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(54) **Low construction height bogie for low-floor rail vehicles especially trams**

Drehgestell mit niedriger Bauhöhe für Niederflur-Schienenfahrzeuge, insbesondere Straßenbahnen

Bogie de construction de faible hauteur pour véhicules ferroviaires à plancher bas, en particulier des tramways

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Description

Field of technology

[0001] The invention concerns the bogie of low rail vehicle for passenger traffic especially trams.

Present state of technology

[0002] Low-floor tram vehicles have nowadays been produced along most of the vehicle length, whereas, the standard floor height can (for low vehicles) be specified within the range of 350÷450 mm above the upper surface of the rail. The minimum standard width is 600 mm.

[0003] The muti-segment low-floor rail vehicle especially tram, known from patent document EP 1 741 610 and CZ 297213, designed as two-segment and three-bogies vehicle, optionally could be protruded at least for one middle segment and one bogie, whereas vehicle is equipped with one side rotary bogie placed below the front and rear part of the vehicle segment and always with one middle bogie below each joint, i.e. the segment connection of the vehicle chasses, whereby on each middle bogie are in any case placed rotary two neighbouring vehicle chasses, each of them in separate linking point.

[0004] Rotary bogies of these vehicle are constructed so that within the space between the separate wheel pairs, respectively to the longitudinal axis of the vehicle, there are cradles, elements of the primary and secondary spring system, drivers, especially engines, transmissions, brakes arranged on the outer side of the chassis wheels However known constructions of primary and secondary spring systems are not suitable for rotary bogie of low-floor tram vehicles.

The gist of invention

[0005] The fundamental aim of the invention was to create a low construction height bogie for a low-floor tram rail vehicle with such an organization of primary and secondary springing composition, which will enable the composition of the main parts of the bogie - axles, bogie frame, cradle - together with the components of the primary and secondary springing below the vehicle floor, at the standard height for low-floor vehicles, i.e. maximum 450mm above the upper rail surface, whose basis dwells in the concept of the bogie frame being situated in the middle part of the axle by means of springing elements of the primary springing system, e.g. steel or rubber-steel springs which are inserted from above into the middle part of the axle and from below inserted into the bogie chassis, so that the composition of the middle part of the axle and bogie chassis occupies minimum possible height, given by the building height of the middle part of the axle and bogie chassis. The building heights are result from the solidness requirements and the necessary clearance between the axle and chassis, which is defined by the necessary up-stroke of the primary springing.

[0006] At least one spring cradle is then placed on bogie frame by means of secondary spring system elements. The secondary springing is realised by the usual spring systems which are inserted into the bogie chassis spring holder, and which the cradle is placed on. The secondary springing is composed so that its upper part is inserted into the cradle from below and its lower part is fixed in the spring holder, which is a part of the bogie frame and whose lower edge reaches the lower part of the middle part of the axle. Thus also, the composition of the bogie frame and the spring cradle occupies minimum height, given only by the building height of the cradle and bogie frame. These building height levels result from the solidness requirements and the necessary clearance between the cradle and bogie frame conditioned by the necessary up-stroke of secondary springing, so that the upper surface of the cradle is situated in such a height so that it is possible to compose the bearing part of the vehicle chassis lower part with the floor at the height level of maximum 450 mm above the upper rail surface, i.e. within the standard height designed for the low-floor vehicles.

[0007] This part of the vehicle chassis lower part is connected with the bogie cradle by means of vertical axis rotary bearing, which is fixed to the cradle and vehicle chassis lower part which is inserted from above into the middle part of the cradle, so that the composition of the bogie cradle and the lower part of the vehicle chassis occupies minimum possible height given by the building height of the cradle which is necessary for the clearance between the cradle and the lower part of the vehicle chassis.

[0008] Besides the secondary springing, every bogie cradle is linked to the bogie chassis by means of a draw bar or a pair of draw bars, enabling the transition of longitudinal forces between the cradle and the bogie chassis, two vertical and at least one horizontal absorber, absorbing the vertical and horizontal movements within the secondary springing system, and the anti-swing stabilizer preventing the chassis from cross-swinging of the vehicle chassis in order to achieve the proper driving properties and keep the standardised vehicle gauge.

[0009] The bogie can bear one vehicle chassis if it is placed below the front or rear part of the vehicle or, it can bear two vehicle chassis in case the bogie is situated below the vehicle joint.

[0010] The bogie according to the invention is also possible to be used with multi-part low-floor tram vehicles of the regular realisation with non-rotary bogies, whereas the bogie itself is composed as a non-rotary one. To such a use, a bogie originally intended for the two vehicle chassis placement is the best choice, whereas, instead of two cradles, the vehicle chassis is directly placed onto the secondary springing. The draw bars ensuring the transition of longitudinal forces, vertical and horizontal swing absorbers and stabilisers are then positioned between the bogie and vehicle chassis.

Figures overview

[0011] The technical realization is more closely specified in the attached drawings, where Figs. 1 and 2 represent the standard pass width for passengers X, fig. 2 presents standard width of low-pass of the vehicle above the boggie, figs. 3 represents the two-part three-bogie vehicle, fig. 4 and 5 depict the bogie realisation with 1 and two cradles. Fig. 6 presents schematic cut through the bogie; figs 7 and 8 demonstrate the width of the row above the bogie in the realization with 1 and 2 cradles.

Example of invention embodiment

[0012] Multi-part low-floor tram rail vehicles, depicted on the fig 3 as two-part, which is equipped with the first side rotary bogie 1 below the front part of segment A and the second rotary bogie 1 below the rear part of segment B and one middle bogie 2 below the joint - the segment connection A and B, where on the middle bogie 2 there are both adjacent ends of vehicle chassis of segments A and B, each with a separate vertical axis of rotation 4 respectively to the bogie 2. On the side bogies 1 there are chassis A and B placed on rotary bearings with vertical axis of rotation 3 placed in a longitudinal axis of bogie in such a proximity from the middle of the common axis of one wheel pair of the bogie which is nearer to the middle part of the vehicle, so that it is possible to ensure convenient access to the driver's cabin and to the seats in the rear part of the vehicle. The above mentioned organisation of rotary axis of the bogies 1 and 2 respectively to the particular vehicle chassis ensures the minimum level of transverse movement of each wheel pair respectively to the particular vehicle chassis during mutual rotation around the axis 3 or 4, which further results in a slight blockage of the pass width W of the vehicle above the bogie 2 (compared to other rotary bogie vehicles - see picture 7), and thus the width W keeps the standard pass width. Above the bogie 1 the pass composition ensures the width which is convenient for the driver's cabin and seats access Z, respectively to the particular standard, see fig. 8. As for the side bogies 1 below the front and rear part of the vehicle, the advantage of smaller transverse wheel movement respectively to the vehicle chassis is evident only with the wheel pairs closer to the middle of the vehicle; the wheel pairs further from the middle of the vehicle show bigger span of movement respectively to the vehicle chassis. These wheel chassis, however, do not block the passenger space because they move in the front part of the vehicle below the driver's cabin and in the rear part of the vehicle below the passenger seats, or, seen from the ground plan, in the bend following trajectory of the wheel pair moving below these seats.

[0013] The composition of the bogie is to be found in the fig. 4, 5 and 6.

[0014] The bogies in realization 1 and 2 contain in the space between the separate wheel pairs 5 contain the elements of the primary 6 and secondary 7 springing. On the outer part of the wheels, or, on the level of the wheels, respectively to the longitudinal axis of the vehicle, there are drives and brakes - engines, transmissions 8, mechanical brakes 9 and rail brakes 10. Thanks to this composition, the floor even above the bogies can be kept in the low standard level, which is only slightly elevated, compared to rest of the passenger space, whereas, both these floor parts are connected with barrier-free pass by means of smoothly rising ramps, while the standard pass height of the vehicle is kept. The connection of separate vehicle chassis segments with the bogie is made so that the axis of rotation 4 of the middle bogie 2 respectively to the vehicle chassis always lie on the geometrically vertical axis running through the common axis of rotation of one of the wheel pair. Each bogie realization 2 is thus equipped with two cradles 16b, always situated between the pairs of opposite wheels with common axis of rotation, whereas, the rotary axis 3 of the side bogie 1 respectively to the vehicle chassis is situated within the longitudinal axis of the bogie, and relatively near, approx. 1/3 of the vehicle perch, representing the middle of the common axis of rotation of one wheel pair of the bogie. Each bogie realization 2 is thus equipped with one cradle 16a, always situated approximately in the middle of the bogie.

[0015] The vehicle bogie, fig. 4, 5, and 6 is organised so that the wheels 5 are fixed by means of pinned bearings on the axle 11, whose middle part is bent downwards. In the axle 11, special gaps are made 11a which serve for insertion the springs of primary springing 6. On the springs of primary springing there is the bogie chassis 12a, 12b where there are gaps 12c for insertion of the springs 6 of primary springing. Furthermore, within the chassis, there are spring holders 12d in which there are springs of the secondary springing 7. These spring holders 12d reach as low as possible so that the springs of the secondary springing 7 reached as close the upper surface of the rail as possible. The secondary springing 7 is supplemented by two vertical 13 and at least one horizontal absorber 14, absorbing the vertical and transverse movements within the secondary springing, and with the swing stabiliser 15 which hinders the transverse swing of the vehicle chassis. The absorbers 13 and 14, and the swing stabiliser 15 are mounted between the bogie frame 12a, 12b and the cradle 16a, 16b. Each cradle 16a, 16b is, respectively to the bogie frame 12a and 12b, lengthwise led by means of pair of draw bars 17 which are fixed to the cradle and the bogie chassis by means of joints 17a.

[0016] The spring set of the secondary springing 7 is inserted into the spring holder 12d of the bogie chassis. On the springs of the secondary springing 7 there is the cradle 16a and 16b installed from above. The cradle contains gaps 16c for insertion of the secondary springing 7. The cradle 16a, 16b is connected to the low part of the vehicle 17 by means of the rotary bearing 18, fixed to the cradle and the lower part of the vehicle. The bearing 18 is inserted into the gap 16c from above in the middle part

of the cradle. On the outer side of the bogie chassis, respectively to the longitudinal axis of the vehicle there are holders of drive units 19 on which the drive units 20 are installed - engines, or, engines with transmissions.

[0017] Each drive unit operates one wheel 5 by means of the clutch. The mechanical brake 9 stops the wheel 5 directly - the brake unit 9b is placed upon the head 11a of the axle 11 by means of the console 9a. The brake jaws 9c directly stop the tyre 5a of the wheel 5.

[0018] In the space between two wheels on the same side of the bogie, respectively to the longitudinal axis of the vehicle, there are two rail brakes 10 hung by means of flexible suspenders 10a upon the bogie frame 12.

Industrial applicability

[0019] The presented bogie is utilizable for low-floor rail vehicles, especially trams, in realization of multi-part (segment) or one-part (segment) vehicle chassis, equipped with the rotary or non-rotary installation of the vehicle chassis upon the bogie.

Claims

1. A low construction height bogie for low-floor rail vehicles, especially trams comprising frame, axles (11), cradle, in non-rotary composition of a bogie without cradle, primary and secondary springing, whereby the axle is bent downwards in the middle and the wheels of the bogie are fixed by means of pinned bearings to the axle,
characterized in that
in the axle (11) there are gaps (11a) intended for insertion of the primary springing (6) and on this system the bogie frame (12a,12b) is inserted, wherein the pans (12c) are made from below intended for insertion of upper part of spring system of the primary springing (6) and in the frame (12a, 12b) there are mounted at least two holders (12d), where the secondary springing system (7) is inserted, whereby holders (12d) reach as low as possible so that the secondary springing system (7) is placed closest to the upper surface of the rail, whereby the secondary springing system (7) is supplemented with vertical absorbers (13) and at least one transverse absorber (14), which are absorbing the movements within the secondary springing system, and with one transverse swing stabilizer (15) limiting the transverse swinging of the vehicle chassis whereby the cradle (16a, 16b) is installed onto the secondary springing system (7) from above, whereby in the cradle (16a, 16b), there are gaps (16c) for insertion of the secondary springing system (7), whereby the cradle (16a, 16b) is connected with the lower part of the vehicle chassis by means of the rotator bearing (18), fixed to the cradle (16a, 16b), and the lower part of the vehicle chassis and the bearing (18) is inserted from above into a gap (16d) in the middle part of the cradle (16a, 16b), or secondary spring system (7) carries the non-rotatory vehicle chassis, whereas the vertical and transverse absorbers (13, 14) together with the swing stabilizer (15) are then mounted between the bogie frame (12a, 12b) and the vehicle chassis.

Patentansprüche

1. Das Fahrwerk mit einer niedrigen Bauhöhe, das für ein Niederflur-Schienenfahrzeug, vor allem für ein Straßenbahnfahrzeug, bestimmt ist, besteht aus einem Fahrwerksrahmen, einem Achskörper, einer Wiege, bei einem nichtdrehbaren Fahrwerk ohne eine Wiege, einer primären und sekundären Abfederung, wobei der Achskörper in der Mitte gekröpft ist und die Räder des Fahrwerks an den Bolzen des Achsenkörpers mit Auflagern gelagert sind, **dadurch gekennzeichnet, dass**
in dem Achskörper (11) Taschen (11a) zur Lagerung des Systems der Feder der primären Abfederung (6) vorhanden sind, und auf diesem System der Feder der primären Abfederung (6) ein Fahniverkrahmen (12a,12b) gelagert ist, in dem sich unten die Aussparungen (12c) zur Lagerung des oberen Teils des Systems der primären Abfederung (6) befinden, und im Fahrwerkrahmen (12a, 12b) mindestens zwei Träger (12d) angebracht sind, wo das System der Feder der sekundären Abfederung (7) gelagert ist, wobei die Träger (12d) möglichst unten eingreifen, sodass das System der Feder der sekundären Abfederung (7) möglichst nah an der Schienenoberkante liegt, wobei die sekundäre Abfederung (7) durch zwei senkrechte Dämpfer (13) und mindestens einen Querdämpfer (14), die die Bewegungen der sekundären Abfederung dämpfen, sowie durch einen Stabilisator der Schwingung (15), der die Querschwingungen des Fahrzeugkastens reduziert, ergänzt ist, wobei auf dem System der Feder der sekundären Abfederung /7/ von oben eine Wiege (16a,16b) gelagert ist, in der sich wegen dem Einbau der sekundären Ablagerung /7/ zwei Aussparungen (16c) befinden, wobei die Wiege (16a, 16b) mit dem Unterboden des Fahrzeugs (17) mit einem fest mit der Wiege (16a, 16b) sowie dem Unterboden des Fahrzeugs (17) verbundenen Drehlager (18) verbunden ist, und das Drehlager (18) von oben in die Tasche (16d) in dem mittleren Teil der Wiege (16a, 16b) eingebaut ist, ggf. auf dem System der Feder der sekundären Abfederung /7/ von oben nichtdrehbar der Kasten des Fahrzeugs gelagert ist, wobei die senkrechten und diagonalen Dämpfer /13, 14/ sowie der Stabilisator der Schwingung /15/zwischen dem Fahrwerkrahmen /12a, 12b/ und den Kasten des Fahrzeugs eingebaut sind.

Revendications

1. Châssis avec une petite hauteur de construction, destiné pour une voiture de voie, surtout pour une voiture de tramway, contenant un cadre, un support essieu, un berceau, auprès du châssis non-tournant sans berceau, suspension primaire et secondaire, tandis que le support essieu est au milieu courbé et les roues du châssis sont fixées sur les tourillons du support essieu par l'intermédiaire des roulements, se distinguant par le fait que,
dans le support essieu (11) sont formés des poches (11a) pour la mise en place du système des ressorts de la suspension primaire (6) et sur ce système des ressorts de la suspension primaire (6) est déposé le cadre du châssis (12a,12b), dans lequel sont d'en bas formés des espaces (12c) pour la mise en place de la partie supérieure du système des ressorts de la suspension primaire (6) et dans le cadre du châssis sont attachés au minimum deux porteurs (12d), où le système des ressorts de la suspension secondaire (7) est posé, tandis que les porteurs interviennent le plus bas possible pourque le système des ressorts de la suspension secondaire (7) soit placé le plus proche possible du sommet de la voie, tandis que la suspension secondaire (7) est complétée par deux amortisseurs verticaux (13) et par au moins un amortisseur transversal (14) amortissants des mouvements dans la suspension secondaire, et le stabilisateur du bercement (15), limitant le bercement transversal de la boîte de la voiture, tandis que sur le système des ressorts de la suspension secondaire /7/ est d'en haut posé le berceau (16a,16b), dans lequel sont pour l'insertion de la suspension secondaire /7/ créés les espaces, (16c), tandis que le berceau (16a, 16b) est relié avec le dessous de la voiture (17) par l'intermédiaire du roulement tournant (18) relié d'une manière solide avec le berceau (16a, 16b), et le dessous de la voiture (17) et le roulement (18) est enfoncé d'en haut dans la poche (16d) dans la partie centrale du berceau (16a,16b), éventuellement sur le système de ressorts de la suspension secondaire /7/ est d'en haut de manière non-tournante posé la boîte dela voiture, tandis que les amortisseurs verticaux et transversaux /13, 14/ et le stabilisateur du bercement /15/ sont montés entre le cadre du châssis /12a, 12b/ et la boîte de la voiture.

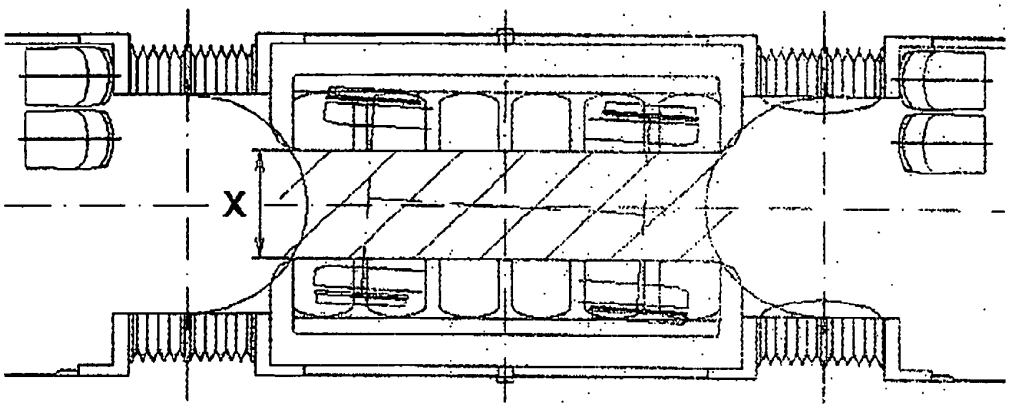


Fig. 1

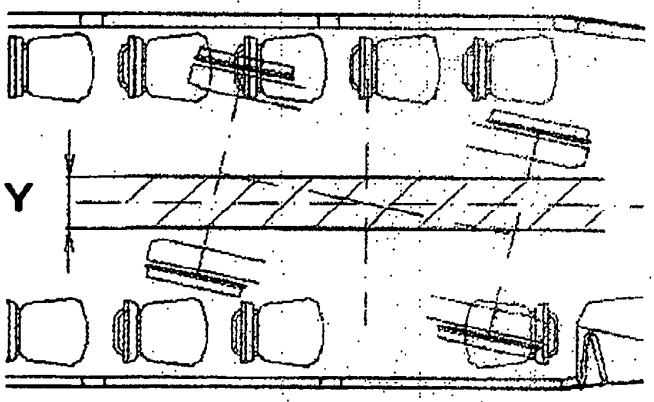


Fig. 2

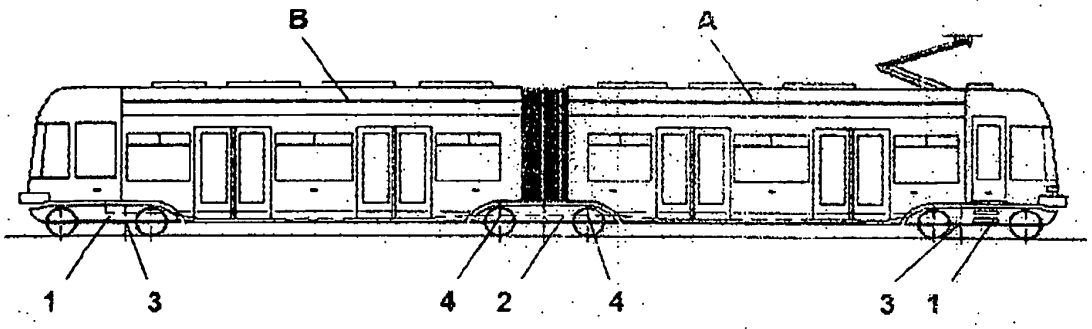

B
A
1
3
4
2
4
3
1

Fig. 3

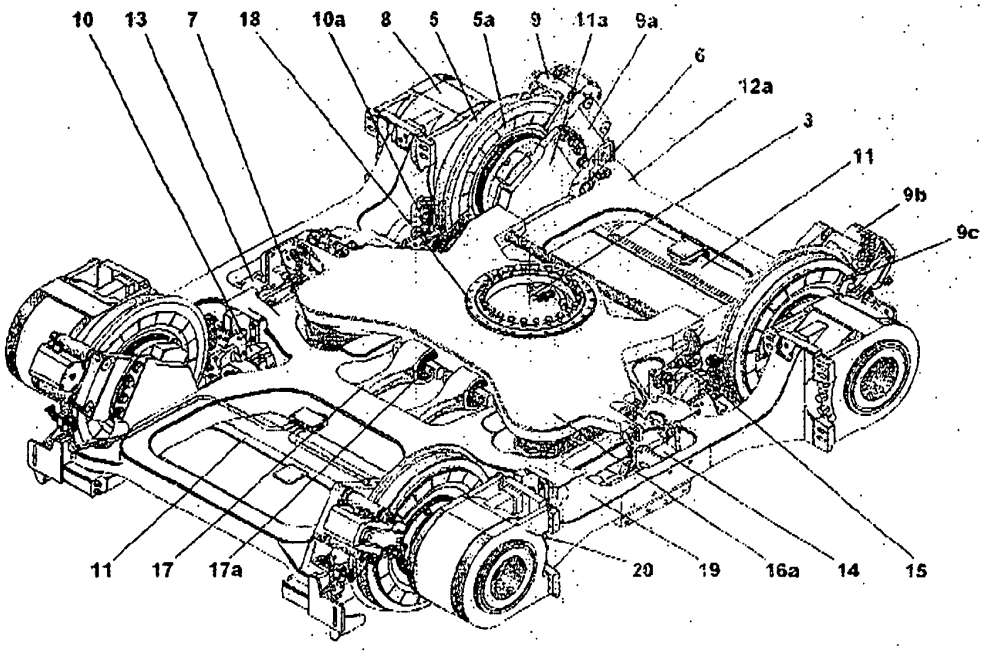

10
13
7
18
10a
8
5
5a
9
11a
9a
6
12a
3
11
9b
9c
11
17
17a
20
19
16a
14
15

Fig. 4

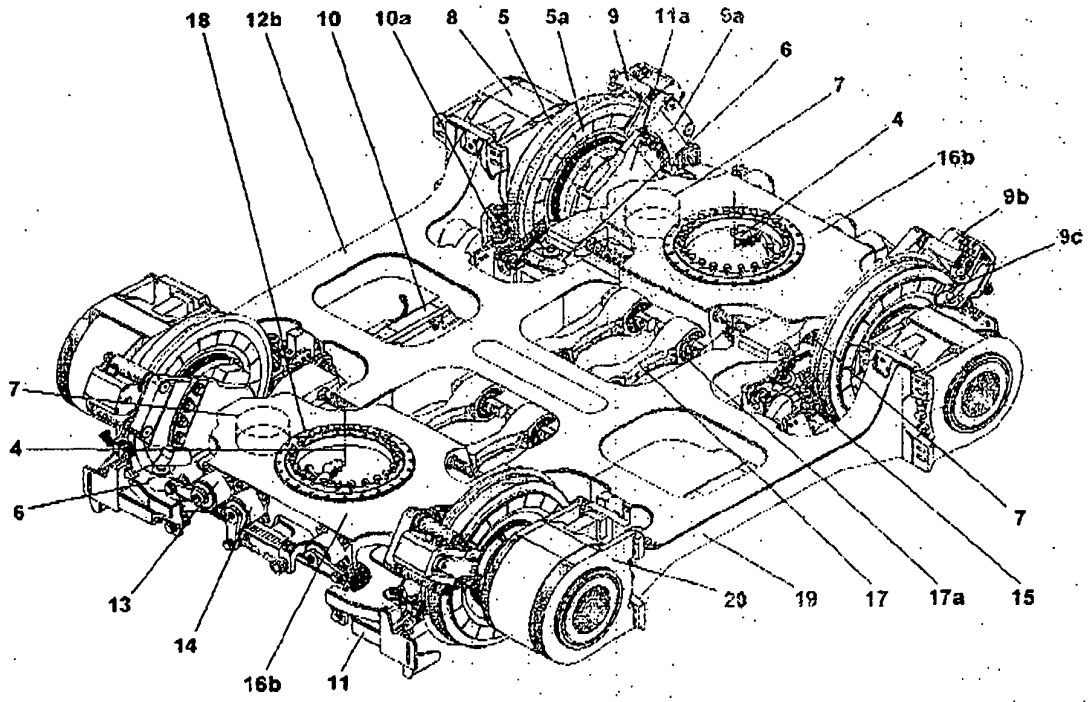
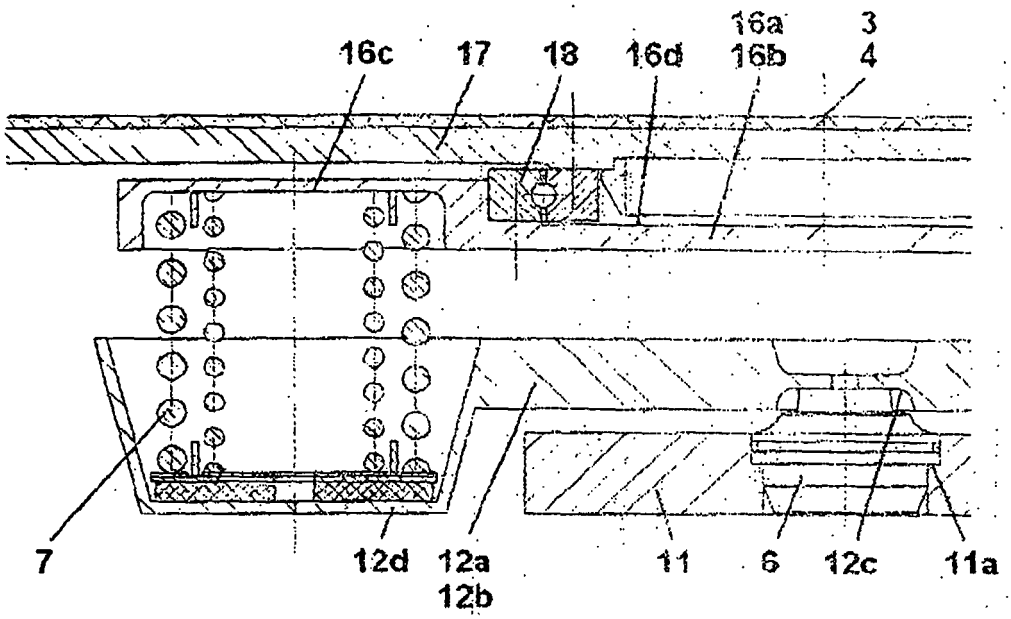

18
12b
10
10a
8
5
5a
9
11a
9a
6
7
4
16b
9b
9c
7
4
6
13
14
16b
11
20
19
17
17a
15
7

Fig. 5



UPPER SURFACE OF THE RAIL

Fig. 6

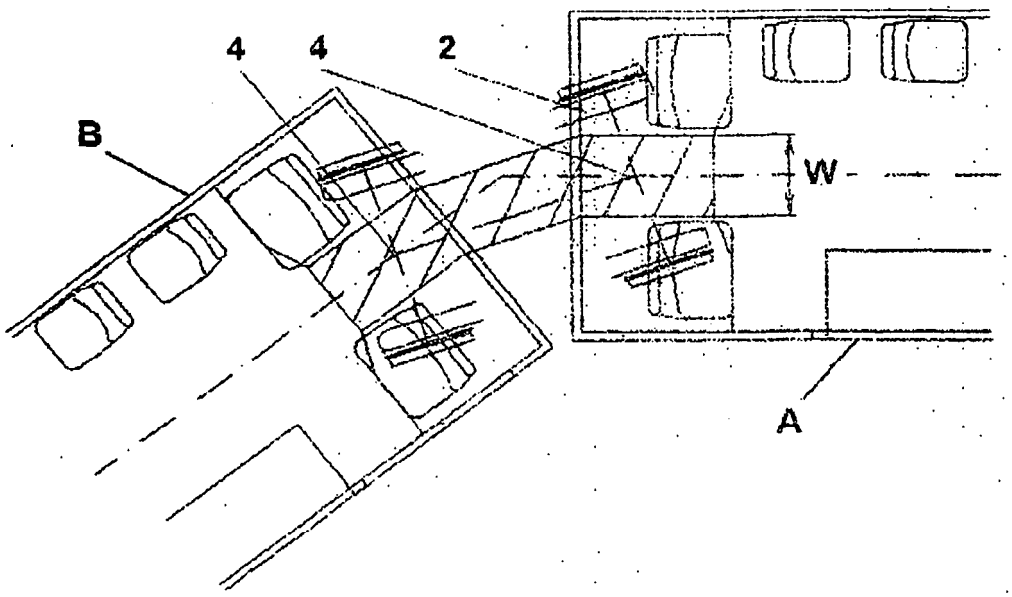


Fig. 7

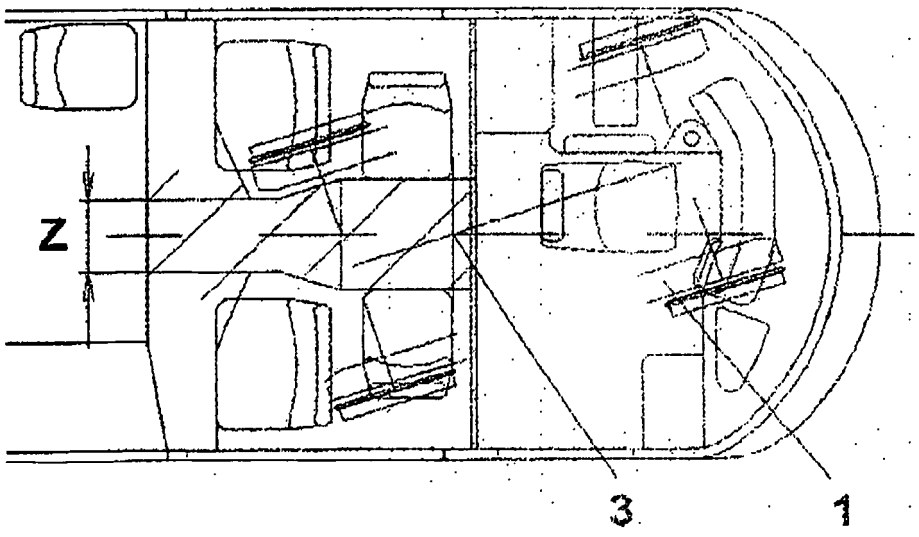


Fig. 8

REFERENCES CITED IN THE DESCRIPTION

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