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(54) BULLET TRAIN GAUGE-CHANGEABLE BOGIE FOR RAILWAY VEHICLE

(57) A bullet train gauge-changing bogie for a railway vehicle comprises a frame, wherein wheels (10) of the gauge-changing wheelset are mounted with wheel-mounted brake discs (100); each of the side beams (20) or each of the cross beams is mounted with a brake clamp (1) and a mounting seat (2), and the brake clamp (1) is connected with the mounting seat (2) by support pins (3): the support pins (3) are horizontally disposed below the mounting seat (2), and both ends thereof are fixedly connected with the mounting seat (2), one end of the brake clamp (1) is provided with a connecting sleeve; the connecting sleeve is firmly sleeved with damping inner sleeves (4) with elastic damping; the connecting sleeve is locked on the support pins (3) through the damping inner sleeves (4). When the thrust on the connecting sleeve is greater than the damping force between the connecting sleeve and the support pins (3), the connecting sleeve drives the brake clamp (1) to move along the support pins (3).

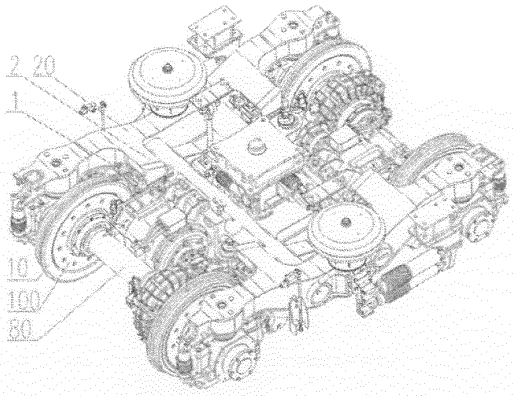

Fig. 1

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Description

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims priority to the Chinese patent application No. 2018103320508 filed on April 13, 2018, entitled Bullet Train Gauge-changing Bogie for Railway Vehicles", which is hereby incorporated by reference in its entirety.

FIELD OF TECHNOLOGY

[0002] The embodiment of the present disclosure relates to the technical field of bogies for railway vehicles, in particular to a bullet train gauge-changing bogie for a railway vehicle.

BACKGROUND

[0003] In order to meet the transportation requirements between rails with different gauges in neighboring countries, bogies with different distances between backs of the wheel flanges are generally replaced at the border with other countries, but such solution is costly and time-consuming. Gauge-changing bogies have been invented in Spain and then in Japan to enable continuous running of trains on rails with different gauges.

[0004] In order to brake and park, a wheel-mounted brake disc is usually installed on a wheel. When the train is braking, a brake lining of a brake clamp holds the wheel-mounted brake disc to brake. However, in the process of changing the gauge of the train, the relative movement will occur between the wheels on the same wheelset, and the position between the wheel-mounted brake disc and the brake clamp will be changed, and the existing installation mode of the brake clamp may fail to meet the requirement of the gauge-changing wheelset.

SUMMARY

(I) Technical problems to be solved

[0005] Embodiments of the present disclosure aims to solve at least one of the technical problems in the prior art or related technologies.

[0006] One of the embodiments of the disclosure provides a bullet train gauge-changing bogie for a railway vehicle, so as to meet the parking and braking requirements of a gauge-changing wheelset under different gauges, improve the operation efficiency of the gauge-changing wheelset on different tracks, and ensure the safe operation of vehicles.

(II) Technical solutions

[0007] In order to solve the technical problems above, one of the embodiments of the present disclosure provides a bullet train gauge-changing bogie for a railway vehicle which includes a frame. The frame includes a pair of side beams disposed in parallel and a pair of cross beams disposed in parallel connected between the pair of side beams, a gauge-changing wheelset is respectively disposed at exterior sides of the pair of the cross beams, the wheels of the gauge-changing wheelset are mounted with wheel-mounted brake discs, each of the side beams or each of the cross beams is mounted with a mounting seat and a brake clamp, and the brake clamp is connected with the mounting seat by support pins. The support pins are horizontally disposed below the mounting seat, and both ends thereof are fixedly connected with the mounting seat. One end of the brake clamp is provided with a connecting sleeve; the connecting sleeve is firmly sleeved with damping inner sleeves with elastic damping; the connecting sleeve is locked on the support pins through the damping inner sleeves. When the gauge is changing, the wheel-mounted brake disc on the wheel exerts a thrust on the brake clamp. When the thrust on the connecting sleeve is greater than the damping force between the connecting sleeve and the support pins, the connecting sleeve drives the brake clamp to move along the support pins.

[0008] In an embodiment of the present disclosure, the length of the connecting sleeves is less than the length of the support pins. Both ends of the connecting sleeve and both ends of the support pins are respectively connected through bellows; and a gap is reserved between the connecting sleeve and the bottom surface of the mounting seat.

[0009] In an embodiment of the present disclosure, the damping inner sleeves include a first damping inner sleeve and a second damping inner sleeve which are disposed at intervals. The support pin between the first damping inner sleeve and the second damping inner sleeve is fixedly sleeved with a spherical bearing. The spherical bearing and the connecting sleeve are positioned through a bearing seat. The bearing seat and the inner surface of the connecting sleeve are press-fitted.

[0010] In an embodiment of the present disclosure, two support pins including a first support pin and a second support pin are disposed below the mounting seat in parallel. The first support pin is located outside the mounting seat: and the

second support pin is located inside the mounting seat. Correspondingly, one end of the brake clamp is provided with two connecting sleeves connected in parallel including a first connecting sleeve and a second connecting sleeve. The first connecting sleeve is connected with the first support pin; and the second connecting sleeve is connected with the second support pin.

[0011] In an embodiment of the present disclosure, the mounting seat is provided with downward extending connecting ends along the axial opposite sides of the gauge-changing wheelset. and the support pins are fixedly connected with the connecting ends.

[0012] In an embodiment of the present disclosure, the side beam or cross beam is provided with a brake hanger bracket on which the mounting seat is installed.

[0013] In an embodiment of the present disclosure, the gauge-changing wheelset includes an axle, wheels and locking mechanisms. Both ends of the pairs of side beams are respectively provided with an axle-box body. Both ends of the axle extend into an axle-box body, respectively. The wheels are installed on the axle and connected with the axles through splines. The locking mechanisms are respectively provided on exterior sides of the wheels and located in an axle-box body at both ends of the axle. The locking mechanisms are connected with the wheels, and configured to lock and unlock the wheels to change a gauge.

[0014] In an embodiment of the present disclosure, the locking mechanism comprises an inner sleeve, a rolling bearing, an outer sleeve and a locking pin.

[0015] In an embodiment of the present disclosure, the inner sleeve, the rolling bearing and the outer sleeve are tightly sleeved in sequence from inside to outside, the inner sleeve is in clearance fit with the axle. An end of the inner sleeve facing the wheels extends beyond the axle-box body and is firmly connected with the wheels. The outer sleeve is in clearance fit with the inner surface of the axle-box body, and opposite sides of the outer sleeve are respectively provided with a boss axially extending along the outer sleeve. A plurality of flutes are disposed at intervals along the length directions of the bosses. The interior side wall of the axle-box body is provided with a concave arc surface corresponding to the grooves respectively. The locking pins are inserted into a locking space defined by the flutes and the concave arc surface, and may be switched between the locking spaces under the action of external force, so as to change the gauge.

[0016] In an embodiment of the present disclosure, the locking pin includes a pin body, one side of which is provided with an open groove penetrating along the radial direction of the pin body. The open groove is provided with at least one lug extending along the axial direction of the pin body. The upper end of the lug is connected with the top of the open groove. A notch is reserved between the lower end of the lug and the bottom of the open groove; and the lug is inserted into the flutes.

[0017] In an embodiment of the present disclosure, the pin body is installed in the axle-box body through a return spring. The upper end of the pin body is connected with the return spring; and the lower end of the pin body extends beyond the bottom surface of the axle-box body.

[0018] In an embodiment of the present disclosure, the axle-box body is provided with a gauge change process detection and early-warning unit.

[0019] In an embodiment of the present disclosure, the axle is configured as a stepped shaft having a diameter in the middle part greater than a diameter at both ends. The wheels are disposed on an intermediate section of the stepped shaft and are respectively arranged at both ends of the intermediate section. The locking mechanisms are arranged on the both ends of the stepped shaft.

[0020] In an embodiment of the present disclosure, an inner circumference of the wheel is provided with an internal splines. Both ends of the intermediate section of the stepped shaft are respectively provided with external splines. The wheels and both ends of the middle shaft are in fit connection through internal spline and external spline.

[0021] In an embodiment of the present disclosure, both ends of the intermediate section are respectively configured as a three-stage stepped shaft including a first flange, a second flange and a third flange, of which the diameters changes are gradually increased from outside to inside. The external spline is provided on the external circumference of the second flange. The center hole of the wheel configured as a three-stage stepped hole including a first connecting hole, a second connecting hole and a third connecting hole, of which the diameters changes are gradually increased from outside to inside. The internal splines are circumferentially disposed of the inner wall of the second connecting hole. The first connecting hole matches the first flange. The internal spline is in fit connection with the external splines. The third connecting hole matches the third flange.

(III) Beneficial effects

[0022] Compared with the prior art. the embodiment of the present disclosure has at least the following advantages:

[0023] The embodiment of the present disclosure provides a bullet train gauge-changing bogie for a railway vehicle, in which the suspension mode of the brake clamp is improved on the basis of the existing bogie, and the brake clamp is connected with the mounting seat through a support pins. The support pins are horizontally disposed below the mounting seat; and both ends thereof are fixedly connected with the mounting seat. One end of the brake clamp is

provided with a connecting sleeve. The connecting sleeve is firmly sleeved with damping inner sleeves with elastic damping. The connecting sleeve is locked on the support pins through the damping inner sleeves. When the gauge is changing, the wheel-mounted brake disc on the wheels exerts a thrust on the brake clamp. When the thrust on the connecting sleeve is greater than the damping force between the connecting sleeve and the support pins, the connecting sleeve drives the brake clamp to move along the support pins, and the brake clamp also reaches the corresponding position after the gauge of the wheelset is changed completely, so as to meet the need of parking and braking of the gauge-changing bogie at different gauges, improve the operation efficiency of the gauge-changing bogie at different gauges, and ensure the safe operation of vehicles. In addition, due to the wheel-mounted brake disc and the brake clamp matched with it, sufficient space can be reserved for setting the driving device required by the bullet train bogie, such as the traction motor, coupling, gearbox and other related parts of the transmission drive device, or transmission box.

[0024] In addition, the locking mechanisms are provided on the exterior sides of the wheels, and a part of the axle between the inner sides of the wheels is consistent with the traditional axle. Thus, on the one hand, there is enough space left for the motor, gearbox and other components mounted on the axle between the inner sides of the wheels; and on the other hand, the interface of the gauge-changing wheelset can be consistent with that of existing vehicles, which is convenient for batch modification of the existing vehicles. In addition, the wheels and the axle are connected through splines, thereby the torque is evenly distributed on the inner circumferences of the wheels, which facilitates not only the transmission of torque, but also the sliding of the wheels along the axle to change the gauge.

[0025] Moreover, each of the two ends of the intermediate section of the axle is configured as a three-stage stepped shaft. The external splines are disposed at the intermediate section of the three-stage stepped shaft. The center hole of the wheel is further configured as a three-stage stepped hole. The internal splines are disposed at the intermediate section of the three-stage stepped hole, and thus the fit connection of flange plus spline plus flange is formed as a whole. The flanges at both ends of the external splines are adopted to carry the radial load; and the torque is transmitted in combination with the internal and external splines to functionally separate radial load from torque transmission, thereby improving the structural reliability of the gauge-changing wheelset.

BRIEF DESCRIPTION OF THE DRAWINGS

[0026]

Fig. 1 is a three-dimensional schematic diagram of a bullet train gauge-changing bogie for a railway vehicle according to the embodiment of the present disclosure;

Fig. 2 is a three-dimensional schematic diagram of a braking part in Fig. 1;

Fig. 3 shows the axial sectional view of a first support pin in the bullet train gauge-changing bogie for the railway vehicle in an embodiment 1 of the present disclosure;

Fig. 4 shows the axial sectional view of a second support pin in the bullet train gauge-changing bogie for the railway vehicle in an embodiment 2 of the present disclosure;

Fig. 5 is a local schematic diagram of a bullet train gauge-changing bogie for a railway vehicle according to the embodiment of the present disclosure;

Fig. 6 is a schematic diagram of the brake clamp installed on the gauge-changing wheelset in a bullet train gauge-changing bogie for railway vehicle according to the embodiment of the present disclosure;

Fig. 7 is a three-dimensional schematic diagram of the outer sleeve in Fig. 6;

Fig. 8 is a three-dimensional schematic diagram of the locking pin in Fig. 6;

Reference numerals::

1 brake clamp	11 first connecting sleeve
12 second connecting sleeve	13 clamp body
14 brake lining	2 mounting seat
3 support pin	31 first support pin
32 second support pin	4 damping inner sleeve

(continued)

5 spherical bearing	6 bearing seat
7 bellow	8 shockproof rubber sleeve
9: bushing	10 wheel
100 wheel-mounted brake disc	20 side beam
30 outer sleeve	31 boss
32 flute	40 locking pin
41 pin body	42 open groove
43 lug	44 notch
45 guide slant	50 rolling bearing
60 inner sleeve	70 axle-box body
80 axle.	

DETAILED DESCRIPTION

[0027] Specific embodiments of the present disclosure will be described in further detail in conjunction with the drawings and embodiments. The following embodiments are used to illustrate the present disclosure, rather than to limit the scope of the disclosure.

[0028] With respect to the description of the present disclosure, it should be noted that the orientation or positional relation indicated by the terms such as "center", "longitudinal", "lateral", "upper", "lower", "front", "back", "left", "right", "vertical", "horizontal", "top", "bottom", "inner", "outer" is based on the orientation or positional relationship shown in the drawings, the purpose of which is only to facilitate describing the present disclosure and simplify the description, rather than to indicate or imply that the device or element referred to must have a specific orientation, be constructed and operated in a specific orientation, and therefore cannot be construed as a limitation of the present disclosure. In addition, the terms "first." "second" and "third" are for descriptive purpose only, and cannot be understood as indicating or implying the relative importance.

[0029] In the description of the present disclosure, it should be noted that, unless otherwise clearly specified or defined, the terms "install", "connect with" and "connect to" should be understood in a broad sense, for example, it can be a fixed connection or a detachable connection, or an integral connection: it can be mechanically connected or electrically connected; it can be directly connected or indirectly connected through an intermediary, and can be communication between interiors of two elements. For those of ordinary skill in the art, the specific meaning of the above terms in the present disclosure can be understood according to the specific situations.

[0030] In addition, in the description of the present disclosure, unless otherwise specified, "a plurality of", "multiple", and "multiple sets" mean two or more.

[0031] In the following, the implementation solution of the present disclosure is described with two embodiments, but does not limit the specific content of the disclosure.

Embodiment 1

[0032] As shown in Fig. 1, a bullet train gauge-changing bogie for a railway vehicle provided for the embodiment of the present disclosure includes frame including a pair of side beams 20 disposed in parallel and a pair of parallel cross beams connected between the pair of side beams 20. A gauge-changing wheelset is respectively disposed outside the pair of cross beams; and the wheels 10 of the gauge-changing wheelset are provided with wheel-mounted brake discs 100. Specifically, as shown in Fig. 6, the wheel-mounted brake discs 100 are respectively installed at the interior and exterior sides of the wheels 10, and are connected as a whole through connecting pieces. As shown in Fig. 5, the side beam 20 is provided with a mounting seat 2 and a brake clamp 1. Alternatively, the mounting seat 2 may also be installed on the cross beam, as shown in Figs. 2-3; the brake clamp 1 is connected with the mounting seat 2 through the support pins 3. Specifically, the support pins 3 are horizontally disposed below the mounting seat 2 and both ends thereof are fixedly connected with the mounting seat 2. One end of the brake clamp 1 is provided with a connecting sleeve. The connecting sleeve is firmly sleeved with damping inner sleeves 4 with elastic damping. Optionally, the damping inner sleeve 4 is made of stable rubber, and the connecting sleeve is locked on the support pins 3 through the damping inner sleeves 4 to ensure that the positions of the brake clamp 1 and the mounting seat 2 remain unchanged when the gauge-changing wheelset operates normally. In addition, the interior sides of the damping inner sleeves 4 contacting the support pins 3 are provided with flutes32 the sizes of which are set according to the size of the required damping force, so that the damping force is adjustable according to the actual needs. When the wheels 10 move due to the inward or outward trust as the gauge is changed, the wheel 10 applies a thrust on the brake clamp 1. When the thrust on the connecting

sleeve is greater than the damping force between the connecting sleeves and the support pins 3, the connecting sleeve drives the brake clamp 1 to move along the support pins 3. After the gauge of the wheelset is changed completely , the brake clamp 1 also reaches the corresponding position, and is locked on the support pins 3 again through the damping inner sleeve 4 to position, so that the gauge-changing bogie may be braked under different tracks, which improves the operation efficiency of the gauge-changing bogie at different gauges and ensures the safe operation of the vehicle. In addition, the vibration and shock generated in the driving of the vehicle may be damped the damping of the stable rubber, so that the lateral positioning of the brake clamp 1 is stable and reliable.

[0033] In addition, by disposing the wheel-mounted brake disc 100 and the brake clamp 1 matched with it and mounting seat 2, sufficient space may be reserved for providing a driving device required by the gauge-changing bogie, such as traction motor. coupling, gearbox and other related parts corresponding to the transmission driving device, or its transmission box.

[0034] In the embodiment of the present disclosure, in order to provide enough space in which the connecting sleeves move back and forth, the length of the connecting sleeves is less than the length of the support pins 3, and the both ends of the connecting sleeves and the both ends of the support pins 3 are respectively connected through the bellows 7. Because the bellows 7 has sufficient elasticity and stretchability, they may expand and contract as the connecting sleeves move. Further, by disposing the bellows 7, dust and impurities can be prevented from entering the connecting sleeves. In addition, bellows 7 have a certain effect on the lateral positioning of the connecting sleeve. In addition, in order to ensure that no interference therebetween will occur when the connecting sleeves move along the support pins 3, a gap is provided between the connecting sleeves and the bottom surface of the mounting seat 2.

[0035] It should be noted that the damping inner sleeves 4 includes a first damping inner sleeve and a second damping inner sleeve which are disposed at intervals. The support pin 3 between the first damping inner sleeve and the second damping inner sleeve is fixedly sleeved with a spherical bearing 5. The spherical bearing 5 and the connecting sleeve are positioned through the bearing seat 6. The outer diameter surface of the outer ring of the spherical bearing 5 is spherical and may fit the corresponding concave spherical surface of the bearing seat 6 to provide self-aligning function. The bearing seat 6 and the inner surface of the connecting sleeve are press-fitted to form an integrated structure. The spherical bearing 5 is disposed such that the bearing seat 6 may be prevented from swinging during the connecting sleeves move. In addition, both ends of the spherical bearing 5 may limit the movement of the first damping inner sleeve and the second damping inner sleeve, that is, the maximum movement distance of the first and second damping inner sleeves is the distance for moving to contact the spherical bearing 5; when the connecting sleeves move, the bearing seat 6 moves along the surface of the spherical bearing 5.

[0036] Further, in order to conveniently install the support pin 3, the mounting seat 2 is respectively provided with downward extending connecting ends along the axial opposite sides of the gauge-changing wheelset, and the support pins 3 are fixedly connected with the connecting ends.

[0037] In addition, in order to provide reliable connection, two support pins 3 including a first support pin 31 and a second support pin 32 are disposed below the mounting seat 2 in parallel, respectively. The first support pin 31 is located outside the mounting seat 2, and the second support pin 32 is located inside the mounting seat 2. Correspondingly, one end of the brake clamp 1 is provided with two connecting sleeves connected in parallel including a first connecting sleeve 11 and a second connecting sleeve 12. The two connecting sleeves can be welded to form a whole. The first connecting sleeve 11 is connected with the first support pin 31, and the second connecting sleeve 12 is connected with the second support pin 32, so that the connecting sleeves may be connected with the support pins smoothly without rotation. When the brake clamp 1 needs to move, it is necessary to overcome the damping force between the first connecting sleeve 11 and the first supporting pin 31 and the damping force between the second connecting sleeve 12 and the second supporting pin 32 at the same time, that is, the damping force experienced is relatively large.

[0038] Specifically, in the embodiment of the present disclosure, the brake clamp 1 comprises a pair of clamp bodies 13 disposed opposite to each other, one end of the clamp body 13 is connected with the connecting sleeves, and interior sides of the other end are respectively provided with a brake lining 14 which is a powder metallurgy brake lining 14 having good wear resistance.

[0039] In addition, in the embodiment of the present disclosure, both ends of a pair of side beams 20 are respectively provided with an axle-box body 70, and both ends of the axle 80 of the gauge-changing wheelset extend into the axle-box body 70 respectively, and the both ends of the axle 80 are supported and positioned by the axle-box body 70. As shown in Fig. 6, the wheels 10 are installed on the axle 80 between the two opposite axle-box bodies 70, and are connected to the axle 80 by splines. Specifically, the connecting hole of each wheel 10 is provided with an internal spline, and the axle 80 is provided with an external spline. The wheels 10 and the axle 80 are connected through the fitting of internal and external splines to evenly distribute the torque on the circumference of the wheel 10, which is not only convenient to transmit the torque and the weight of the vehicle, but also convenient for the wheel 10 to slide along the axle 80 to change the gauge. The locking mechanisms are respectively provided on the exterior sides of the wheels 10 and are located in the axle-box body 70, only little improvement is needed to the axle 80 at exterior sides of the wheels 10, and the axle 80 of the inner part of the wheel 10 is consistent with the traditional axle 80. On one hand, there is

enough space available for the motor, gearbox and other parts mounted on the axle 80 inside the wheel 10. On the other hand, the interface of the gauge-changing wheelset can be consistent with that of the existing vehicle, so as to facilitate the batch modification of the existing vehicles. The locking mechanism is connected with the exterior sides of the wheels 10 for locking and unlocking the wheels 10, so as to change the gauges of the wheels 10. It is simple in structure and convenient to operate.

[0040] In the embodiment of the present disclosure, in order to conveniently install and position the locking mechanisms, the axle 80 is configured as a stepped shaft having a diameter in the middle part greater than a diameter at both ends, the wheels 10 are disposed on an intermediate shaft of the stepped shaft and are respectively arranged at both ends of the intermediate section, and the locking mechanisms are arranged on the shafts at both ends of the stepped shaft.

[0041] In the embodiment of the present disclosure, as shown in Fig. 6. the locking mechanism specifically includes an inner sleeve 60, a rolling bearing 50. an outer sleeve 30 and a locking pin 40.

[0042] The inner sleeve 60, the rolling bearing 50 and the outer sleeve 30 are tightly sleeved in sequence from inside to outside to form a sliding entirety, and seals are adopted at both ends of the sliding entirety to prevent the oil leakage in the rolling bearing 50 and prevent the external dust and sundries from entering the sliding entirety. When the train runs normally, the inner sleeve 60 and the inner ring of the rolling bearing 50 rotate together with the wheels 10. the outer ring of the rolling bearing 50 and the outer sleeve 30 remains relatively fixed. The inner sleeve 60 is in clearance fit with the axle 80, one end of the inner sleeve 60 facing the wheels 10 extends beyond the axle-box body 70, and is firmly connected with the wheels 10 through fasteners such as a bolt. The outer sleeve 30 is in clearance fit with the inner surface of the axle-box body 70, and the sliding body can slide horizontally relative to the axle-box body 70. As shown in Fig. 7, the opposite sides outside of the outer sleeve 30 are respectively provided with bosses 31 axially extending along the outer sleeve 30, and a plurality of flutes 32 are spaced along the length direction of the bosses 31. An inner wall of the axle-box body 70 is provided with concave arc surfaces corresponding to the flutes 32 respectively. The locking pins 40 are inserted into the locking spaces defined by the flutes 32 and the inner concave arc surface, and can be switched between the locking spaces under the action of external force, to change the gauge of the wheels 10. Specifically, when the locking pins 40 are inserted into the locking spaces, one part of the locking pins 40 is located in the flutes 32, and the other part fits the concave arc surface; and the outer sleeve 30 is fixed relative to the axle-box body 70 to lock. At this time, the position of wheels 10 is fixed relative to the axle 80. When the gauge needs to change, the locking pin 40 disengages from the locking space under the action of external force to unlock. In the embodiment, the locking pin 40 can disengage from the locking space by using the upward thrust. At this time, the wheels 10 are pushed to move outward or inward along the axle 80, and then bring the sliding entirety is driven to move relative to the axle-box body 70 and the locking pins 40. When the locking space corresponding to the changed gauge moves just below the locking pins 40, the locking pins 40 are inserted into the locking space under its own gravity and the downward force, the gauge of wheel 10 is changed completely.

[0043] Specifically, the inner sleeve 60 is sleeved on the axles at both ends of the stepped shaft, with the two being in clearance fit, and a gauge change interval is reserved between the inner sleeve 60 and the shoulder of the stepped shaft, so as to ensure that enough spacing can be provided for the inner sleeve 60 to move along the axle 80 without interfering with the axle 80 during the gauge change. The distance between the two adjacent flutes 32 is equal to the half of the required gauge change. When the gauge is changing, the wheels 10 at both ends of the axle 80 move simultaneously, and the two wheels 10 move half the distance of the gauge to be changed, then the total movement distance is the distance of the gauge to be changed, for example, from the standard gauge to the narrow gauge or wide gauge, or from the narrow gauge or wide gauge to the standard gauge, the gauge to be changed can be selected according to the specific needs.

[0044] Furthermore, both ends of the intermediate section of the stepped shaft are respectively provided with external splines, the wheels 10 and the both ends of the intermediate section are in fit connection through the internal splines and the external splines. Further, the both ends of the intermediate section are respectively configured as a three-stage stepped shaft, and the three-stage shaft including a first flange, a second flange and a third flange of which the diameters are gradually increased from outside to inside. The external spline is provided on the an external circumference of the second flange; and the central hole of the wheel 10 is configured as a three-stage stepped hole including a first connecting hole, a second connecting hole and a third connecting hole of which diameters are gradually increased from outside to inside. The internal splines are circumferentially disposed on the inner wall of the second connecting hole, the first connecting hole matches the first flange, the internal splines are in fit connection with the external splines, and the third connecting hole matches the third flange. The flange plus spline plus flange connection mode is formed integrally. The flange at both ends of the external splines is configured to carry the radial load, and the torque is transmitted in combination with the internal and external splines to functionally separate radial load from torque transmission, thereby improving the structural reliability of the gauge-changing wheelset.

[0045] Specifically, as shown in Fig. 8. the locking pin 40 includes a pin body 41. one side of which is provided with an open groove 42, penetrating along the radial direction of the pin body 41. The open groove 42 is provided with at least one lug 43 extending axially along the pin body 41. For example, two parallel lugs 43 can be disposed to improve

the stress condition of a single lug 43 and improve the reliability. The upper end of the lug 43 is connected with the groove top of the open groove 42, and a notch 44 is reserved between a lower end of the lug 43 and the groove bottom of the open groove 42, and the lug 43 is inserted into the flute 32. When the gauge is changed, the locking pin 40 is disengaged from the flutes 32 upwards under the action of a vertical upward external force, first, the lug 43 is disengaged from the flutes 32 upwardly and move to a position above the flutes 32 and then, the notch 44 under the lug 43 is opposite to the boss 31 between the two flutes 32. When an external force is applied to the left or right, the outer sleeve 30 moves along the wheel 10, and the boss 31 is locked into the notch 44 and move along the notch 44. The lower end of the lug 43 is supported on the boss surface of the boss 31 until it moves to the position of another flute 32. Then, the pin body 41 moves downwards under the action of its own gravity and the downward force, and the lug 43 is inserted into the flute 32 to realize locking, and the gauge is changed completely.

[0046] Furthermore, the width of the lug 43 matches the width of the flute 32, so that the lug 43 may be inserted into or disengaged from the flute 32. It is ensured that the stable position of the entire locking mechanism after the lug 43 is inserted into the flute 32 so as to avoid any shaking. The width of the notch 44 is greater than or equal to the thickness of the boss 31, so that the boss 31 can be locked into the notch 44 and can slide therein.

[0047] In the embodiment of the present disclosure, in order to ensure that the part of the pin body 41 inserted into the axle-box body 70 fits well with well the axle-box body 70, the concave arc surface located on the axle-box body 70 matches an outer surface on the opposite side of the pin body 41 having the open groove 42.

[0048] In addition, the pin body 41 is mounted in the axle-box body 70 through a return spring. An upper end of the pin body 41 is connected with the return spring, and an lower end of the pin body 41 extends beyond the bottom surface of the axle-box body 70. Specifically, a supporting seat may be disposed in the axle-box body 70, the upper end of the pin body 41 is connected with the return spring and the upper end of the return spring is connected with the supporting seat. The return spring is configured to ensure that the pin body 41 has a locking force when it is located in the locking space to keep it in a locked state, and provides a reverse force for the pin body 41 when it is locked again after being unlocked, which facilitates quick locking. The bottom surface of the axle-box body 70a is provided with through hole of which the diameter is slightly larger than that of the pin body 41. The lower end of the pin body 41 extends beyond the bottom surface of the axle-box body 70. The bottom surface of the pin body 41 is respectively provided as an upward-sloping guide slant 45 on both sides of the central axis, so that the ground gauge-changing facilities can exert acting forces on the pin body 41 to change the gauge.

[0049] In order to laterally position the axle 80, the both ends of the axle 80 are respectively connected with the axle-box body 70 through the positioning bearing, so as to prevent the axle 80 from transverse moving relative to the axle-box body 70. The positioning bearing may be the deep groove ball bearing.

[0050] In the embodiment of the present disclosure, the axle-box body 70 is provided with a gauge-changing process detection and early warning unit to provide safe operation of vehicle before and after the change in gauge, so as to study the dynamic response characteristics and modal matching rules of bogies before and after the change in gauge, predict the dynamic indexes of a train, propose the change limit of suspension parameters, and analyze the adaptability of different gauges.

[0051] The gauge-changing process of the embodiment of the present disclosure: during the change in gauge, the gauge-changing process is triggered by the locking pin 40 disposed at the lower part of the axle-box body 70. When the wheels pass through the ground gauge-changing facility, the ground device is used firstly to jack up the axle-box body 70 to bear the weight of the vehicle body, and the wheelset is unloaded, the locking mechanisms of the gauge-changing wheelset are unlocked through the ground gauge-changing facility, the gauge is changed completely by squeezing the inside/outside of wheel rim 10 through auxiliary tracks on the ground, the locking mechanisms are locked, the axle-box body 70 is lowered to carry the load, and the wheelset starts to carry the load and the gauge is changed completely, and the vehicle runs normally.

[0052] The gauge-changing process detection of the embodiment of the present disclosure comprises: disposing the gauge-changing process detection and early warning unit in the bogie axle-box 70 of the ground gauge-changing facility, and setting the safe braking distance after the change in gauge to ensure the safety and reliability of the gauge-changing process: and when the gauge is changed unsucessfully, triggering the alarm device to notify the vehicle to execute emergency braking.

Embodiment 2

[0053] The difference between embodiment 2 and embodiment 1 is that, as shown in Fig. 4. the second connecting sleeve 12 in embodiment 2 is sleeved with the second support pin 32 through a bush 9. and the bush 9 is fixedly provided with a shockproof rubber sleeve 8, the second connecting sleeve 12 is press fitted on the shockproof rubber sleeve 8. The connecting sleeve, the shockproof rubber sleeve 8 and the bush 9 form an integral structure. The connecting sleeve may move freely back and forth along the support pin by being driven by the bush 9. In the second embodiment, it is necessary to only overcome the damping force between the first connecting sleeve 11 and the first support pin 31, that

is, the damping force is small.

[0054] It should be noted that the bush 9 is made of metal material, and the shockproof rubber sleeve 8 is vulcanized on the outer circumference of the bush 9.

[0055] According to the embodiment above, the embodiment of the disclosure can meet the parking brake of the gauge-changing bogie at different gauges, improve the operation efficiency of the gauge-changing bogie at different gauges, ensure the safe operation of the vehicle, and provides the stable and reliable lateral positioning of the brake clamp.

[0056] Moreover, according to the gauge-changing structure of the embodiment of the present disclosure, only a small amount of improvement is made on the structure of current bogie, while the part of axle at the inner sides of the wheels 6 is consistent with the traditional axle; and there is enough space left for the motor, gearbox and other components mounted on the axle between the inner sides of the wheels.

[0057] The embodiments above are only preferred embodiments of the present disclosure, and is not intended to limit the present disclosure. Any modifications, equivalent replacements, improvements, etc. made in the spirit and within the principles of the present disclosure should be included in the scope of protection of the present disclosure.

Claims

1. A bullet train gauge-changing bogie for a railway vehicle, comprising a frame, the frame comprising a pair of side beams disposed in parallel and a pair of cross beams connected between the two side beams, **characterized in that**, a gauge-changing wheelset is respectively disposed at exterior sides of the pair of the cross beams, the wheels of the gauge-changing wheelset are mounted with wheel-mounted brake discs; each of the side beams or each of the cross beams is mounted with a mounting seat and a brake clamp, and the brake clamp is connected with the mounting seat by support pins: the support pins are horizontally disposed below the mounting seat, and both ends thereof are fixedly connected with the mounting seat, one end of the brake clamp is provided with a connecting sleeve; the connecting sleeve is firmly sleeved with damping inner sleeves with elastic damping; the connecting sleeve is locked on the support pins through the damping inner sleeves: when the gauge is changing, the wheel-mounted brake disc on the wheel exerts a thrust on the brake clamp; when the thrust on the connecting sleeve is greater than the damping force between the connecting sleeve and the support pins, the connecting sleeve drives the brake clamp to move along the support pins.

2. The bullet train gauge-changing bogie for a railway vehicle of claim 1, **characterized in that**, the length of the connecting sleeves is less than the length of the support pins, both ends of the connecting sleeve and both ends of the support pins are respectively connected through bellows, and a gap is reserved between the connecting sleeve and the bottom surface of the mounting seat.

3. The bullet train gauge-changing bogie for a railway vehicle of claim 1, **characterized in that**, the damping inner sleeves include a first damping inner sleeve and a second damping inner sleeve which are disposed at intervals, the support pin between the first damping inner sleeve and the second damping inner sleeve is fixedly sleeved with a spherical bearing, the spherical bearing and the connecting sleeve are positioned through a bearing seat; the bearing seat and the inner surface of the connecting sleeve are press-fitted.

4. The bullet train gauge-changing bogie for a railway vehicle of claim 1, **characterized in that**, two support pins including a first support pin and a second support pin are disposed below the mounting seat in parallel, the first support pin is located outside the mounting seat, and the second support pin is located inside the mounting seat, one end of the brake clamp is provided with two connecting sleeves connected in parallel including a first connecting sleeve and a second connecting sleeve, the first connecting sleeve is connected with the first support pin, and the second connecting sleeve is connected with the second support pin.

5. The bullet train gauge-changing bogie for a railway vehicle of claim 1, **characterized in that**, the mounting seat is provided with downward extending connecting ends along the axial opposite sides of the gauge-changing wheelset, and the support pins are fixedly connected with the connecting ends.

6. The bullet train gauge-changing bogie for a railway vehicle of claim 1, **characterized in that**, the side beam or cross beam is provided with a brake hanger bracket on which the mounting seat is installed.

7. The bullet train gauge-changing bogie for a railway vehicle of any one of claims 1 to 6, **characterized in that**, the gauge-changing wheelset includes an axle, wheels and locking mechanisms; both ends of the pairs of side beams are respectively provided with an axle-box body, both ends of the axle extend into an axle-box body, respectively,

the wheels are installed on the axle and connected with the axles through splines; the locking mechanisms are respectively provided on exterior sides of the wheels and located in an axle-box body at both ends of the axle; and the locking mechanisms are connected with the wheels, and configured to lock and unlock the wheels to change a gauge of the wheels.

8. The bullet train gauge-changing bogie for a railway vehicle of claim 7, **characterized in that**, the locking mechanism comprises an inner sleeve, a rolling bearing, an outer sleeve and a locking pin;
the inner sleeve, the rolling bearing and the outer sleeve are tightly sleeved in sequence from inside to outside, the inner sleeve is in clearance fit with the axle, an end of the inner sleeve facing the wheels extends beyond the axle-box body and is firmly connected with the wheels; the outer sleeve is in clearance fit with the inner surface of the axle-box body, and opposite sides of the outer sleeve are respectively provided with a boss axially extending along the outer sleeve; a plurality of flutes is are disposed at intervals along the length directions of the bosses, the interior side wall of the axle-box body is provided with a concave arc surface corresponding to the grooves respectively, and the locking pins are inserted into a locking space defined by the flutes and the concave arc surface, and is switched between the locking spaces under the action of external force, so as to change the gauge.

9. The bullet train gauge-changing bogie for a railway vehicle of claim 8, **characterized in that**, the locking pin includes a pin body, one side of which is provided with an open groove penetrating along the radial direction of the pin body. The open groove is provided with at least one lug extending along the axial direction of the pin body, the upper end of the lug is connected with the top of the open groove, and a notch is reserved between the lower end of the lug and the bottom of the open groove, and the lug is inserted into the flutes.

10. The bullet train gauge-changing bogie for a railway vehicle of claim 9, **characterized in that**, the pin body is installed in the axle-box body through a return spring; the upper end of the pin body is connected with the return spring, and the lower end of the pin body extends beyond the bottom surface of the axle-box body.

11. The bullet train gauge-changing bogie for a railway vehicle of claim 7, **characterized in that**, the axle-box body is provided with a gauge change process detection and early-warning unit.

12. The bullet train gauge-changing bogie for a railway vehicle of claim 7, **characterized in that**, the axle is configured as a stepped shaft having a diameter in the middle part greater than a diameter at both ends, the wheels are disposed on an intermediate section of the stepped shaft and are respectively arranged at both ends of the intermediate section, and the locking mechanisms are arranged on the both ends of the stepped shaft;
an inner circumference of the wheel is provided with an internal splines, both ends of the intermediate section of the stepped shaft are respectively provided with external splines, and the wheels and both ends of the middle shaft are in fit connection through internal spline and external spline; and
both ends of the intermediate section are respectively configured as a three-stage stepped shaft including a first flange, a second flange and a third flange of which the diameters changes are gradually increased from outside to inside; the external spline is provided on the external circumference of the second flange; the center hole of the wheel configured as a three-stage stepped hole including a first connecting hole, a second connecting hole and a third connecting hole, of which the diameters changes are gradually increased from outside to inside: the internal splines are circumferentially disposed of the inner wall of the second connecting hole, the first connecting hole matches the first flange, the internal spline in fit connection with the external splines, and the third connecting hole matches the third flange.

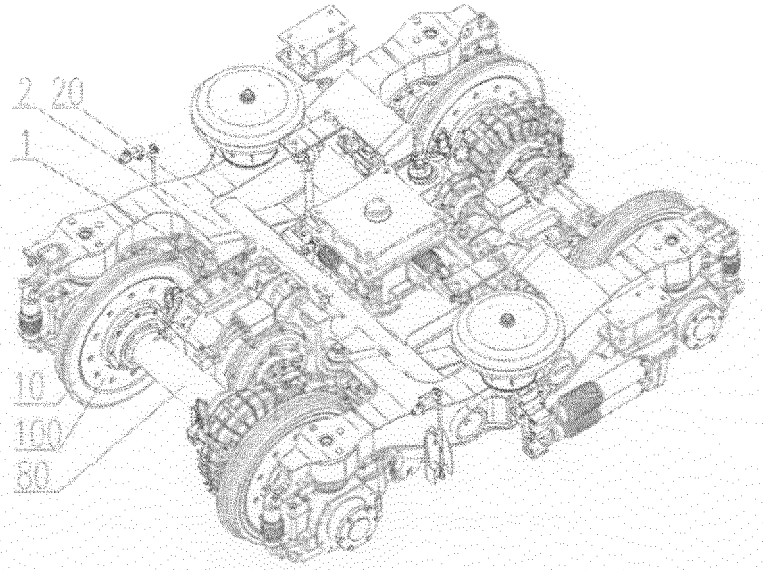

Fig. 1

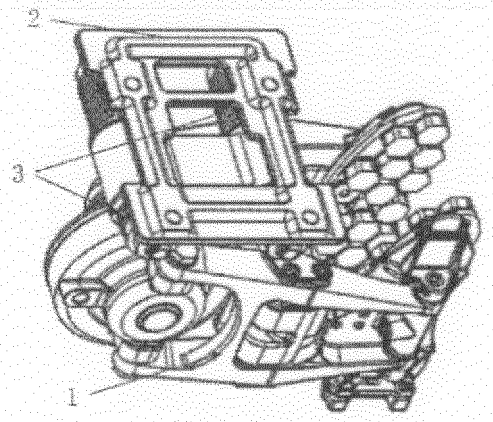

Fig. 2

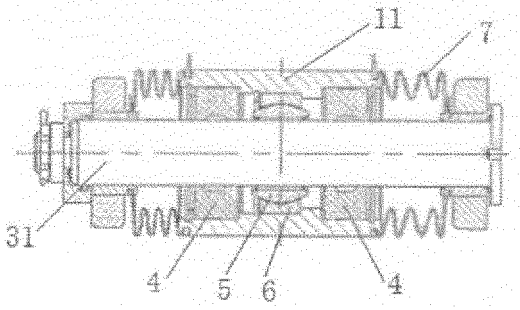

Fig. 3

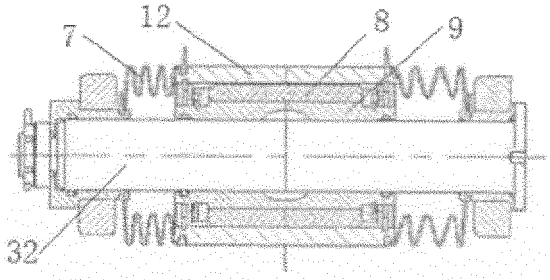

Fig. 4

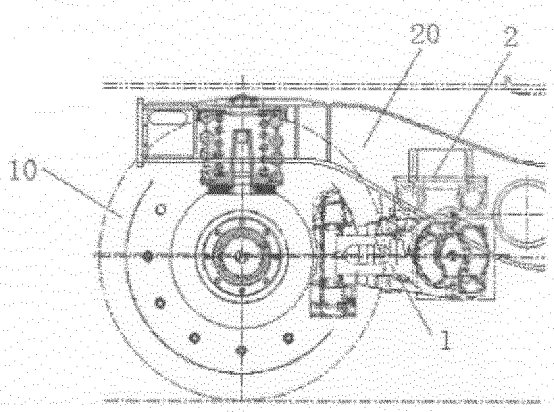

Fig. 5

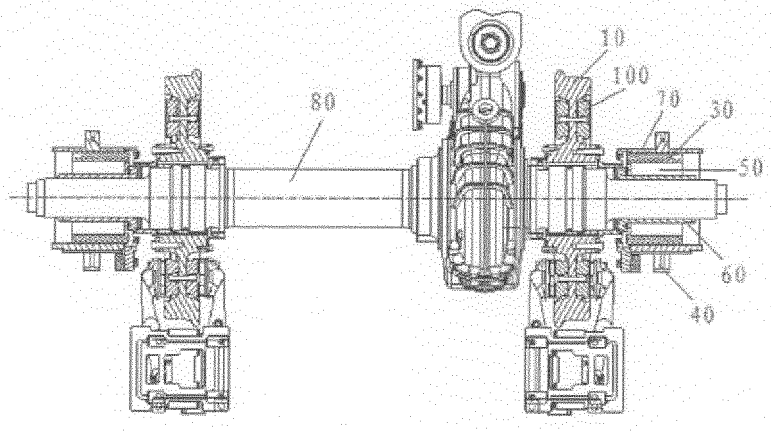

Fig. 6

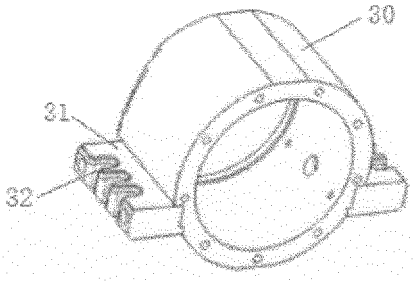

Fig. 7

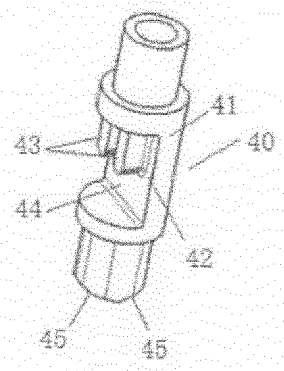

Fig. 8

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2018/107815

A. CLASSIFICATION OF SUBJECT MATTER

B61F 5/50(2006.01)i; B61F 7/00(2006.01)i; B61H 5/00(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

B61F; B61H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CNABS; VEN; CNKI; CNTXT; USTXT; EPTXT: 青岛四方机车, 轨距, 轨道, 间距, 轮边, 制动, 刹车, 夹钳, 轮对, 橡胶, 阻尼, 弹性, railway, gage, pitch, gauge, change, vary, damping, cushion, rubber, brake, flap, dish, disc

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 108515981 A (CRRC QINGDAO SIFANG CO., LTD.) 11 September 2018 (2018-09-11) description, paragraphs [0033]-[0043], and figures 1-4	1-6
PY	CN 108515981 A (CRRC QINGDAO SIFANG CO., LTD.) 11 September 2018 (2018-09-11) description, paragraphs [0033]-[0043], and figures 1-4	7-12
PY	CN 108407840 A (CRRC QINGDAO SIFANG CO., LTD.) 17 August 2018 (2018-08-17) description, paragraphs [0054]-[0070], and figures 1-17	7-12
A	CN 107521519 A (SOUTHWEST JIAOTONG UNIVERSITY ET AL.) 29 December 2017 (2017-12-29) description, paragraphs [0031]-[0081], and figures 1-63	1-12
A	US 3974780 A (THE BUDD COMPANY) 17 August 1976 (1976-08-17) entire document	1-12

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

* Special categories of cited documents:

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
26 November 2018	**20 December 2018**
Name and mailing address of the ISA/CN **National Intellectual Property Administration, PRC (ISA/CN)** **No. 6, Xitucheng Road, Jimenqiao, Haidian District, Beijing 100088** **China** Facsimile No. **(86-10)62019451**	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2018/107815

Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)			Publication date (day/month/year)
CN	108515981	A	11 September 2018	None			
CN	108407840	A	17 August 2018	None			
CN	107521519	A	29 December 2017	CN	207360332	U	15 May 2018
US	3974780	A	17 August 1976	BR	7502069	A	06 July 1976

Form PCT/ISA/210 (patent family annex) (January 2015)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- CN 2018103320508 **[0001]**