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

(11) EP 2 660 120 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
06.11.2013 Bulletin 2013/45

(51) Int Cl.:
B61F 5/04 *(2006.01)*

(21) Application number: **12180801.8**

(22) Date of filing: **17.08.2012**

(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

(30) Priority: **03.05.2012 CN 201220193623 U**
03.05.2012 CN 201220193602 U
03.05.2012 CN 201220193656 U
04.05.2012 CN 201210136640
04.05.2012 CN 201210135845
04.05.2012 CN 201220197013 U
04.05.2012 CN 201220198127 U

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Remarks:
Amended claims in accordance with Rule 137(2) EPC.

(54) Railway vehicle bogie

(57) A railway vehicle bogie comprises a frame, a bolster, a wheel set assembly, an axle box suspension system, a longitudinal traction device and a hanger rod device. Wherein, the bolster is connected with the frame through the hanger rod device, and the frame is suspended above the wheel set assembly through an axle box; and one end of the longitudinal traction device is connected with the frame, and the other end of the longitudinal traction device is connected with the bolster and used for transferring a force along a longitudinal direction between the frame and the bolster. According to the railway vehicle bogie provided by an embodiment, the longitudinal traction device is arranged between the frame and the bolster and can transfer the longitudinal force between the frame and the bolster, so that the longitudinal traction device is more proper compared with the longitudinal stop for transferring the longitudinal force in the prior art; in addition, the hanger rod device with a novel structure in the railway vehicle bogie provided by an embodiment can effectively avoid the problem of abrasion in the hanger rod device in the prior art.

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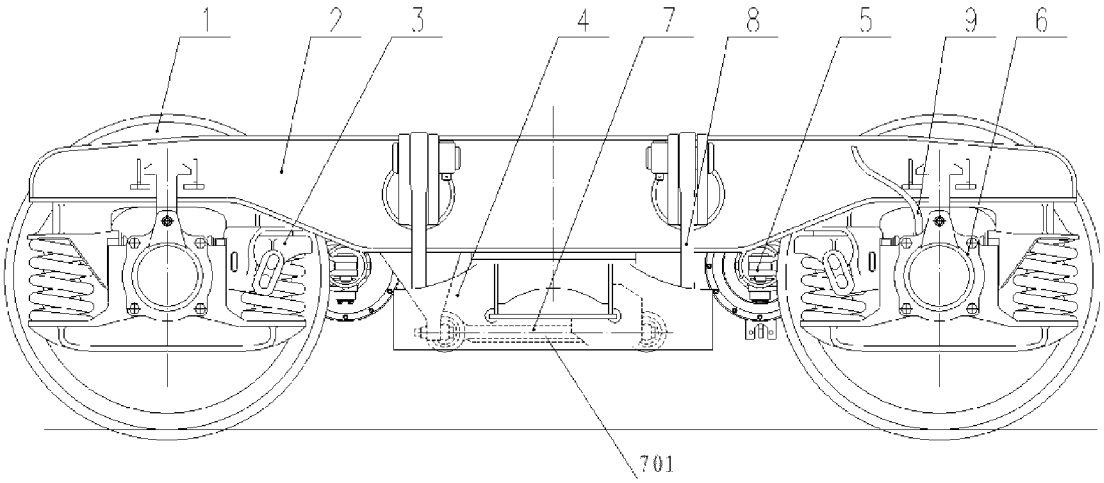

Figure 1

Description

FIELD OF THE TECHNOLOGY

[0001] The present invention relates to a railway vehicle bogie technology, and particularly to a railway wagon bogie.

BACKGROUND

[0002] Railway vehicle bogie mainly can be divided into two categories: a three-piece type bogie and a frame type bogie. The three-piece type bogie has disadvantages such as smaller diamond resistant rigidity, bigger unsprung mass, inability of installing disc brake, the running speed not exceeding 120km/h and etc. While the frame type bogie has advantages, such as high diamond resistant rigidity, small unsprung mass and etc. The dynamics performance of the frame type bogie is obviously superior to that of the three-piece type bogie.

[0003] At present, a bogie of a railway carriage is featured by a speed of 160km/h and an axle load of not more than 18t. However, since the railway carriage has a smaller loading capacity change than the wagon when the carriage is in unloaded or full-loaded state, and due to a complex structure and high cost, the railway carriage bogie cannot be directly applied to a quick railway wagon with a speed of greater than or equal to 160km/h.

[0004] The existing frame type bogie consists of a wheel set assembly, a frame, an axle box suspension system, a bolster and a braking system. The frame is arranged above two wheel set assemblies through the axle box suspension system. The bolster is connected with the frame through a hanger rod device. The middle part of the bolster is connected with the frame in the transverse direction through a damping device. The longitudinal force between the frame and the bolster is transferred through a longitudinal stop. The existing transferring way of longitudinal force between the frame and the bolster through the longitudinal stop not only has problems that the longitudinal force is not properly transferred, but also aggravates abnormal friction of the hanger rod device and the longitudinal stop, and then limits the improvement on the running speed of railway vehicles.

SUMMARY

[0005] An aspect of the present invention provides a railway vehicle bogie, and particularly, a railway wagon bogie with a running speed of more than or equal to 160km/h, which can solve the problem that the longitudinal force between the frame and the bolster is not properly transferred in the prior art.

[0006] An embodiment of the present invention provides a railway vehicle bogie, which comprises frame, bolster and at least one longitudinal traction device; wherein, the bolster is connected with the frame through a hanger rod device; and one end of the longitudinal traction device is connected with the frame, and the other end is connected with the bolster and used for transferring longitudinal force between the frame and the bolster.

[0007] The railway vehicle bogie comprises two longitudinal traction devices, and each longitudinal traction device comprises a longitudinal traction rod; the frame comprises a first side beam and a second side beam which are arranged in parallel; one end of the bolster is connected with the first side beam through the longitudinal traction rod, and the other end of the bolster is connected with the second side beam through the longitudinal traction rod; a first pull rod mounting bracket and a second pull rod mounting bracket for hinging the longitudinal traction rods are respectively arranged on two sides of the bolster in the length direction; and
the first side beam is provided with a third pull rod mounting bracket for hinging the longitudinal traction rod, and the second side beam is provided with a fourth pull rod mounting bracket for hinging the longitudinal traction rod; and the third pull rod mounting bracket and the fourth pull rod mounting bracket are distributed on two sides of the bolster.

[0008] In the railway vehicle bogie, the frame further comprises a first cross beam and a second cross beam which are arranged between the first side beam and the second side beam; the first cross beam is provided with at least one first longitudinal stop; the second cross beam is provided with at least one second longitudinal stop; and the bolster is positioned between the first longitudinal stop and the second longitudinal stop.

[0009] In the railway vehicle bogie, the bolster is provided with longitudinal stop wear plates at the positions corresponding to the first longitudinal stop and the second longitudinal stop, for interaction with the first longitudinal stop and the second longitudinal stop, respectively.

[0010] In the railway vehicle bogie, the bolster comprises a spherical center plate; the bolster is provided with a center plate mounting hole adapted to the spherical surface of the spherical center plate; and the spherical center plate is arranged in the center plate mounting hole.

[0011] In the railway vehicle bogie, the frame further comprises a first hanger rod connecting device, and the first hanger rod connecting device comprises a hanger rod mounting bracket and a connecting rod; the hanger rod mounting bracket is connected with the hanger rod device; and each of the first side beam and the second side beam is provided with a through hole, and the connecting rod of the first hanger rod connecting device penetrates through the through holes and is connected with the first cross beam or the second cross beam.

[0012] In the railway vehicle bogie, the bolster comprises upper cover plate, web plate, lower cover plate and end plate; wherein,
the bolster upper cover plate, the bolster web plate, the bolster lower cover plate and the bolster end plate form a box-type structure;
the middle part of the bolster upper cover plate in the

length direction is provided with the center plate mounting hole, the bolster upper cover plate is also provided with a side bearing mounting bracket, and the side bearing mounting bracket close to the bolster end plate is provided with a transverse stop;
the bolster end plate is provided with a second hanger rod connecting device connected with the hanger rod device; and
the first pull rod mounting bracket and the second pull rod mounting bracket are arranged on the bolster web plate and the bolster lower cover plate or the joints of the bolster web plate and the bolster lower cover plate.

[0013] In the railway vehicle bogie, the bolster upper cover plate is provided with a mounting surface for mounting the side bearing mounting bracket, the mounting surface is a concave arc surface, while the mounting surface of the side bearing mounting bracket is a convex arc surface adapted to the concave arc surface of the bolster upper cover plate.

[0014] In the railway vehicle bogie, the hanger rod device comprises a hanger rod, a hanger rod round pin and a locking pin; wherein,
two ends of the hanger rod are respectively provided with a first hanger rod through hole and a second hanger rod through hole;
the frame is provided with a first hanger rod connecting hole, and the bolster is provided with a second hanger rod connecting hole;
one end of the hanger rod is connected with the frame through the hanger rod round pin penetrating through the first hanger rod through hole and the first hanger rod hole;
the other end of the hanger rod is connected with the bolster through the hanger rod round pin penetrating through the second hanger rod through hole and the second hanger rod connecting hole;
one end of each hanger rod round pin is provided with a locking pin hole;
and each locking pin penetrates through each locking pin hole.

[0015] In the railway vehicle bogie, a bush is arranged between each hanger rod through hole and each hanger rod round pin;
each hanger rod round pin is provided with an annular groove with a concave arc surface; and the inner wall of the bush is provided with a convex curved surface adapted to the annular groove of each hanger rod round pin.

[0016] In the railway vehicle bogie, the locking pin hole is a slotted hole so that the hanger rod round pin can shift in the axis direction thereof when the locking pin penetrate through the locking pin hole.

[0017] In the railway vehicle bogie, the hanger rod device comprises a hanger rod, a rubber bearing and a locking unit; wherein,
two ends of the hanger rod are respectively provided with a first hanger rod through hole and a second hanger rod through hole;
two ends of the rubber bearing are respectively provided with fixing rods with semicircular cross sections, and a middle section of the rubber bearing is a cylindrical ball hinge; and
the fixing rod of the rubber bearing penetrating through the first hanger through hole of the hanger rod is connected with the frame through the locking unit, and the fixing rod of the rubber bearing penetrating through the second hanger rod through hole of the hanger rod is connected with the bolster through the locking unit.

[0018] In the railway vehicle bogie, the locking unit comprises a locking plate and a locking bolt;
the locking plate is provided with a threaded hole;
and the locking plate is fixed on the frame or the bolster through the locking bolt in the threaded hole.

[0019] In the railway vehicle bogie, one lateral surface, in contact with the fixing rod of the rubber bearing, of the locking plate is provided with a groove adapted to a rectangular lateral surface of the fixing rod.

[0020] In the railway vehicle bogie, a locking gasket is arranged between the locking bolt and the locking plate, and the locking gasket consists of two gaskets which are buckled together, wherein the buckled surfaces of the two gaskets are provided with saw teeth.

[0021] According to the railway vehicle bogie provided by an embodiment of the present invention, the longitudinal traction device arranged between the frame and the bolster can transfer the longitudinal force between the frame and the bolster more properly compared with the longitudinal stop for transferring the longitudinal force in the prior art, abnormal abrasion of the longitudinal stop and the hanger rod device due to transfer of the longitudinal force is avoided, and the running speed of a railway vehicle is improved. In addition, the railway vehicle bogie provided by an embodiment of the present invention is applied to a railway wagon, which can achieve a running speed of the railway wagon of more than or equal to 160km/h and a maximum applied axle load of 18t.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] Figure 1 is a front structural schematic diagram of a railway vehicle bogie provided by an embodiment of the present invention;

[0023] Figure 2 is an top structural schematic diagram of the railway vehicle bogie provided by an embodiment of the present invention;

[0024] Figure 3 is a structural schematic diagram of a frame in the railway vehicle bogie provided by an embodiment of the present invention;

[0025] Figure 4 is a structural schematic diagram of a first hanger rod connecting device of the frame in the railway vehicle bogie provided by an embodiment of the present invention;

[0026] Figure 5 is a structural schematic diagram of a cross beam of the frame in the railway vehicle bogie provided by an embodiment of the present invention;

[0027] Figure 6 is a structural schematic diagram of a side beam of the frame in the railway vehicle bogie provided by an embodiment of the present invention;

[0028] Figure 7 is a structural schematic diagram of a second guide frame of the frame in the railway vehicle bogie provided by an embodiment of the present invention;

[0029] Figure 8 is a structural schematic diagram of a bolster in the railway vehicle bogie provided by an embodiment of the present invention;

[0030] Figure 9 is a structural schematic diagram that a spherical center plate and a bolster upper cover plate of the bolster in the railway vehicle bogie provided by an embodiment of the present invention are fixedly connected by a bolt;

[0031] Figure 10 is a structural schematic diagram that the spherical center plate and the bolster upper cover plate of the bolster in the in the railway vehicle bogie provided by an embodiment of the present invention are fixedly connected by welding;

[0032] Figure 11 is a partial sectional schematic diagram of Embodiment I of a hanger rod device in the railway vehicle bogie provided by an embodiment of the present invention;

[0033] Figure 12 is an axonometric diagram of Embodiment I of the hanger rod device in the railway vehicle bogie provided by an embodiment of the present invention;

[0034] Figure 13 is an assembly schematic diagram of a hanger rod round pin and a bush in Embodiment I of the hanger rod device in the railway vehicle bogie provided by an embodiment of the present invention;

[0035] Figure 14 is a structural schematic diagram of the hanger rod round pin in Embodiment I of the hanger rod device in the railway vehicle bogie provided by an embodiment of the present invention;

[0036] Figure 15 is a structural schematic diagram of Embodiment II of the hanger rod device in the railway vehicle bogie provided by an embodiment of the present invention;

[0037] Figure 16 is a structural schematic diagram of a rubber bearing in Embodiment II of the hanger rod device in the railway vehicle bogie provided by an embodiment of the present invention;

[0038] Figure 17 is an assembly schematic diagram of a hanger rod and the rubber bearing in Embodiment II of the hanger rod device in the railway vehicle bogie provided by an embodiment of the present invention;

[0039] Figure 18 is a structural schematic diagram of a locking plate in Embodiment II of the hanger rod device in the railway vehicle bogie provided by an embodiment of the present invention;

[0040] Figure 19 is a structural schematic diagram of a pin nut in the railway vehicle bogie provided by an embodiment of the present invention;

[0041] Figure 20 is a structural schematic diagram of a locking gasket in Embodiment II of the hanger rod device in the railway vehicle bogie provided by an embodiment of the present invention;

[0042] Figure 21 is a structural schematic diagram of Embodiment III of the hanger rod device in the railway vehicle bogie provided by an embodiment of the present invention; and

[0043] Figure 22 is a structural schematic diagram of the rubber bearing in Embodiment III of the hanger rod device in the railway vehicle bogie provided by an embodiment of the present invention.

DETAILED DESCRIPTION

[0044] Figure 1 and Figure 2 show the structural schematic diagram of the railway vehicle bogie provided by an embodiment of the present invention. As shown in the figures, the railway vehicle bogie comprises a frame 2, a bolster 4 and a longitudinal traction device 7. Wherein, as shown in Figure 1 and Figure 2, the bolster 4 is connected with the frame 2 through a hanger rod device 8. The hanger rod device 8 is arranged vertical to the body direction of a railway vehicle, so that the frame is vertically connected with the bolster. One end of the longitudinal traction device 7 is connected with the frame 2, and the other end of the longitudinal traction device 7 is connected with the bolster 4. The longitudinal traction device 7 is used for transferring a force along a longitudinal direction between the frame 2 and the bolster 4. The longitudinal force is a force parallel to the body direction of the railway vehicle, and the longitudinal force is produced between the frame and the bolster when the vehicle runs.

[0045] According to Embodiment I, the longitudinal traction device arranged between the frame and the bolster can transfer the longitudinal force between the frame and the bolster more properly compared with the hanger rod device for transferring the longitudinal force in the prior art, abrasion of the hanger rod device due to transfer of the longitudinal force is avoided, and the running speed of the railway vehicle is improved. The railway vehicle bogie provided by embodiments of the present invention can be applied to a railway wagon, which can achieve a running speed of the railway wagon of more than or equal to 160km/h and a maximum applied axle load of 18t.

[0046] Based on the railway vehicle bogie provided by Embodiment I of the present invention, the technical solutions of the railway vehicle bogie can be further improved, and the specific improved solutions are illustrated as follows.

[0047] Further, the railway vehicle bogie comprises two longitudinal traction devices, and each longitudinal traction device comprises a longitudinal traction rod. The frame 2 comprises a first side beam 2031 and a second side beam 2032 which are arranged in parallel. One end of the bolster 4 is connected with the first side beam 2031 through the longitudinal traction rod, and the other end of the bolster 4 is connected with the second side beam 2032 through the longitudinal traction rod. A first pull rod mounting bracket 440 and a second pull rod mounting bracket 441 for hinging the longitudinal traction rods are respectively arranged on two sides of the bolster 4 in the length direction. The first side beam 2031 is provided with a third pull rod mounting bracket 270 for hinging the

longitudinal traction rod, and the second side beam 2032 is provided with a fourth pull rod mounting bracket 271 for hinging the longitudinal traction rod. The third pull rod mounting bracket 270 and the fourth pull rod mounting bracket 271 are distributed on two sides of the bolster 4. Wherein, two ends of one longitudinal traction rod, namely two ends of the first longitudinal traction rod 701 in Figure 2 are respectively hinged with the first pull rod mounting bracket 440 and the third pull rod mounting bracket 270; and two ends of the other longitudinal traction rod, namely two ends of the second longitudinal traction rod 702 in Figure 2 are respectively hinged with the second pull rod mounting bracket 441 and the fourth pull rod mounting bracket 271. Specifically, as shown in Figure 2, the frame 2 comprises a first side beam 2031 and a second side beam 2032 which are arranged in parallel. The first side beam 2031 and the second side beam 2032 are arranged in parallel to the body. The axis 250 of the frame 2 is vertical to the first side beam 2031 and the second side beam 2032. The bolster 4 is arranged in parallel to the axis 250 of the frame 2, and the symmetrical axis 260 of the bolster 4 in the length direction is superposed with the axis 250 of the frame 2. The first pull rod mounting bracket 440 and the second pull rod mounting bracket 441 are respectively arranged on two sides of the symmetrical axis 260 of the bolster 4. The first side beam 2031 is provided with the third pull rod mounting bracket 270 on one side of the axis 250 of the frame 2, and the second side beam 2032 is provided with the fourth pull rod mounting bracket 271 on the other side of the axis 250 of the frame 2. One end of the first longitudinal traction rod 701 is hinged with the first pull rod mounting bracket 440, and the other end of the first longitudinal traction rod 701 is hinged with the third pull rod mounting bracket 270. One end of the second longitudinal traction rod 702 is hinged with the second pull rod mounting bracket 441, and the other end of the second longitudinal traction rod 702 is hinged with the fourth pull rod mounting bracket 271. Specifically, two ends of the first longitudinal traction rod 701 can be respectively hinged with the first side beam 2031 and the bolster 4 by adopting a structure of a rubber ball hinge. Two ends of the second longitudinal traction rod 702 can also be hinged with the second side beam 2032 and the bolster 4 by adopting a structure of a rubber ball hinge. Wherein, the shapes of the first longitudinal traction rod 701 and the second longitudinal traction rod 702 are not limited to a rod-like structure with through holes at two ends thereof, as shown in the figure, but can also be other shapes, as long as transfer of the longitudinal force can be achieved. In addition, the first pull rod mounting bracket and the second pull rod mounting bracket can be fixed on the bolster by welding. The third pull rod mounting bracket and the fourth pull rod mounting bracket can be respectively fixed on the first side beam and the second side beam by welding. By adopting the above structure, the two longitudinal traction rods can transfer the longitudinal force between the frame and the bolster together, and the transfer effect of the longitudinal force is better.

[0048] It should be noted that when the frame 2 and the bolster 4 in Figure 1 are in a static state, the first longitudinal traction rod 701 and the second longitudinal traction rod (not marked in the figure) which are connected to the frame 2 and the bolster 4 are parallel to the first side beam and the second side beam, or parallel to the body of the railway vehicle. This embodiment is not limited to the connecting mode shown in Figure 1. When the railway vehicle bogie is in a static state, after the first longitudinal traction rod and the second longitudinal traction rod are respectively connected with the bolster and the frame, the first longitudinal traction rod and the second longitudinal traction rod can form certain inclined angle with the body, and the inclined angle can be set according to the actual installation space and the design requirement.

[0049] Specifically, as shown in Figure 1 and Figure 2, the structure of the railway vehicle bogie illustrated in Embodiment I further comprises two pairs of wheel set assemblies 1, four axle box suspension systems 3, a braking system assembly 5 and four axle box assemblies 6. Each wheel set assembly 1 comprises a pair of wheels and an axle for connecting the pair of wheels. Wherein, the axle is provided with two brake discs. An anti-skid device 16 is arranged at one end of each wheel set assembly 1. The axle box suspension systems 3 can be Lenoir damper. The braking system assembly 5 can be a unit type caliper brake. The bolster 4 is connected with the frame 2 in the vertical direction through four pairs of hanger rod assemblies 8 which are parallel to one another. The middle part of the bolster 4 is connected with the frame 2 through a transverse oil damper 15. The frame 2 is provided with two bolster safety hangers 13. The bogie is provided with a weighing valve 10. The bogie is provided with two constant contact side bearing assemblies 11. An axle temperature monitoring system 9 is arranged above the four axle box assemblies 6. The axle temperature monitoring system 9 is used for monitoring the temperatures of the axle box assemblies 6.

[0050] Further, as shown in Figure 2 and Figure 3, the frame 2 further comprises a first cross beam 2021 and a second cross beam 2022 which are arranged between the first side beam 2031 and the second side beam 2032. Specifically, the first cross beam 2021 and the second cross beam 2022 are vertical to the first side beam and the second side beam. Moreover, the first cross beam 2021 and the second cross beam 2022 can be respectively connected with the first side beam 2031 and the second side beam 2032 in a manner of girth butt welding. The first cross beam is provided with at least one first longitudinal stop 1401. The second cross beam 2022 is provided with at least one second longitudinal stop 1402. The bolster 4 is positioned between the first longitudinal stop 1401 and the second longitudinal stop 1402. As shown in the figures, the first cross beam 2021 is provided with two first longitudinal stops 1401, and the second cross beam 2022 is provided with two second longitudinal

stops 1402. Specifically, as shown in Figure 2, the first longitudinal stops and the second longitudinal stops can be respectively fixed on the first cross beam 2021 and the second cross beam 2022 through longitudinal stop mounting brackets respectively arranged on the first cross beam 2021 and the second cross beam 2022. The first longitudinal stops and the second longitudinal stops can assist the longitudinal traction device in transferring the longitudinal force between the frame and the bolster together. Certainly, when the longitudinal traction device fails, the first longitudinal stops and the second longitudinal stops can replace the longitudinal traction device to function. The first longitudinal stops, the second longitudinal stops and the longitudinal traction device together form a force along a longitudinal direction transfer system of the bogie, so that the longitudinal force transfer reliability of the bogie is greatly improved. Wherein, for avoiding the abrasion of the bolster due to the first longitudinal stops and the second longitudinal stops, longitudinal stop wear plates are arranged at the positions of the bolster corresponding to the first longitudinal stops and the second longitudinal stops. The longitudinal stop wear plates function coordinately with the first longitudinal stops and the second longitudinal stops to transfer the longitudinal force, which can prevent the bolster from being abraded when the first longitudinal stops and the second longitudinal stops work. Wherein, the longitudinal stop wear plates can be fixed on the bolster by welding. Furthermore, as shown in Figure 3, in order that the installation space is utilized more properly and the structure of the bogie is simpler, the longitudinal stop and a bolster safety hanger can be arranged on the longitudinal stop mounting bracket 1403. Each of the first cross beam 2021 and the second cross beam 2022 is provided with a brake hanging bracket 209 for mounting the braking system. The brake hanging brackets 209 are used for mounting the unit braking systems of the bogie.

[0051] Specifically, as shown in Figure 3, the frame further comprises a first hanger rod connecting device 205. As shown in Figure 4, the first hanger rod connecting device 205 comprises a hanger rod mounting bracket 2051 and a connecting rod 2052. Specifically, the first hanger rod connecting device 205 can be designed into an integrally forged structure. The integrally forged structure has the characteristics of high strength, high reliability and the like. The hanger rod mounting bracket 2051 is connected with the hanger rod device. The first side beam and the second side beam are provided with through holes. The first side beam 2031 as shown in Figure 3 is provided with two through holes 2011. Similarly, the corresponding positions of the second side beam 2032 are also provided with two through holes 2011. The connecting rods 2052 of two first hanger rod connecting devices 205 respectively penetrate through the two through holes 2011 and are connected with the first cross beam and the second cross beam. Correspondingly, ends 220, to be connected with the first hanger rod connecting device, of the first cross beam and the second cross beam are of tubular-shaped structure, as shown in Figure 5. The connecting rod of the first hanger rod connecting device is connected with the first cross beam and the second cross beam in an inserting mode.

[0052] Specifically, as shown in Figure 6, each of the first side beam and the second side beam has a double-web box-type structure, namely the first side beam is a hollow box body consisting of a side beam upper cover plate 2101 of which two ends are provided with folded edges, a side beam lower cover plate 2102 and two side beam web plates 2103 arranged between the side beam upper cover plate 2101 and the side beam lower cover plate 2102. The side beam web plates 2103 are provided with the through holes 2011. Two ends of the first side beam and the second side beam in the length direction are provided with first guide frames. As shown in the figure, two ends of the side beam lower cover plate 2102 in the length direction of each side beam are provided with first guide frames 206. Four first guide frames 206 arranged on the side beam lower cover plates of the first side beam and the second side beam can be matched with the axle box suspension systems with the Lenoir damper to install the axle box suspension systems. The side beam lower cover plates of the first side beam and the second side beam are also provided with the third pull rod mounting bracket 270 and the fourth pull rod mounting bracket (not marked in the figure) for connecting the first longitudinal traction rod and the second longitudinal traction rod. The third pull rod mounting bracket and the fourth pull rod mounting bracket can be fixed on the side beam lower cover plate by welding. One end of the first side beam or the second side beam in the length direction is also provided with a second guide frame 207 for installing the weighing valve. According to the embodiment shown in Figure 3, one end of the second side beam in the length direction is also provided with the second guide frame 207. Specifically, as shown in Figure 7, the part 230 of the second guide frame 207 for installing the weighing valve is provided with an annular equal wall thickness hole.

[0053] Further, as shown in Figure 8, the bolster 4 comprises a spherical center plate 407. The bolster 4 is provided with a center plate mounting hole adapted to the spherical surface of the spherical center plate 407. The spherical center plate 407 is arranged in the center plate mounting hole. The spherical center plate can obtain a stable rotary resistance moment when the railway vehicle bogie runs at a high speed, so that the running speed of the railway vehicle is improved.

[0054] Specifically, as shown in Figure 8, the bolster 4 comprises a bolster upper cover plate 401, a bolster web plate 402, a bolster lower cover plate 403 and a bolster end plate 404. Wherein, the bolster upper cover plate 401, the bolster web plate 402, the bolster lower cover plate 403 and the bolster end plate 404 form a box-type structure, namely the bolster upper cover plate 401, the bolster web plate 402, the bolster lower cover plate 403 and the bolster end plate 404 encircle a hollow box body.

The middle part of the bolster upper cover plate 401 in the length direction is provided with the center plate mounting hole. The spherical center plate 407 is arranged in the center plate mounting hole, as shown in Figure 9 and Figure 10. The bolster upper cover plate 401 is also provided with a side bearing mounting bracket 406. The side of the side bearing mounting bracket 406 close to the bolster end plate 404 is provided with a transverse stop 408. The bolster end plate 404 is provided with a second hanger rod connecting device 405 connected with the hanger rod device. The first pull rod mounting bracket and the second pull rod mounting bracket are arranged on the bolster web plate the bolster lower cover plate, or the joints of the bolster web plate and the bolster lower cover plate. According to the embodiment illustrated in Figure 8, the first pull rod mounting bracket 440 and the second pull rod mounting bracket (not marked in the figure) are arranged on the joints of the bolster web plate 402 and the bolster lower cover plate 403. The first pull rod mounting bracket and the second pull rod mounting bracket are fixed on the joints of the bolster web plate 402 and the bolster lower cover plate 403 by welding. Longitudinal stop wear plates 410 are arranged at the positions of the bolster web plate 402 corresponding to the first longitudinal stop and the second longitudinal stop to prevent the bolster web plate 402 from being abraded by the first longitudinal stop and the second longitudinal stop.

[0055] Wherein, the spherical center plate 407 can be connected with the bolster upper cover plate 401 by a bolt 411, as shown in Figure 8 and Figure 9. Alternatively, the spherical center plate can also be fixed on the bolster upper cover plate by welding, as shown in Figure 10. Compared with the welding connection, connecting the spherical center plate with the bolster upper cover plate by a bolt has the advantage that: the installation height of the spherical center plate can be adjusted more conveniently by the installation personnel according to the requirement. In addition, in the case of connecting the spherical center plate with the bolster upper cover plate through a connector, when the connector fails, the spherical center plate can still transfer the longitudinal force load.

[0056] Further, as shown in Figure 8, the bolster upper cover plate 401 is provided with a mounting surface 4011 for mounting the side bearing mounting bracket, the mounting surface 4011 is a concave arc surface, and the mounting surface of the side bearing mounting bracket 406 is a convex arc surface adapted to the concave arc surface of the bolster upper cover plate 401. The bolster upper cover plate 401 can be fixedly connected with the side bearing mounting bracket 406 by welding. The matching surfaces of the bolster upper cover plate and the side bearing mounting bracket are connected by adopting an arc surface, so that the strength of the position, where the side bearing mounting bracket is installed, of the bolster can be effectively improved, and the working reliability of the bolster is improved.

[0057] Further, Figures 11 and 12 show the sectional structural schematic diagram and the axonometric diagram of the first embodiment of the hanger rod device. As shown in Figures 11 and 12, the hanger rod device comprises a hanger rod 801, a hanger rod round pin 803 and a locking pin 804. Wherein, the hanger rod 801 can have a rod-like structure of which cross section is in a random shape. Two ends of the hanger rod 801 are provided with a first hanger rod through hole and a second hanger rod through hole, respectively. The frame is provided with a first hanger rod connecting hole. The bolster is provided with a second hanger rod connecting hole. One end of the hanger rod 801 is connected with the frame through the hanger rod round pin 803 penetrating through the first hanger rod through hole and the first hanger rod connecting hole. The other end of the hanger rod 801 is connected with the bolster through the hanger rod round pin 803 penetrating through the second hanger rod through hole and the second hanger rod connecting hole. As shown in the figures, the first hanger rod connecting hole is formed in the first hanger rod connecting device 205 of the frame. The hanger rod round pin 803 penetrates through the first hanger rod through hole and the first hanger rod connecting hole of the hanger rod to hinge the hanger rod and the frame. The second hanger rod connecting hole is formed in the second hanger rod connecting device of the bolster. The hanger rod round pin 803 penetrates through the second hanger rod through hole and the second hanger rod connecting hole of the hanger rod to hinge the hanger rod and the bolster. The other end of the hanger rod round pin 803 is provided with a locking pin hole. The locking pin 804 penetrates through the locking pin hole. Specifically, as shown in Figures 11 and 12, one side of the first hanger rod connecting device 205 of the frame is provided with a fixing platform. The fixing platform is provided with a first fixing through hole adapted to the outside diameter of the hanger rod round pin 803. The fixing platform is also provided with a second fixing through hole of which axis is vertical to that of the first fixing through hole. One end of the hanger rod round pin 803 penetrates through the first fixing through hole of the fixing platform. The locking pin 804 penetrates through the second fixing through hole of the fixing platform and the locking pin hole of the hanger rod round pin 803 to fixedly connect the first hanger rod connecting device 205 of the frame and the hanger rod round pin 803. Through the structure that the first hanger rod connecting device 205 of the frame is fixedly connected with the hanger rod round pin 803, the hanger rod round pin 803 and the first hanger rod connecting device 205 in the frame do not have relative movement, so that abrasion between the hanger rod round pin 803 and the first hanger rod connecting device 205 is avoided. Likewise, for avoiding the abrasion between the second hanger rod connecting device of the bolster and the hanger rod round pin, as shown in Figures 11 and 12, and the structure of the second hanger rod connecting device 405 of the bolster and the fixed connecting mode of the

second hanger rod connecting device 405 and the hanger rod round pin are the same as the structure of the first hanger rod connecting device 205 of the frame and the fixed connecting mode of the hanger rod 205 on the bolster and the hanger rod round pin 803.

[0058] It should be noted that, when the first hanger rod connecting device is fixedly connected with the hanger rod round pin, relative movement is generated between the hanger rod round pin and the inner wall of the through hole of the hanger rod, therefore the problem of abrasion between the hanger rod round pin and the hanger rod results. Therefore, a bush is arranged between the hanger rod round pin and the hanger rod in the through hole. Further, for reducing abnormal abrasion between the hanger rod round pin and the bush, as shown in Figures 13 and 14, the hanger rod round pin 803 is provided with an annular groove 8032 with a concave arc surface. The inner wall of the bush 802 is provided with a convex curved surface adapted to the shape of the annular groove 8032 of the hanger rod round pin 803. A curved surface matching structure is adopted between the bush 802 and the hanger rod round pin 803, so that rotation of the bush relative to the hanger rod round pin around the axis direction can be met, and abrasion of the bush due to small movement relative to the hanger rod round pin in other directions can be avoided.

[0059] Further, the locking pin hole 8031 can be a slotted hole, for example, with an oval cross section, as shown in Figure 14, or other shaped cross section. The cross section of the shaft of the locking pin can be round shape, or other shape, as long as when the locking pin penetrates through the locking pin hole, the hanger rod round pin can still shift in its axis direction. It should be noted that the purpose of providing a slotted locking pin hole 8031 is that the structure of the slotted hole, for example, with an oval cross section allows the hanger rod round pin to have certain axial displacement in its axis direction when the locking pin, for example, with a round cross section penetrates through the locking pin hole, so that an automatic centering function between the annular groove 8032 formed on the hanger rod round pin and the convex curved surface on the inner wall of the bush 802 is realized, and abrasion caused by deviation between the annular groove 8032 and the convex curved surface on the inner wall of the bush 802 is avoided.

[0060] Further, Figure 15 to Figure 20 show the structural schematic diagram of the second embodiment of the hanger rod device. As shown in Figure 15, the hanger rod device comprises a hanger rod 801, a rubber bearing 806 and a locking unit 805. Wherein, the hanger rod 801 can have a rod-like structure of which cross section can be in a random shape. Two ends of the hanger rod 801 are respectively provided with a first hanger rod through hole and a second hanger rod through hole. Specifically, as shown in Figure 16, two ends of the rubber bearing 806 are provided with fixing rods 8061 with semicircular sections, respectively, and a middle section of the rubber bearing 806 is provided with a cylindrical ball hinge 8062. As shown in Figure 17, the cylindrical ball hinge 8062 is matched with two hanger rod through holes of the hanger rod 801. The fixing rod 8061 of the rubber bearing 806 penetrating through the first hanger rod through hole of the hanger rod is connected with the frame through the locking unit 805. Specifically, as shown in Figure 15, the fixing rod 8061 of the rubber bearing 806 is connected with the first hanger rod connecting device 205 of the frame through the locking unit 805. The fixing rod 8061 of the rubber bearing 806 penetrating through the second hanger rod through hole of the hanger rod is connected with the bolster through the locking unit 805. Specifically, as shown in Figure 15, the fixing rod 8061 of the rubber bearing 806 is connected with the second hanger rod connecting device 405 of the bolster through the locking unit 805. By adopting the rubber bearing, all abrasion between the rubber bearing and the hanger rod through holes can be effectively eliminated, and the maintenance workload can be reduced. The fixing rods of the rubber bearing are designed to be semicircular, so that abrasion on the connecting parts caused by small movement between the rubber bearing and the first hanger rod connecting device and between the rubber bearing and the second hanger rod connecting device can be effectively avoided.

[0061] Wherein, as shown in Figure 15, the locking unit 805 comprises a locking plate 8052 and a locking bolt 8051. Specifically, as shown in Figure 18, the locking plate 8052 is provided with threaded hole. The locking plate 8052 is fixed on the frame or the bolster through the locking bolt 8051 in the threaded hole. Specifically, the locking bolt can fix the corresponding locking plate through the threaded holes formed in corresponding positions of the first hanger rod connecting device 205 of the frame and the second hanger rod connecting device 405 of the bolster respectively. Alternatively, the first hanger rod connecting device 205 in the frame is provided with a first fixing through hole. The locking bolt 8051 penetrates through the first fixing through hole. The first hanger rod connecting device 205 is provided with a second fixing through hole of which axis is vertical to that of the first fixing through hole. A pin nut 808 is arranged in the second fixing through hole. As shown in Figure 19, the pin nut 808 is provided with a positioning through hole 8081 of which axis is vertical to that of the pin nut 808. The locking bolt penetrating through the first fixing through hole in the frame penetrates through the positioning through hole 8081 to fix the locking plate. Likewise, the second hanger rod connecting device 405 in the bolster has the same structure as the first hanger rod connecting device 205 of the frame. Namely, the locking bolt can fix the locking plate through a positioning through hole in the second hanger rod connecting device 405.

[0062] Further, as shown in Figures 15 and 18, one lateral surface, in contact with the fixing rod 8061 of the rubber bearing 806, of the locking plate 8052 is provided with a groove 8053 adapted to the shape of the rectan-

gular lateral surface of the fixing rod 8061. When the fixing rod 8061 of the rubber bearing 806 is installed, the fixing rod 8061 can be higher than the first hanger rod connecting device or the second hanger rod connecting device, so that the fixing rod 8061 is embedded into the groove 8053 in the locking plate 8052, and the locking effect of the locking plate is better. Furthermore, for preventing the locking bolt from loosening, a locking gasket 807 is arranged between the locking bolt 8051 and the locking plate 8052. As shown in Figure 20, the locking gasket 807 consists of two gaskets 8071 and 8072 which are buckled together, wherein, the buckled surfaces of the two gaskets 8071 and 8072 are provided with saw teeth.

[0063] It should be noted that the rubber bearing in the hanger rod device can be the structure as shown in Figure 22, namely the rubber bearing 806 consists of a cylindrical ball hinge and fixing rods arranged at two ends of the cylindrical ball hinge. The fixing rods are cylinders. The fixing rods are coaxial with the cylindrical ball hinge, and the diameter of each fixing rod is smaller than that of the cylindrical ball hinge. Correspondingly, one lateral surface, in contact with the fixing rod of the rubber bearing 806, of the locking plate 8052 is provided with a groove adapted to the shape of the cylindrical surface of the fixing rod.

[0064] Finally, it should be noted that the above embodiments are merely provided for describing the technical solutions of the present invention, but not intended to limit the present invention. It should be understood by persons skilled in the art that although the present invention has been described in detail with reference to the foregoing embodiments, modifications can be made to the technical solutions described in the foregoing embodiments, or equivalent replacements can be made to some technical features in the technical solutions; however, such modifications or replacements do not cause the essence of corresponding technical solutions to depart from the spirit and scope of the embodiments of the present invention.

Claims

1. A railway vehicle bogie, comprising a frame, a bolster and at least one longitudinal traction device, wherein, the bolster is connected with the frame through a hanger rod device; and
   one end of the longitudinal traction device is connected with the frame, and the other end of the longitudinal traction device is connected with the bolster and used for transferring a force along a longitudinal direction between the frame and the bolster.

2. The railway vehicle bogie of claim 1, comprising two longitudinal traction devices, wherein each longitudinal traction device comprises a longitudinal traction rod;
   the frame comprises a first side beam and a second side beam which are arranged in parallel; one end of the bolster is connected with the first side beam through the longitudinal traction rod, and the other end of the bolster is connected with the second side beam through the longitudinal traction rod; a first pull rod mounting bracket and a second pull rod mounting bracket for hinging the longitudinal traction rods are respectively arranged on two sides of the bolster in the length direction;
   the first side beam is provided with a third pull rod mounting bracket for hinging the longitudinal traction rod, and the second side beam is provided with a fourth pull rod mounting bracket for hinging the longitudinal traction rod; and the third pull rod mounting bracket and the fourth pull rod mounting bracket are distributed on two sides of the bolster.

3. The railway vehicle bogie of claim 2, wherein the frame further comprises a first cross beam and a second cross beam which are arranged between the first side beam and the second side beam;
   the first cross beam is provided with at least one first longitudinal stop;
   the second cross beam is provided with at least one second longitudinal stop;
   and the bolster is positioned between the first longitudinal stop and the second longitudinal stop.

4. The railway vehicle bogie of claim 3, wherein the bolster is provided with longitudinal stop wear plates at the positions corresponding to the first longitudinal stop and the second longitudinal stop, for interaction with the first longitudinal stop and the second longitudinal stop, respectively.

5. The railway vehicle bogie of claim 2, 3 or 4, wherein the bolster comprises a spherical center plate; the bolster is provided with a center plate mounting hole adapted to the spherical surface of the spherical center plate; and the spherical center plate is arranged in the center plate mounting hole.

6. The railway vehicle bogie of claim 3 or 4, wherein the frame further comprises a first hanger rod connecting device, and the first hanger rod connecting device comprises a hanger rod mounting bracket and a connecting rod; the hanger rod mounting bracket is connected with the hanger rod device; and each of the first side beam and the second side beam is provided with a through hole, and the connecting rod of the first hanger rod connecting device penetrates through the through holes and is connected with the first cross beam or the second cross beam.

7. The railway vehicle bogie of claim 5, wherein the bolster comprises a bolster upper cover plate, a bolster web plate, a bolster lower cover plate and a bol-

ster end plate; wherein,
the bolster upper cover plate, the bolster web plate, the bolster lower cover plate and the bolster end plate form a box-type structure;
a middle part of the bolster upper cover plate in the length direction is provided with a center plate mounting hole, the bolster upper cover plate is also provided with a side bearing mounting bracket, and the side of the side bearing mounting bracket close to the bolster end plate is provided with a transverse stop;
the bolster end plate is provided with a second hanger rod connecting device connected with the hanger rod device; and
the first pull rod mounting bracket and the second pull rod mounting bracket are arranged on the bolster web plate and the bolster lower cover plate or the joints of the bolster web plate and the bolster lower cover plate.

8. The railway vehicle bogie of claim 7, wherein the bolster upper cover plate is provided with a mounting surface for mounting the side bearing mounting bracket, the mounting surface is a concave arc surface, while the mounting surface of the side bearing mounting bracket is a convex arc surface adapted to the concave arc surface of the bolster upper cover plate.

9. The railway vehicle bogie of claim 1, wherein the hanger rod device comprises a hanger rod, a hanger rod round pin and a locking pin; wherein,
two ends of the hanger rod are respectively provided with a first hanger rod through hole and a second hanger rod through hole;
the frame is provided with a first hanger rod connecting hole, and the bolster is provided with a second hanger rod connecting hole;
one end of the hanger rod is connected with the frame through the hanger rod round pin penetrating through the first hanger rod through hole and the first hanger rod connecting hole;
the other end of the hanger rod is connected with the bolster through the hanger rod round pin penetrating through the second hanger rod through hole and the second hanger rod connecting hole;
one end of each hanger rod round pin is provided with a locking pin hole;
and each locking pin penetrates through each locking pin hole.

10. The railway vehicle bogie of claim 9, wherein a bush is arranged between each hanger rod through hole and each hanger rod round pin;
each hanger rod round pin is provided with an annular groove with a concave arc surface; and
the inner wall of the bush is provided with a convex curved surface adapted to the annular groove of each hanger rod round pin.

11. The railway vehicle bogie of claim 9 or 10, wherein, the locking pin hole is a slotted hole so that the hanger rod round pin can shift in the axis direction thereof when the locking pin penetrate through the locking pin hole.

12. The railway vehicle bogie of claim 1, wherein, the hanger rod device comprises a hanger rod, a rubber bearing and a locking unit; wherein,
two ends of the hanger rod are respectively provided with a first hanger rod through hole and a second hanger rod through hole;
two ends of the rubber bearing are respectively provided with a fixing rod with semicircular cross section, and a middle section of the rubber bearing is a cylindrical ball hinge; and
the fixing rod of the rubber bearing penetrating through the first hanger rod through hole of the hanger rod is connected with the frame through the locking unit, and the fixing rod of the rubber bearing penetrating through the second hanger rod through hole of the hanger rod is connected with the bolster through the locking unit.

13. The railway vehicle bogie of claim 12, wherein the locking unit comprises a locking plate and a locking bolt;
the locking plate is provided with a threaded hole;
and the locking plate is fixed on the frame or the bolster through the locking bolt in the threaded hole.

14. The railway vehicle bogie of claim 13, wherein one lateral surface, in contact with the fixing rod of the rubber bearing, of the locking plate is provided with a groove adapted to a rectangular lateral surface of the fixing rod.

15. The railway vehicle bogie of claim 13 or 14, wherein a locking gasket is arranged between the locking bolt and the locking plate, and the locking gasket consists of two gaskets which are buckled together, wherein the buckled surfaces of the two gaskets are provided with saw teeth.

Amended claims in accordance with Rule 137(2) EPC.

1. A railway vehicle bogie, comprising a frame (2), a bolster (4) and at least one longitudinal traction device (7), wherein,
the bolster (4) is connected with the frame (2) through a hanger rod device (8); and
one end of the longitudinal traction device (7) is connected with the frame (2), and the other end of the longitudinal traction device (7) is connected with the

bolster (4) and used for transferring a force along a longitudinal direction between the frame (2) and the bolster (4);
wherein the bolster (4) comprises a bolster upper cover plate (401), a bolster web plate (402), a bolster lower cover plate (403), a bolster end plate (404) and a spherical center plate (407); the bolster upper cover plate (401), the bolster web plate (402), the bolster lower cover plate (403) and the bolster end plate (404) form a box-type structure; and the spherical center plate (407) is connected with the bolster upper cover plate (401) by a bolt (411);
the hanger rod device (8) comprises a hanger rod (801), two hanger rod round pin (803) and two locking pin (804), wherein two ends of the hanger rod (801) are respectively provided with a first hanger rod through hole and a second hanger rod through hole;
the frame (2) is provided with a first hanger rod connecting hole, and the bolster is provided with a second hanger rod connecting hole;
one end of the hanger rod (801) is connected with the frame (2) through one hanger rod round pin (803) penetrating through the first hanger rod through hole and the first hanger rod connecting hole;
another end of the hanger rod (801) is connected with the bolster (4) through another hanger rod round pin (803) penetrating through the second hanger rod through hole and the second hanger rod connecting hole;
one end of each hanger rod round pin (803) is provided with a locking pin hole (8031);
and each locking pin (804) penetrates through each locking pin hole (8031);
a bush (802) is arranged between each hanger rod through hole and each hanger rod round pin (803);
each hanger rod round pin (803) is provided with an annular groove (8032) with a concave arc surface; and
the inner wall of the bush (802) is provided with a convex curved surface adapted to the annular groove (8032) of each hanger rod round pin (803).

2. The railway vehicle bogie of claim 1, comprising two longitudinal traction devices (7), wherein each longitudinal traction device (7) comprises a longitudinal traction rod;
the frame (2) comprises a first side beam (2031) and a second side beam (2032) which are arranged in parallel;
one end of the bolster (4) is connected with the first side beam (2031) through the longitudinal traction rod (701), and the other end of the bolster (4) is connected with the second side beam (2032) through the longitudinal traction rod (702); a first pull rod mounting bracket (440) and a second pull rod mounting bracket (441) for hinging the longitudinal traction rods (701; 702) are respectively arranged on two sides of the bolster (4) in the length direction;
the first side beam (2031) is provided with a third pull rod mounting bracket (270) for hinging the longitudinal traction rod (701), and the second side beam is provided with a fourth pull rod mounting bracket (271) for hinging the longitudinal traction rod (702); and the third pull rod mounting bracket (270) and the fourth pull rod mounting bracket (271) are distributed on two sides of the bolster (4).

3. The railway vehicle bogie of claim 2, wherein the frame (2) further comprises a first cross beam (2021) and a second cross beam (2022) which are arranged between the first side beam (2031) and the second side beam (2032);
the first cross beam (2021) is provided with at least one first longitudinal stop (1401);
the second cross beam (2022) is provided with at least one second longitudinal stop (1402);
and the bolster (4) is positioned between the first longitudinal stop (1401) and the second longitudinal stop (1402).

4. The railway vehicle bogie of claim 3, wherein the bolster (4) is provided with longitudinal stop wear plates at the positions corresponding to the first longitudinal stop (1401) and the second longitudinal stop (1402), for interaction with the first longitudinal stop (1401) and the second longitudinal stop (1402), respectively.

5. The railway vehicle bogie of claim 2, 3 or 4, wherein a middle part of the bolster upper cover plate (401) in the length direction is provided with a center plate mounting hole, the center plate mounting hole is adapted to the spherical surface of the spherical center plate (401); and the spherical center plate (401) is arranged in the center plate mounting hole.

6. The railway vehicle bogie of claim 3 or 4, wherein the frame (2) further comprises a first hanger rod connecting device (205), and the first hanger rod connecting device (205) comprises a hanger rod mounting bracket (2051) and a connecting rod (2052); the hanger rod mounting bracket (2051) is connected with the hanger rod device (8); and each of the first side beam (2031) and the second side beam (2032) is provided with a through hole (2011), and the connecting rod (2052) of the first hanger rod connecting device (205) penetrates through the through holes (2011) and is connected with the first cross beam (2031) or the second cross beam (2032).

7. The railway vehicle bogie of claim 5, wherein the bolster upper cover plate (401) is also provided with a side bearing mounting bracket (406), and the side of the side bearing mounting bracket (406) close to the bolster end plate (404) is provided with a transverse stop (408);

the bolster end plate (404) is provided with a second hanger rod connecting device (405) connected with the hanger rod device (8); and
the first pull rod mounting bracket (440) and the second pull rod mounting bracket (441) are arranged on the bolster web plate (402) and the bolster lower cover plate (403) or the joints of the bolster web plate (402) and the bolster lower cover plate (403).

8. The railway vehicle bogie of claim 7, wherein the bolster upper cover plate (401) is provided with a mounting surface (4011) for mounting the side bearing mounting bracket (406), the mounting surface (4011) is a concave arc surface, while the mounting surface of the side bearing mounting bracket (406) is a convex arc surface adapted to the concave arc surface of the bolster upper cover plate (401).

9. The railway vehicle bogie of claim 1, wherein, the locking pin hole (8031) is a slotted hole so that the hanger rod round pin (803) can shift in the axis direction thereof when the locking pin (804) penetrate through the locking pin hole (8031).

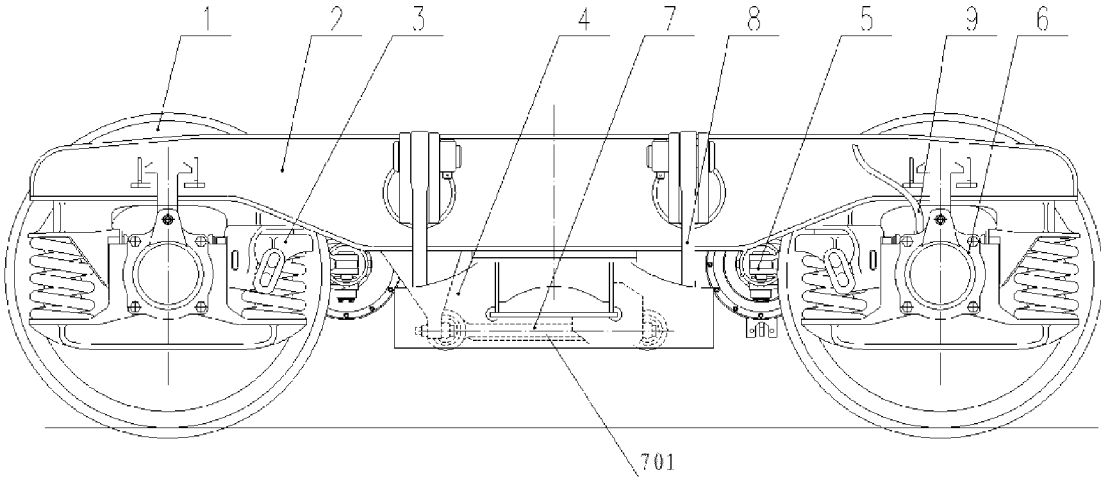

Figure 1

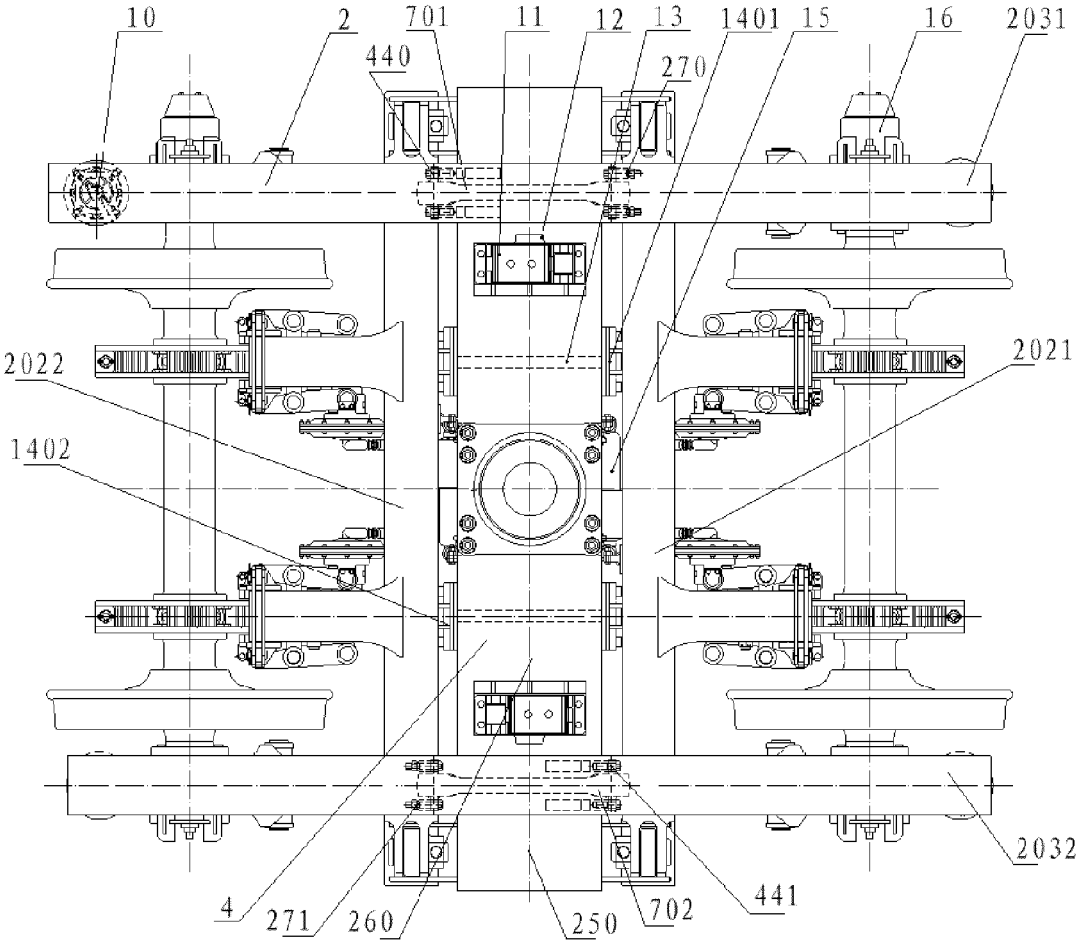

Figure 2

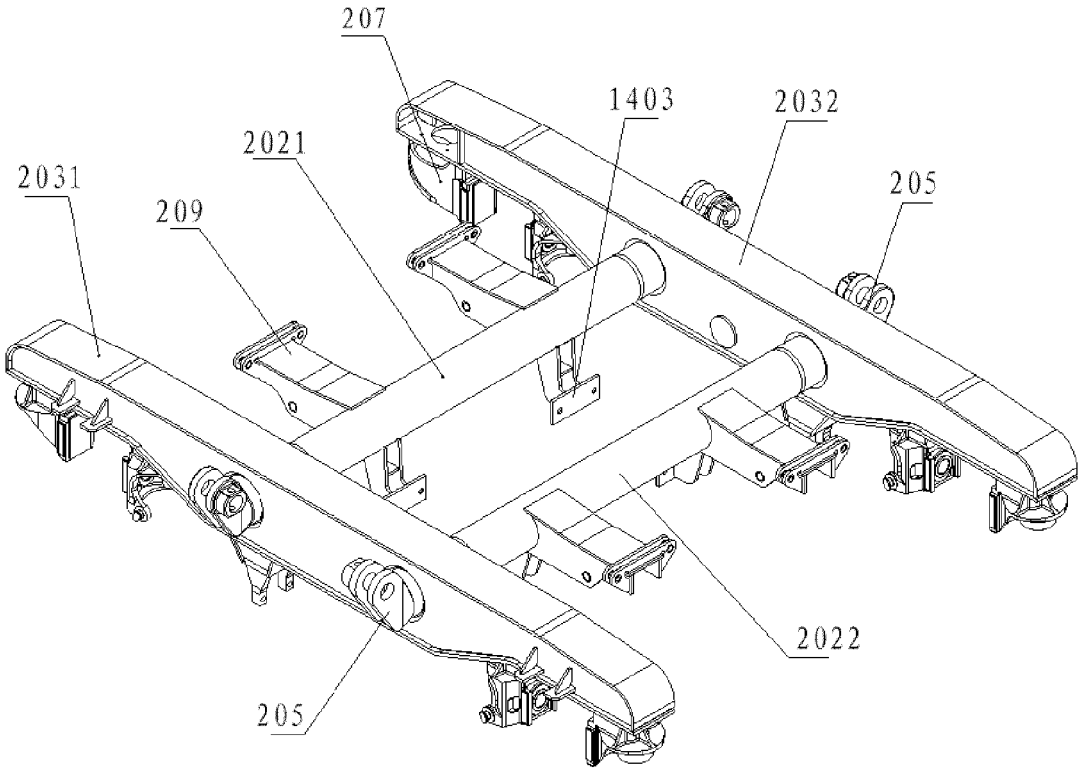

Figure 3

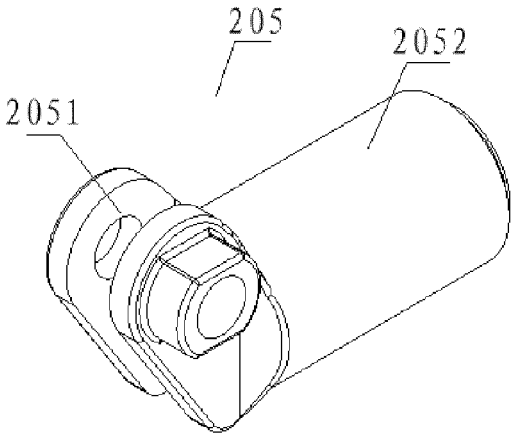

Figure 4

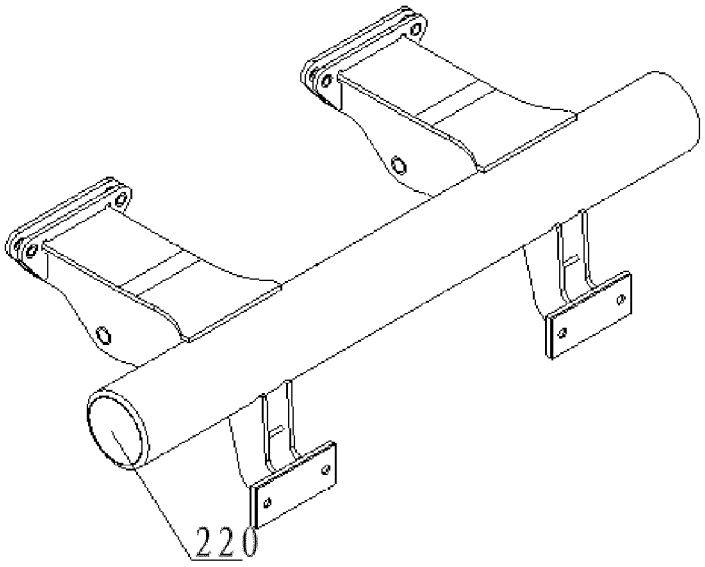

Figure 5

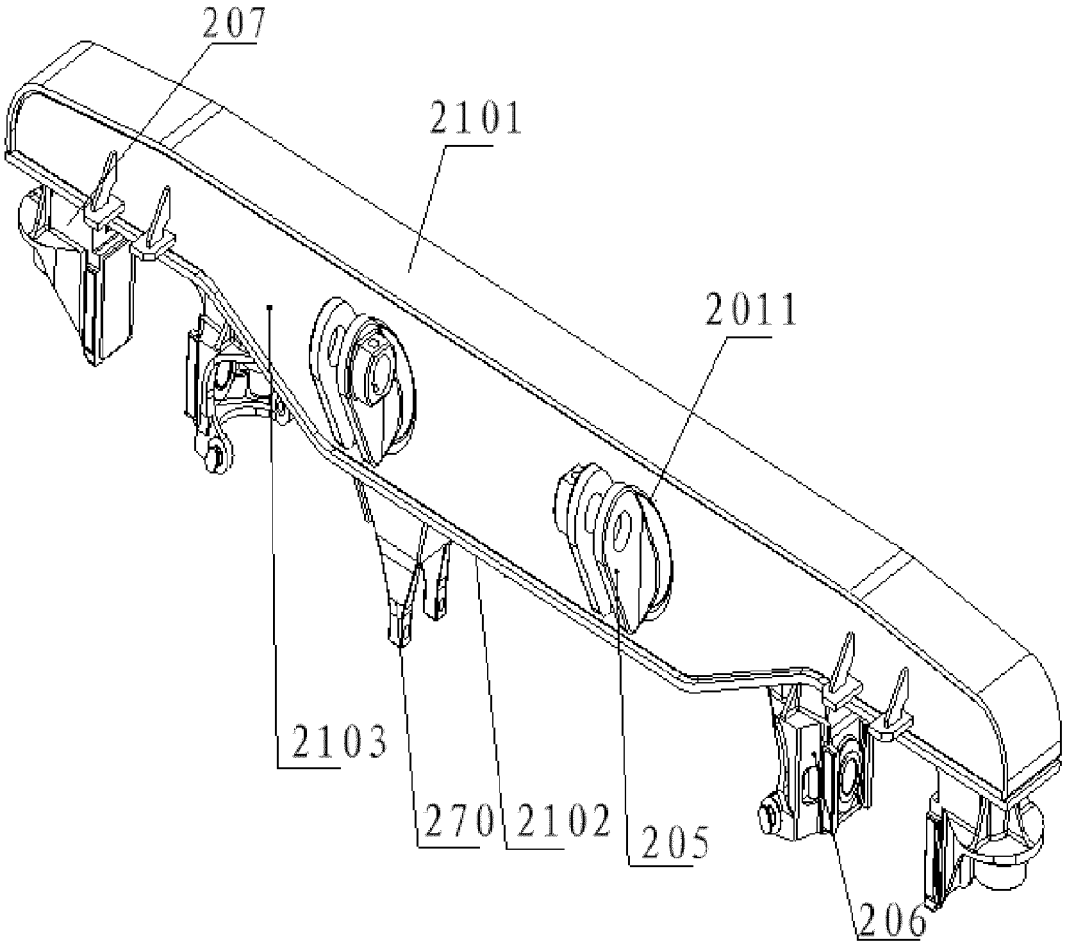

Figure 6

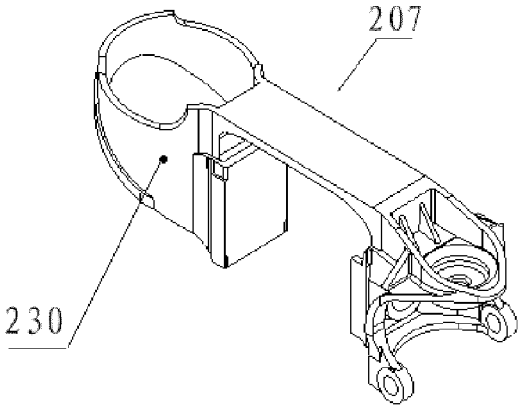

Figure 7

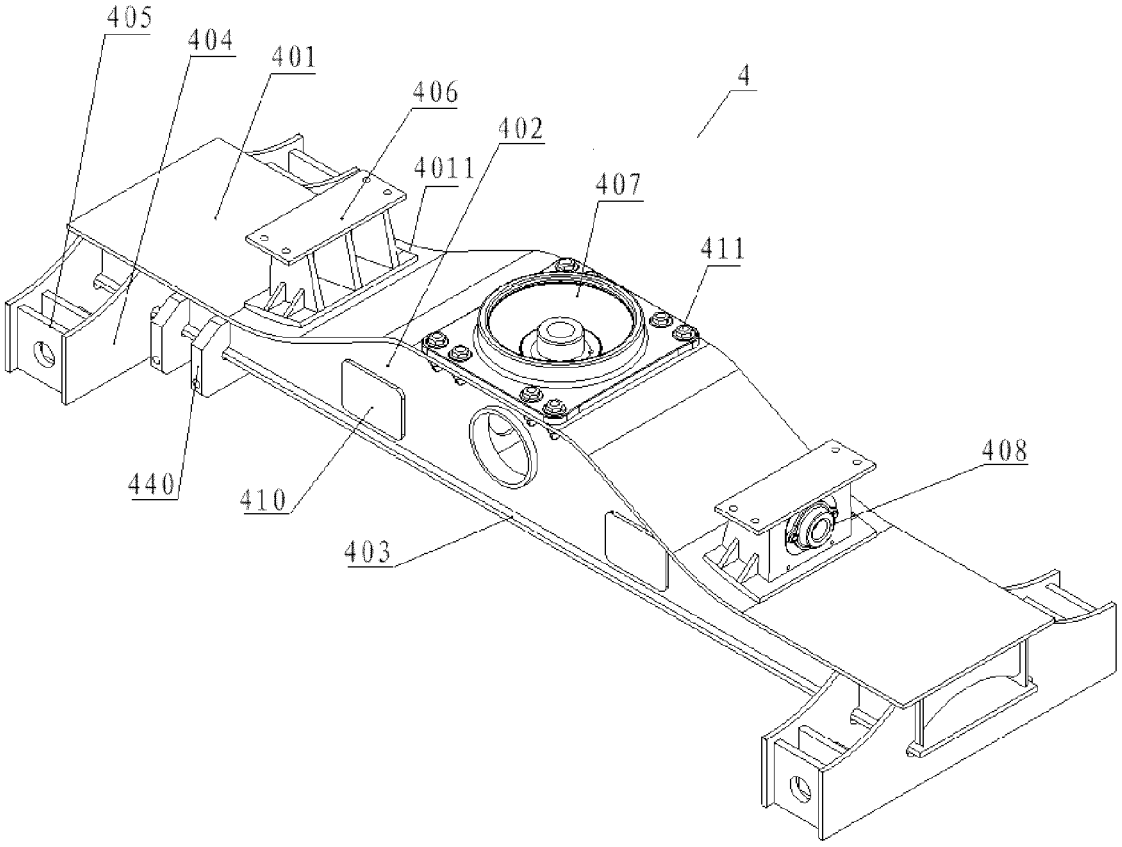

Figure 8

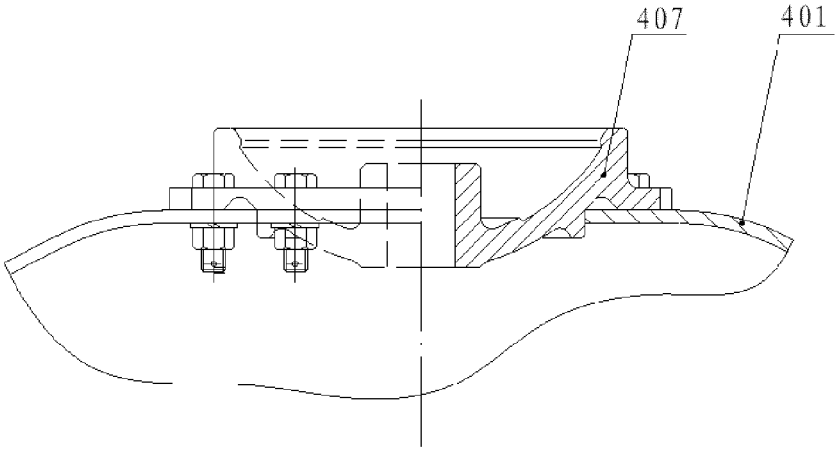

Figure 9

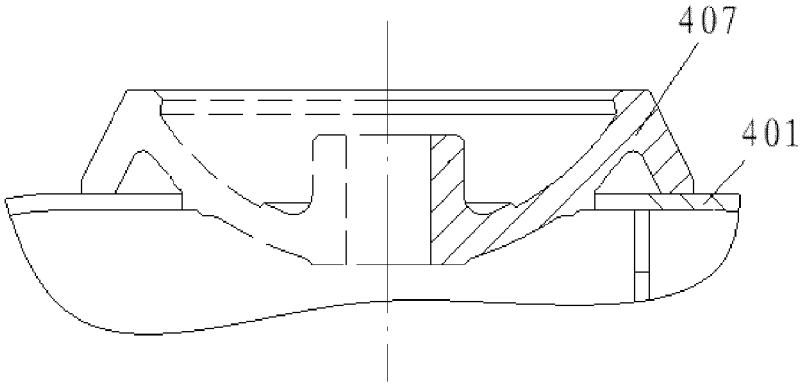

Figure 10

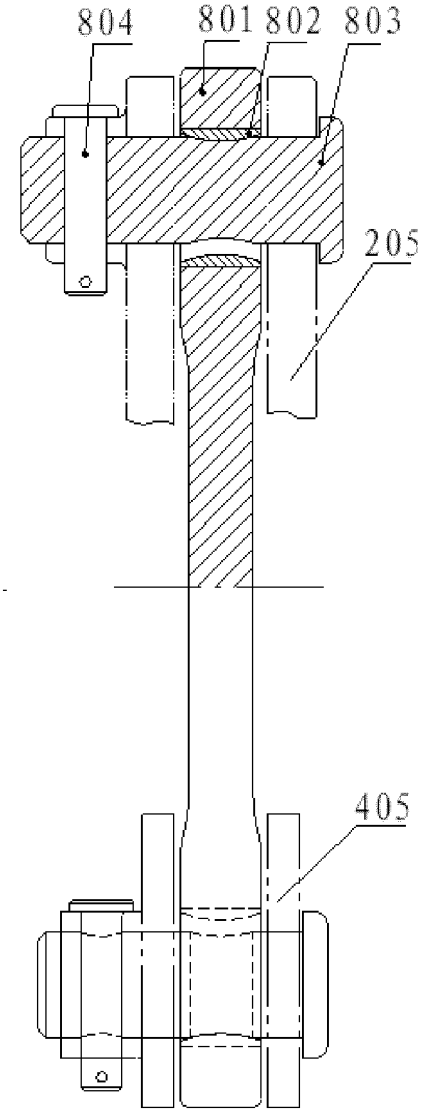

Figure 11

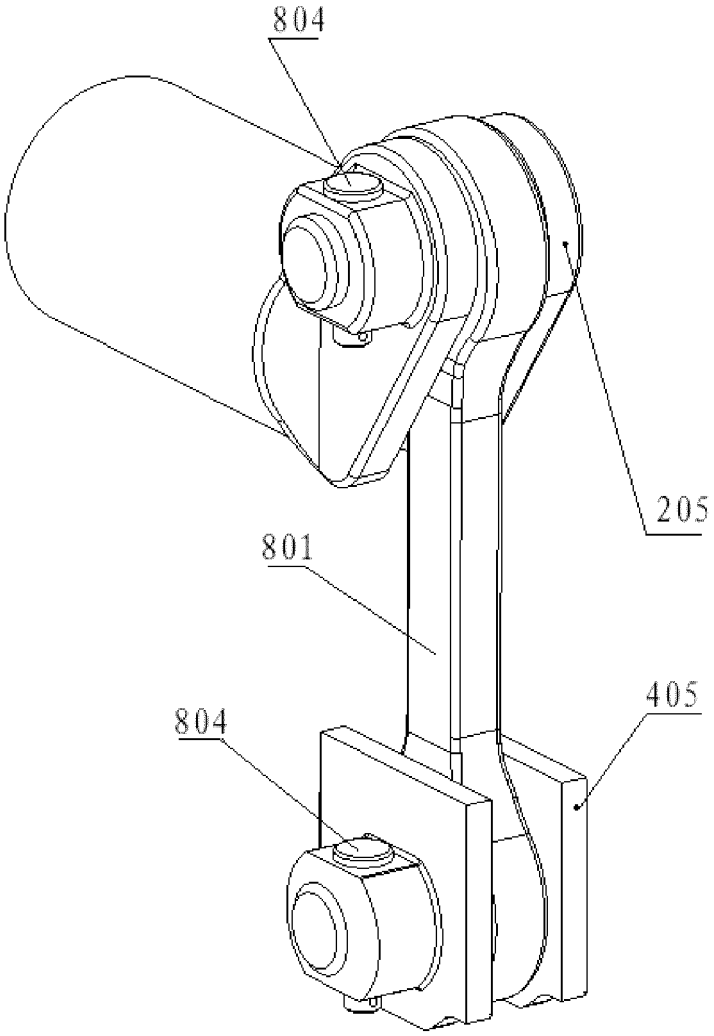

Figure 12

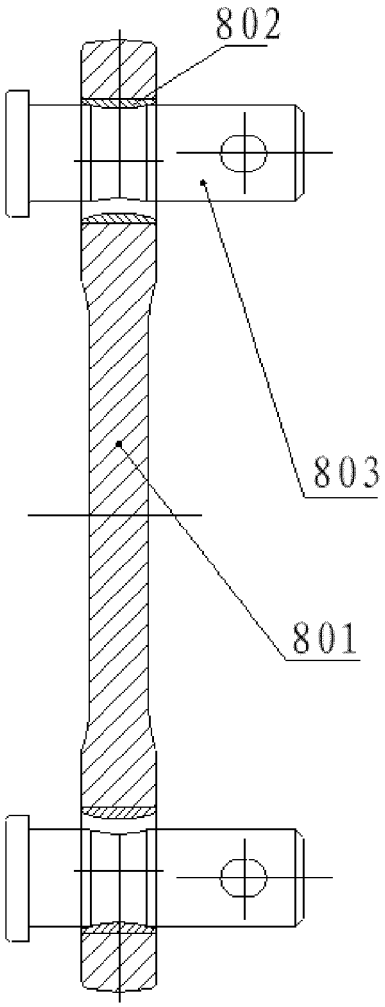

Figure 13

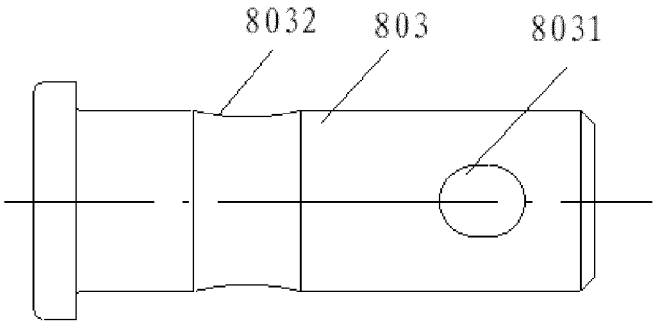

Figure 14

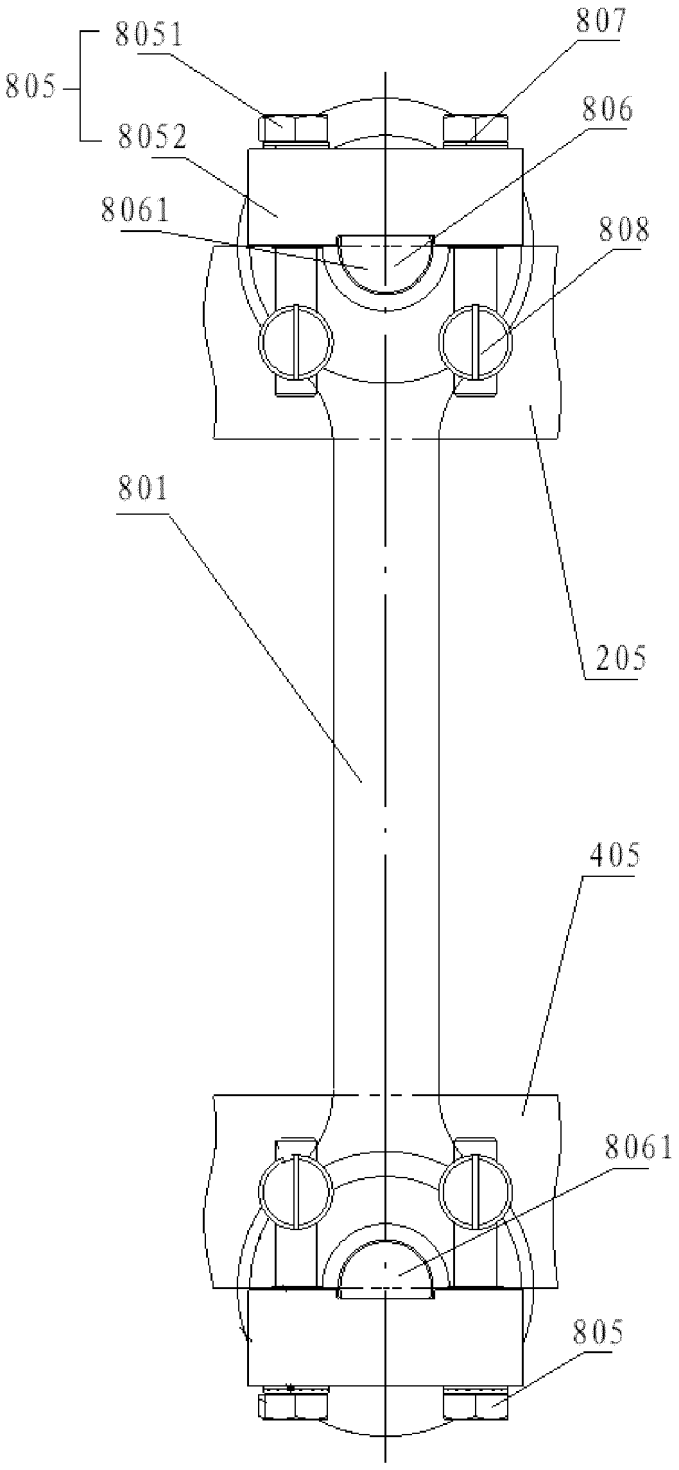

Figure 15

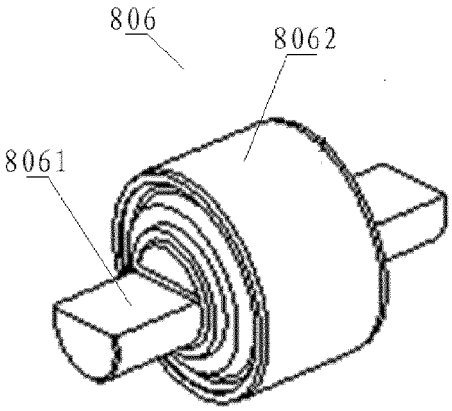

Figure 16

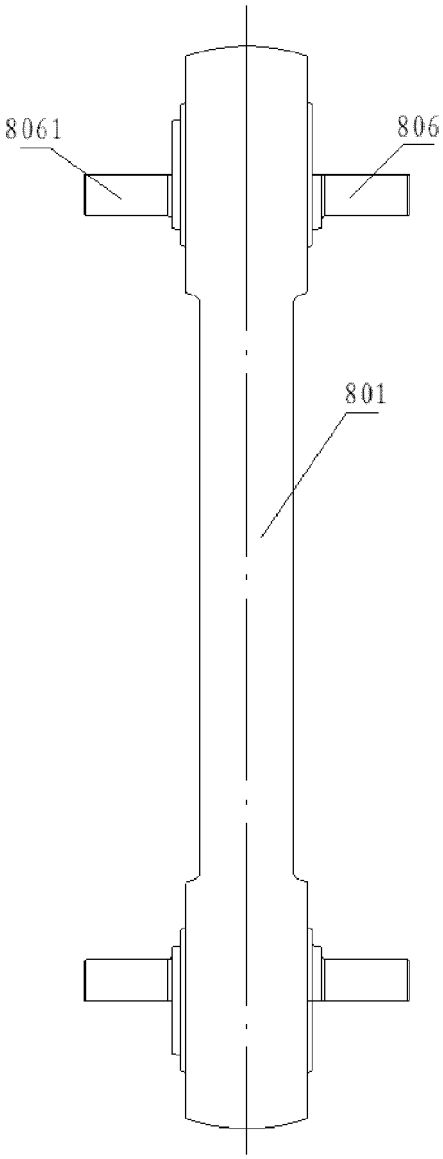

Figure 17

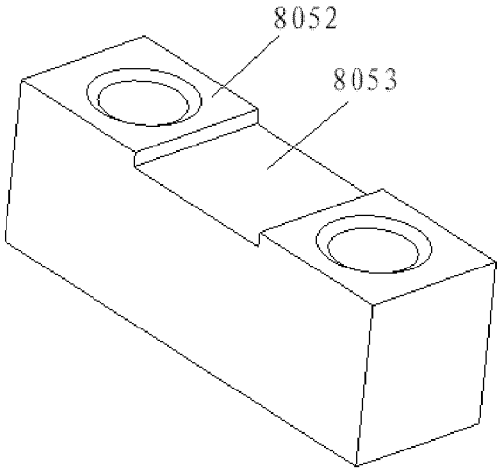

Figure 18

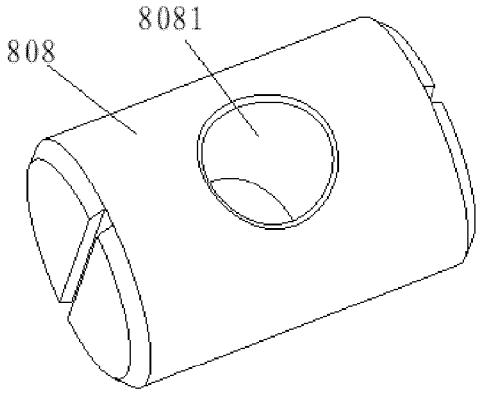

Figure 19

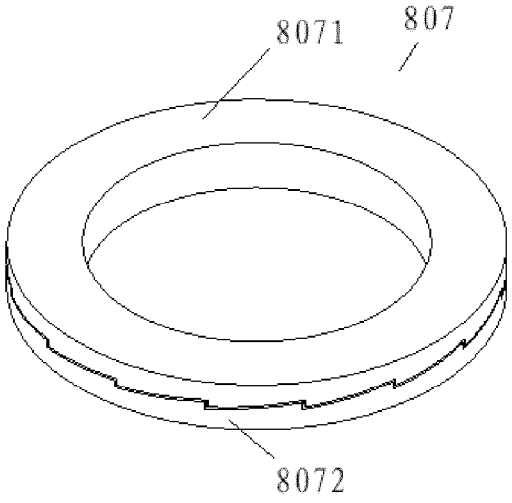

Figure 20

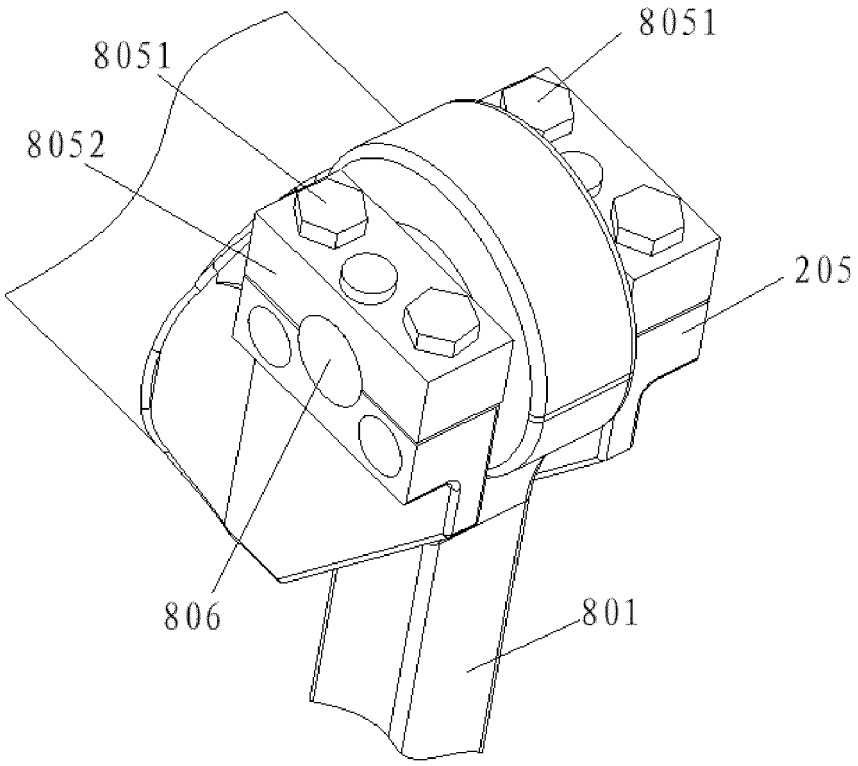

Figure 21

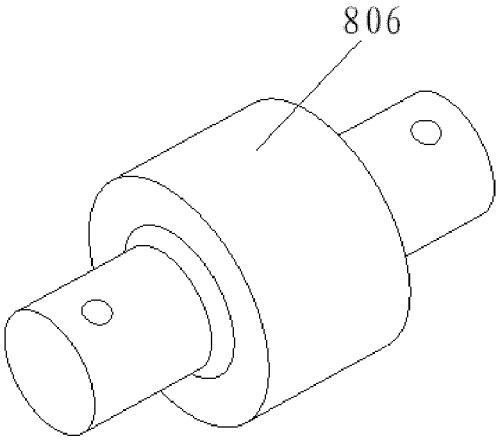

Figure 22

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EUROPEAN SEARCH REPORT

Application Number
EP 12 18 0801

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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X	CH 543 416 A (LINKE HOFMANN BUSCH [DE]) 31 October 1973 (1973-10-31) * figures 1-3 * -----	1	
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	14 January 2013	Lorandi, Lorenzo

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1

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