time. However, with some embodiments of the invention, control of the exchange of air between at least one of the chamber units and the associated air spring unit may be provided. Hence, in these cases, the first connector unit comprises a controllable first valve unit for controlling air exchange between the

first chamber unit and the first air spring unit. In addition or as alternative, the second connector unit comprises a controllable second valve unit for controlling air exchange between the second chamber unit and the second air spring unit.

[0012] It will be appreciated that the two chamber units may be pneumatically separated at any time. However, with certain embodiments of the invention, pneumatic communication between the first and second chamber unit may be provided. Hence, with certain embodiments of the invention, the connector device comprises a third connector unit, the third connector unit connecting the first chamber unit and the second chamber unit for exchanging air between the first chamber unit and the second chamber unit. In these cases, pneumatic communication between the first and second chamber unit may be provided at any time. However, with certain other embodiments of the invention increasing flexibility of the system, the third connector unit comprises a controllable third valve unit for controlling air exchange between the first chamber unit and the second chamber unit.

[0013] The respective chamber unit may be a single compartment unit. However, with other embodiments of the invention, a plurality of separate compartments may be formed within the chamber unit. In particular, it may be provided that pneumatic communication between these separate compartments may be controlled (in the most simple case be substantially switched on or off) to rapidly modify, for example, the effective air volume of the air spring unit. Hence, with certain embodiments of the invention, the first chamber unit and/or the second chamber unit comprises at least two adjacent compartments separated by at least one compartment wall element. Preferably, the at least two adjacent compartments communicate via at least one air passage formed in the at least one compartment wall element, the air passage, in particular, being controllable for controlling air exchange between said adjacent compartments.

[0014] Furthermore, the respective chamber unit may be separated into a plurality of substantially parallel compartments. However, with certain embodiments of the invention providing good structural stability of the traverse unit, a plurality of obliquely arranged compartment wall elements is provided allowing to achieve a grid like inner reinforcement structure for the traverse unit. Hence, with certain embodiments of the invention, the first chamber unit and/or the second chamber unit comprises a plurality of compartment wall elements, the plurality of compartment wall elements being obliquely arranged to separate a plurality of compartments arranged in a matrix like manner. Preferably, the plurality of compartment wall elements forms an internal reinforcement structure of the traverse unit.

[0015] The size of the respective chamber unit may be selected as a function of the requirements of the air spring device and the traverse unit. In particular, different sizes may be selected for the first and second chamber unit. However, with preferred embodiments of the invention, the first chamber unit and/or the second chamber unit, in a transverse direction of the running gear, extends over substantially half of a dimension of the traverse unit in the transverse direction. Preferably, the separation between the first chamber unit and the second chamber unit is located at a substantially central location in the transverse direction. Furthermore, preferably, the separation defines a plane of symmetry, the traverse unit being substantially symmetric with respect to the plane of symmetry.

[0016] It will be appreciated that the respective pneumatic connection provided by the connector unit may have any suitable design. In particular, conventional (flexible and/or inflexible) piping means and (passively and/or actively controllable) valve means may be used.

[0017] With certain preferred embodiments of the invention providing increased functional integration the respective connector unit may also integrate at least a part of the mechanical connection transmitting at least a considerable fraction of the forces and moments acting between the traverse unit and the respective air spring unit. Hence, with certain embodiments of the invention, the connector device comprises a connector unit mechanically connecting the air spring device to the traverse unit and integrating an air connector for exchanging air between the chamber device and the air spring device.

[0018] Such a connector unit integrating both the pneumatic and the mechanical connection may have any suitable design. A very simple and robust configuration may be achieved if the connector device comprises a tubular element, the tubular element being mechanically connected to the air spring device and the traverse unit. Furthermore, the tubular element forms an air duct between the air spring device and the chamber device of the traverse unit.

[0019] The traverse unit may have any suitable design providing a cavity forming the chamber device. Very simple designs may be achieved if the traverse unit is a substantially box shaped component. Furthermore, with certain embodiments of the invention, the traverse unit, in a transverse direction of the running gear, shows a central section being lowered in a height direction of the running gear. Such a configuration has the advantage to provide increased stability and to allow the integration of further components, such as piping, electrical connections etc., between the wagon body and the traverse unit in this region.

[0020] The traverse unit may be formed using any suitable manufacturing technique. For example, the traverse unit may be a widely monolithic component made in a casting process or an extrusion molding process. Furthermore it may be composed of a plurality of separate components connected using positive connections of frictional connections, adhesive connections or arbitrary combinations thereof. Comparatively simple to manufacture configurations are achieved if the traverse unit is a welded component made of the plurality of components connected in a welding process. Preferably, the plurality

of welded components comprises a plurality of sheet metal elements. However, cast components may also be used for at least parts of the traverse unit.

[0021] With certain preferred embodiments of the invention functional integration is even pushed forward by integrating further functions, in particular, interface sections for adjacent components of the vehicle, into the components forming wall elements of the traverse unit. With preferred embodiments of the invention, the traverse unit is an elongated component extending in a transverse direction of the running gear, the traverse unit, in the region of at least one lateral end, comprising an end component integrating an interface for a longitudinal damper device. The longitudinal damper device acts in a longitudinal direction of the running gear between the running gear frame and the traverse unit.

[0022] Preferably, the end component is a cast or forged component, thereby providing a robust and simple design. In addition or as an alternative, the end component comprises an arm element, a free end of the arm element forming the interface for the longitudinal damper device.

[0023] The present invention furthermore relates to raise vehicle comprising a running gear according to the invention as it has been outlined above.

[0024] It will be appreciated that the present invention may be used for any desired rail vehicle operating at any desired nominal operating speed. However, the beneficial effect of the present invention is particularly noticeable in high-speed operations. Hence, preferably, the rail vehicle is adapted for operation at a nominal operating speed above 250 km/h, preferably above 300 km/h, more preferably above 350 km/h.

[0025] Further embodiments of the present invention will become apparent from the dependent claims and the following description of preferred embodiments which refers to the appended figures.

BRIEF DESCRIPTION OF THE DRAWINGS

[0026]

Figure 1 is a schematic perspective top view of a part of a preferred embodiment of a running gear according to the present invention used in a preferred embodiment of the rail vehicle according to the present invention;

Figure 2 is a partially sectional top view of a part of the running gear of Figure 1.

DETAILED DESCRIPTION OF THE INVENTION

[0027] With reference to Figure 1 and 2 a preferred embodiment of a rail vehicle 101 according to the present invention comprising a preferred embodiment of a running gear 102 according to the invention will now be described in greater detail. In order to simplify the explanations given below, an xyz-coordinate system has been introduced into the Figures, wherein (on a straight, level track) the x-axis designates the longitudinal direction of the rail vehicle 101, the y-axis designates the transverse direction of the rail vehicle 101 and the z-axis designates the height direction of the rail vehicle 101. It will be appreciated that all statements made in the following with respect to the position and orientation of components of the rail vehicle, unless otherwise stated, refer to a static situation with the rail vehicle 101 standing on a straight level track.

[0028] The vehicle 101 is a high-speed rail vehicle with a nominal operating speed above 250 km/h, more precisely above 300 km/h to 380 km/h. The vehicle 101 comprises a wagon body (not shown) supported by a suspension system on the running gear 102. The running gear 102 comprises two wheel units in the form of wheel sets 103 supporting a running gear frame 104 via a primary spring unit 105. The running gear frame 104 supports the wagon body via a secondary spring unit 106 and a traverse unit 107 supported by the secondary spring unit 106 and itself supporting the wagon body.

[0029] As can be seen from Figure 1 and 2, the traverse unit 107 is an elongated, substantially box shaped body extending in the transverse direction (y axis) between both sides of the vehicle 101. The traverse unit 107, in the transverse direction, shows a central section 107.1 which is lowered in the height direction (z axis) of the running gear 102 with respect to its adjacent end sections 107.2. This angled configuration has the advantage to provide increased structural stability of the traverse unit 107 (in particular regarding torsional moments about the tranverse axis). Furthermore, it allows the integration of further components, such as piping, electrical connections etc., between the wagon body and the traverse unit 107 in this area.

[0030] The underside of each of the lateral sections 107.2 of the traverse unit 107 rests on an air spring unit in the form of a first and a second air spring 106.1, respectively, of the air spring device 106. The upper side of each of the lateral sections 107.2 of the traverse unit 107 in turn contacts an underside of the wagon body.

[0031] The first and second air springs 106.1 are formed in a conventional manner, i.e. among others comprise a rubber bellows providing elasticity of the air spring 106.1 in all degrees of freedom. Rigid components of the air springs 106.1 are connected to the upper and lower sides of the rubber bellows to mechanically connect the latter to the traverse unit 107 and the running gear frame 104, respectively.

[0032] As can be seen, in particular, from Figure 1, the traverse unit 107 is a component which is substantially symmetric with respect to a centrally located plane of symmetry extending parallel to the xz plane. However, with other embodiments of the invention a more or less pronounced deviation from such a symmetric arrangement may also be selected.

[0033] Figure 2 shows a partially sectional represen-

tation with the right half of the top cover 107.3 of the traverse unit 107 removed. As can be seen from Figure 2, the traverse unit 107 comprises a chamber device 108 formed by a first and a second chamber unit 103.1, each extending over substantially half of the traverse unit 107 and being separated by a central wall element 108.2. The first and a second chamber unit 108.1 are symmetric with respect to the plane of the central wall element 108.2 that the explanations given in the following with reference to the internal structure of the traverse unit 107 (visible in Figure 2 only for the right half of it) apply to both chamber units 108.1.

[0034] Each chamber unit 108.1 forms an air reservoir adapted to receive pressurized air to be exchanged with the associated first and second air spring 106.1, respectively, via a first and second connector unit 109.1, respectively, of a connector device 109. Each connector unit 109.1 is formed as a tubular air connector element mechanically connected to the associated air spring unit 106.1 and the traverse unit 107. Each tubular connector unit 109.1 forms an air duct between the air spring unit 106.1 and the associated chamber unit 108.1. Each tubular connector unit 109.1 is rigidly connected to the upper rigid structure of the air spring 106.1 (holding the upper part of the bellows), thereby integrating also a part of the mechanical connection transmitting a considerable fraction of the forces and moments acting between the traverse unit 107 and the respective air spring unit 106.1 in the plane of the traverse unit 107 (i.e. the xy plane).

[0035] As mentioned initially, it may be provided that the respective connector unit 109.1 is a simple interface element providing pneumatic communication between the respective chamber unit 108.1 and the associated air spring unit 106.1 at any time. However, with some embodiments of the invention, control of the exchange of air between the respective chamber unit 108.1 and the associated air spring unit 106.1 may be provided. In these cases, the respective first and second connector unit 109.1 comprises a controllable first and second valve unit, respectively, for controlling air exchange between the first chamber unit 108.1 and the first air spring unit 106.1 and between the second chamber unit 108.1 and the second air spring unit 106.1.

[0036] In any case, a very simple and space-saving connection between the respective reservoir formed by the chamber unit 108.1 and the associated air spring unit 106.1 may be achieved which exhibits very low throttling losses, thereby, in a beneficial way, increasing the effective air volume of the air spring 106.1 without any necessity to increase the dimensions of the air spring 106.1 itself or the traverse unit 107. Furthermore, a very simple pneumatic connection between the respective air spring unit 106.1 and the traverse unit 107 is realized which also reduces the overall effort necessary for the running gear.

[0037] It will be appreciated that the two chamber units 108.1 may be pneumatically separated at any time. However, in the embodiments shown, pneumatic communication between the first and second chamber unit 108.1 is provided via a third connector unit 110. The third connector unit 110 is located outside the first and second chamber unit 108.1 and comprises conventional piping connected to each of the first and second chamber unit 108.1 via an inlet 110.1 for exchanging air between the first and second chamber unit 108.1.

[0038] It will be appreciated that pneumatic communication between the first and second chamber unit 108.1 may be provided at any time. However, in the embodiment shown flexibility of the system is increased in that the third connector unit 110 comprises a controllable third valve unit 110.2 for controlling air exchange between the first and second chamber unit 108.1. The third valve unit 110.2 also serves to connect the first and second chamber unit 108.1 to a source of pressurized air (not shown).

[0039] In the embodiment shown, the respective chamber unit 108.1 is separated into a plurality of compartments 108.3 arranged in a matrix like manner by a plurality of obliquely arranged compartment wall elements 108.4, 108.5 forming a grid like inner reinforcement structure for the traverse unit 107 and, hence, increasing structural stability of the traverse unit 107.

[0040] Pneumatic communication between these separate compartments 108.3 is provided via air passages formed by openings 108.6 in the wall elements 108.4, 108.5. It may be provided that pneumatic communication between these separate compartments 108.3 may be controlled (in the most simple case be substantially switched on or off) to rapidly modify, for example, the effective air volume of the air spring unit 106.1. Hence, with certain embodiments of the invention, means for opening and closing (or selectively reducing the size of) the openings 108.6 may be provided. To this end (passively and/or actively controllable) valve means may be used.

[0041] The traverse unit 107, in the embodiment shown, is a formed from a plurality of separate components connected in a welding process. The welded components comprise a plurality of steel sheet metal elements and, at each lateral end of the traverse unit 107, a cast or forged steel end component 107.4.

[0042] The end component 107.4 forms an arm element 107.5 integrating an interface 107.6 for a longitudinal damper device 111 acting in the longitudinal direction (x axis) of the running gear 102 between the running gear frame 104 and the traverse unit 107.

[0043] Although the present invention in the foregoing has only a described in the context of high-speed rail vehicles, it will be appreciated that it may also be applied to any other type of rail vehicle in order to overcome similar problems with respect to a simple solution for generally vibrational problems, such as running stability problems and acoustic problems.

Claims

1. A running gear for a rail vehicle comprising

- a running gear frame (104) and
- a traverse unit (107);
- said running gear frame (104) being supported on at least one wheel unit (103);
- said traverse unit (107) being supported on said running gear frame (104) via an air spring device (106) and being adapted to support a wagon body;
- said traverse unit (107) forming a chamber device (108) adapted to form an air reservoir receiving pressurized air;

characterized by

- a connector device (109) connecting said chamber device (108) and said air spring device (106) for exchanging air between said chamber device (108) and said air spring device (106).

2. The running gear according to claim 1, wherein

- said chamber device (108) comprises a first chamber unit (108.1) and a second chamber unit (108.1),
- said air spring device (106) comprises a first air spring unit (106.1) and a second air spring unit (106.1), and
- said connector device (109) comprises a first connector unit (109.1) and a second connector unit (109.1);
- said first connector unit (109.1) connecting said first chamber unit (108.1) and said first air spring unit (106.1) for exchanging air between said first chamber unit (108.1) and said first air spring unit (106.1);
- said second connector unit (109.1) connecting said second chamber unit (108.1) and said second air spring unit (106.1) for exchanging air between said second chamber unit (108.1) and said second air spring unit (106.1).

3. The running gear according to claim 2, wherein

- said first connector unit (109.1) comprises a controllable first valve unit for controlling air exchange between said first chamber unit (108.1) and said first air spring unit (106.1),

and/or

- said second connector unit (109.1) comprises a controllable second valve unit for controlling air exchange between said second chamber unit (108.1) and said second air spring unit (106.1).

4. The running gear according to any one of claims 2 and 3, wherein

- said connector device (109) comprises a third connector unit (110);
- said third connector unit (110) connecting said first chamber unit (108.1) and said second chamber unit (108.1) for exchanging air between said first chamber unit (108.1) and said second chamber unit (108.1);
- said third connector unit (110), in particular, comprising a controllable third valve unit for controlling air exchange between said first chamber unit (108.1) and said second chamber unit (108.1).

5. The running gear according to any one of claims 2 to 4, wherein

- said first chamber unit (108.1) and/or said second chamber unit (108.1) comprises at least two adjacent compartments (108.3) separated by at least one compartment wall element (108.4, 108.5);
- said at least two adjacent compartments (108.3), in particular, communicating via at least one air passage formed in the at least one compartment wall element (108.4, 108.5);
- said air passage, in particular, being controllable for controlling air exchange between said at least two adjacent compartments (108.3).

6. The running gear according to claim 5, wherein

- said first chamber unit (108.1) and/or said second chamber unit (108.1) comprises a plurality of compartment wall elements (108.4, 108.5);
- said plurality of compartment wall elements (108.4, 108.5) being obliquely arranged to separate a plurality of compartments (108.3) arranged in a matrix like manner;
- said plurality of compartment wall elements (108.4, 108.5), in particular, forming an internal reinforcement structure of said traverse unit.

7. The running gear according to any one of claims 2 to 6, wherein

- said first chamber unit (108.1) and/or said second chamber unit (108.1), in a transverse direction of said running gear (102), extends over substantially half of a dimension of said traverse unit (107) in said transverse direction;
- a separation (108.2) between said first chamber unit (108.1) and said second chamber unit (108.1), in particular, being located at a substantially central location in said transverse direction;
- said separation (108.2), in particular, defining a plane of symmetry, said traverse unit (107) being substantially symmetric with respect to said plane of symmetry.

8. The running gear according to any one of claims 1 to 7, wherein said connector device (109) comprises a connector unit (109.1) mechanically connecting

said air spring device (106) to said traverse unit (107) and integrating an air connector for exchanging air between said chamber device (108) and said air spring device.

9. The running gear according to claim 8, wherein

- said connector device (109) comprises a tubular element (109.1);
- said tubular element (109.1) being mechanically connected to said air spring device (106) and said traverse unit;
- said tubular element (109.1) forming an air duct between said air spring device (106) and said chamber device (108) of said traverse unit.

10. The running gear according to any one of claims 1 to 8, wherein

- said traverse unit (107) is a substantially box shaped component
and/or
- said traverse unit (107), in a transverse direction of said running gear, showing a central section (107.1) being lowered in a height direction of said running gear.

11. The running gear according to any one of claims 1 to 9, wherein

- said traverse unit (107) is a welded component made of the plurality of components connected in a welding process;
- said plurality of welded components, in particular, comprising a plurality of sheet metal elements (108.4, 108.5).

12. The running gear according to any one of claims 1 to 11, wherein

- said traverse unit (107) is an elongated component extending in a transverse direction of said running gear (102);
- said traverse unit (107), in the region of at least one lateral end, comprising an end component (107.4) integrating an interface (107.6) for a longitudinal damper device (111);
- said longitudinal damper device (111) acting in a longitudinal direction of said running gear between said running gear frame (104) and said traverse unit.

13. The running gear according to claim 12, wherein

- said end component (107.4) is a cast or forged component
and/or
- said end component (107.4) comprises an arm element (107.5), a free end of said arm element (107.5) forming said interface (107.6) for said longitudinal damper device (111).

14. A rail vehicle with a running gear according to any one of claims 1 to 13.

15. The rail vehicle according to claim 14, wherein it is adapted for a nominal operating speed above 250 km/h, preferably above 300 km/h, more preferably above 350 km/h.

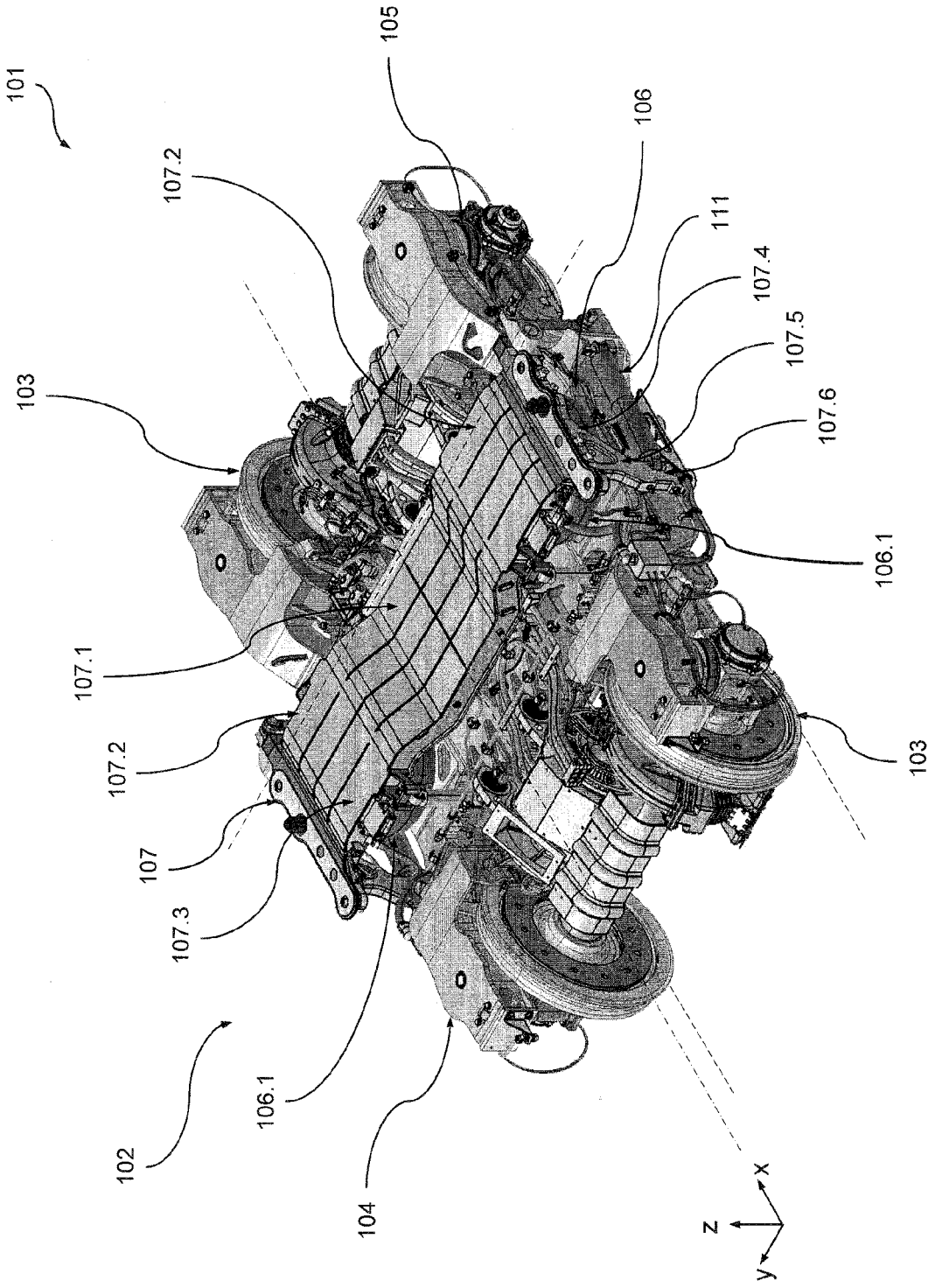
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Fig. 1

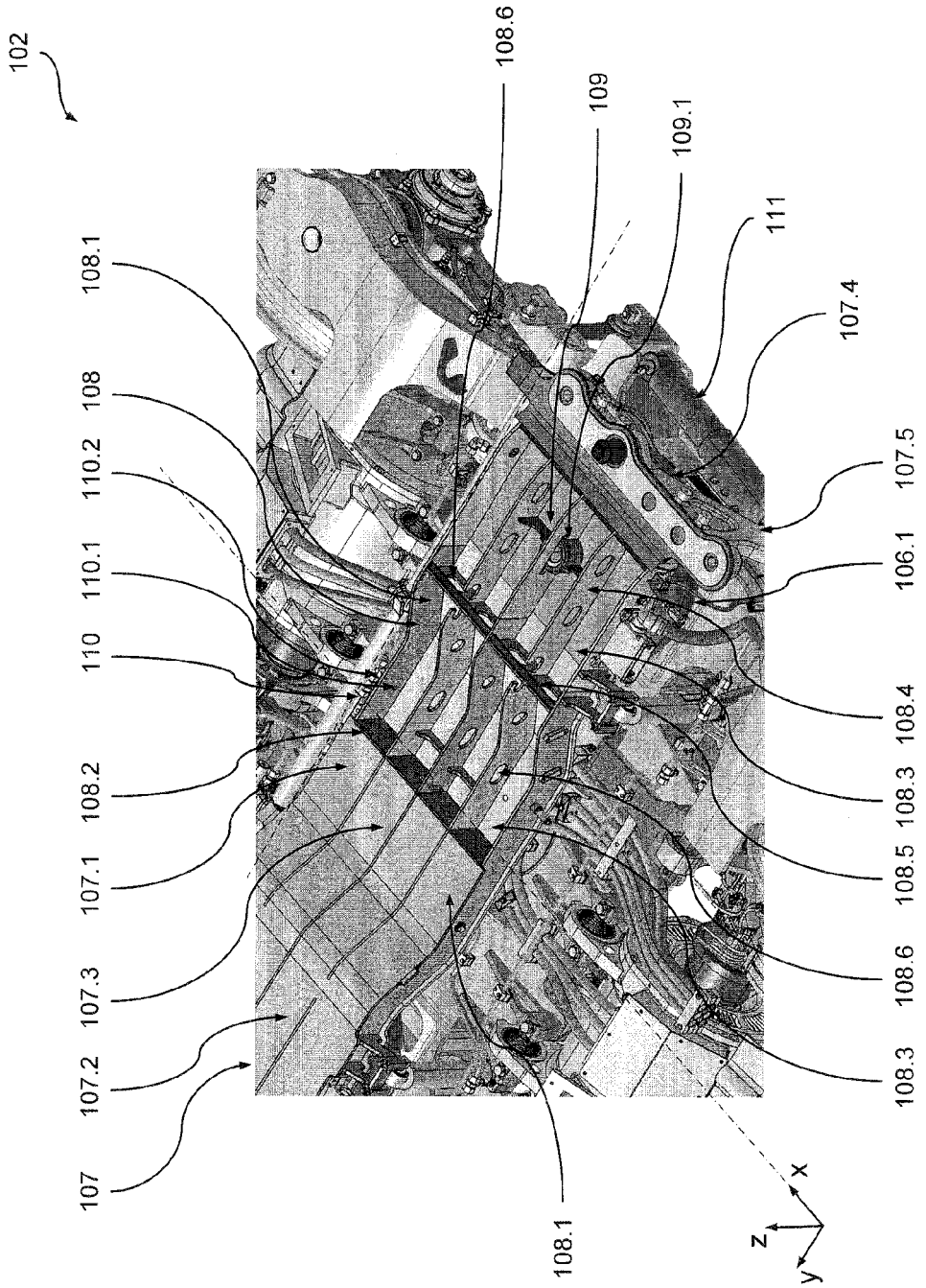
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Fig. 2

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EUROPEAN SEARCH REPORT

Application Number
EP 11 17 1966

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	US 4 817 536 A (CRIPE CHRISTOPHER A [US] ET AL) 4 April 1989 (1989-04-04) * column 4, line 36 - column 5, line 53 * * column 8, line 46 - column 9, line 63; figures 1-4 * -----	1-3,6,8, 10-14	INV. B61F5/10
X	US 4 278 030 A (AHLBORN GUENTHER ET AL) 14 July 1981 (1981-07-14) * column 3, line 45 - column 5, line 4; figures 1-7 * -----	1-3,8, 10,11, 14,15	
X	US 2 908 230 A (DEAN WALTER B) 13 October 1959 (1959-10-13) * column 1, line 47 - line 64 * * column 3, line 52 - column 4, line 54 * * column 5, line 1 - line 19; figures 1-8,13 * -----	1,3,8, 10,11,14	
			TECHNICAL FIELDS SEARCHED (IPC) B61F B62D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	23 November 2011	Chlosta, Peter

CATEGORY OF CITED DOCUMENTS

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 11 17 1966

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REFERENCES CITED IN THE DESCRIPTION

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