



EUROPEAN PATENT APPLICATION
published in accordance with Art. 153(4) EPC

(43) Date of publication:
17.11.2021 Bulletin 2021/46

(51) Int Cl.:
B61F 15/26 ^(2006.01) **B61F 15/22** ^(2006.01)

(21) Application number: **19908343.7**

(86) International application number:
PCT/CN2019/108096

(22) Date of filing: **26.09.2019**

(87) International publication number:
WO 2020/143251 (16.07.2020 Gazette 2020/29)

(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
Designated Validation States:
KH MA MD TN

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(30) Priority: **07.01.2019 CN 201910012719**

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(54) **SEALING APPARATUS USED FOR VARIABLE GAUGE WHEELSET, AND VARIABLE GAUGE WHEELSET**

(57) Disclosed are a sealing apparatus for a gauge changing wheelset, and a gauge changing wheelset. The sealing apparatus is arranged between a sliding mechanism (3) of the gauge changing wheelset and an axle-box rear cover (2) of an axle-box body (1); the sliding mechanism (3) is axially movable relative to the axle-box body (1) and rotatable relative to the axle-box body (1); the sealing apparatus includes a sliding seal and a rotary seal; the sliding seal includes a sliding ring (4) sleeved outside the sliding mechanism (3) and hermetically connected to the axle-box rear cover (2); an inner wall of the sliding ring (4) is axially provided with a through groove (41), and an outer wall of the sliding mechanism (3) is axially provided with a protrusion which is slidably fitted with the through groove (41); the rotating seal includes a sealing baffle (5) fixed on an outer side of the axle-box rear cover (2); an outer wall of the sliding ring (4) is circumferentially provided with an annular groove (42), and a lower end of the sealing baffle (5) extends into the annular groove (42). The described sealing apparatus may seal between the sliding mechanism (3) and the axle-box body (1), thereby improving the sealing environment and enhancing the sealing effects.

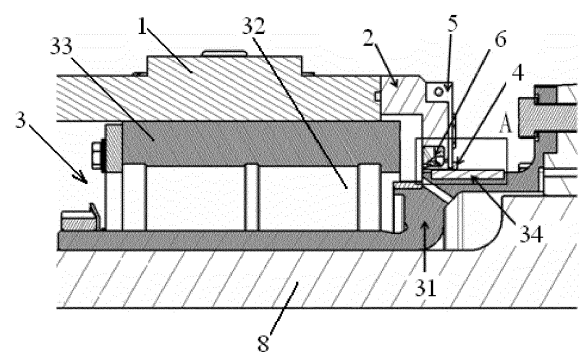


Fig. 1

Description

CROSS-REFERENCE TO RELATED APPLICATION

[0001] The present application claims priority to Chinese application No. 201910012719X filed on January 7, 2019, entitled "Sealing Apparatus for Gauge-Changing Wheelset and Gauge-Changing Wheelset", the disclosure of which is hereby incorporated by reference in its entirety.

FIELD OF TECHNOLOGY

[0002] The present application relates to the technical field of rail vehicle gauge change, and in particular, to a sealing apparatus for gauge-changing wheelset and a gauge-changing wheelset.

BACKGROUND

[0003] With the rapid evolution of global economic integration, transnational passenger and cargo transportation has grown rapidly in recent years. However, different rail gauges of various countries have seriously hindered the transnational rail transportation. In order to solve the problem that the different rail gauges of various countries hinder the transnational railway transportation, a gauge-changing wheelset is proposed, that is, when running on a railway of another country, a train changes the distance between the wheels of its own wheelset to adapt to the gauge of the railway of another country.

[0004] During the process of gauge change, a sliding mechanism on the wheelset will slide relative to an axle-box body under the pushing of the ground guide rail. The traditional sealing structure cannot be applied to gauge-changing wheelsets. Therefore, how to seal between the sliding mechanism and the axle-box body is an urgent problem to be solved.

SUMMARY

(I) Technical problems to be solved

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

[0006] It is an objective of the present disclosure is to provide a sealing apparatus for gauge-changing wheelset to seal between the sliding mechanism and the axle-box body, thereby improving the sealing environment and enhancing sealing effects.

(II) Technical solutions

[0007] In order to solve the technical problems mentioned above, the present disclosure provides a sealing apparatus for gauge-changing wheelset. The sealing apparatus is arranged between a sliding mechanism of the

gauge-changing wheelset and an axle-box rear cover of an axle-box body, the sliding mechanism is axially movable relative to the axle-box body and rotatable relative to the axle-box body. The sealing apparatus includes a sliding seal and a rotating seal, the sliding seal includes a sliding ring sleeved outside the sliding mechanism and hermetically connected to the axle-box rear cover, an inner wall of the sliding ring is axially provided with a through groove, and an outer wall of the sliding mechanism is axially provided with a protrusion which is slidably fitted with the through groove; the rotating seal includes a sealing baffle fixed on an outer side of the axle-box rear cover, an outer wall of the sliding ring is circumferentially provided with an annular groove, and a lower end of the sealing baffle extends into the annular groove.

[0008] In an embodiment of the present disclosure, the sealing apparatus further includes a first sealing ring, the axle-box rear cover is provided with an axial through hole and is also provided with a first mounting groove on an inner circumference of the axial through hole, an outer circumference of the first sealing ring is installed by interference in the first mounting groove, and an inner circumference of the first sealing ring is pressed against an outer circumference of the sliding ring.

[0009] In an embodiment of the present disclosure, the outer wall of the sliding mechanism is axially provided with a positioning groove, in which a positioning key protruding from the positioning groove is placed to form the protrusion.

[0010] In an embodiment of the present disclosure, the inner wall of the sliding ring is circumferentially provided with a plurality of the through grooves, and the outer wall of the sliding mechanism is circumferentially provided with the protrusions corresponding to the through grooves in a one-to-one manner.

[0011] In an embodiment of the present disclosure, the inner wall of the sliding ring is circumferentially provided with two through grooves, and the two through grooves are arranged on two radial sides of the inner wall of the sliding ring.

[0012] In an embodiment of the present disclosure, the sealing baffle includes a first baffle and a second baffle butted end to end to form a ring, and an inner circumference of the ring formed by the butting of the first baffle and the second baffle is located in the annular groove of the sliding ring.

[0013] In an embodiment of the present disclosure, the first baffle and the second baffle have L-shaped cross sections, a shorter side of the L-shape is fastened on an outer circumference of the axle-box rear cover by fasteners, and a longer side of the L-shape is arranged proximate to the outside of the axle-box rear cover.

[0014] In an embodiment of the present disclosure, a second sealing ring is arranged between the sliding ring and the sliding mechanism, and the second sealing ring is fixedly sleeved in a second mounting groove on an outer circumference of the sliding mechanism.

[0015] An embodiment of the present disclosure also

provides a gauge-changing wheelset, including sliding mechanisms, axle-box bodies and sealing apparatus for gauge-changing wheelset, where the sealing apparatus is arranged between the sliding mechanism and the axle-box rear cover of the axle-box body, and is configured to provide the axially sliding sealing and a rotating sealing of the sliding mechanism.

[0016] In an embodiment of the present disclosure, the gauge-changing wheelset further includes wheels and an axle, where the wheels are slidably arranged at both ends of the axle, the sliding mechanisms are respectively connected with the wheels, and are located in the axle-box bodies at both ends of the axle, the wheels are unlocked and locked through the sliding mechanisms, and the sliding mechanism includes an inner sleeve sleeved on the axle and in clearance fit with the axle, and the sealing apparatus is arranged between the inner sleeve and the axle-box rear cover of the axle-box body.

(III) Beneficial effects

[0017] Compared with the prior art, the present disclosure has at least the following advantages:
the embodiments of the present disclosure provide a sealing apparatus for gauge-changing wheelset, the sealing apparatus is arranged between the sliding mechanism of the gauge-changing wheelset and the axle-box rear cover of the axle-box body, the sealing apparatus includes a sliding seal and a rotating seal, the sliding seal includes a sliding ring sleeved outside the sliding mechanism and hermetically connected to the axle-box rear cover, the inner wall of the sliding ring is axially provided with a through groove, and the outer wall of the sliding mechanism is axially provided with a protrusion which is slidably fitted with the through groove. When the sliding mechanism moves, the protrusion moves along the through groove, so as to ensure that the sliding ring and the sliding mechanism may rotate together and slide along the axial direction relative to each other; the rotating seal includes a sealing baffle fixed on the outer side of the axle-box rear, the outer wall of the sliding ring is circumferentially provided with an annular groove, and the lower end of the sealing baffle extends into the annular groove to provide axial positioning for the sliding ring, so that the sliding ring does not move axially; therefore, the sliding ring can only rotate circumferentially relative to the axle-box rear cover, and can only slide axially relative to the sliding mechanism. For the sealing apparatus, the double-degree of-freedom sealing is decoupled into a two-stage single-degree-of-freedom sealing, in which each layer of the sealing is only for relative translation or relative rotation, so as to improve the sealing environment and enhance the sealing effects. It is also conducive to the optimization of the seals under a single influence factor, and finally realize the sealing of the composite degree of freedom structure.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018]

5 FIG. 1 is an axial cross-sectional view of a sealing apparatus for gauge-changing wheelset according to an embodiment of the present disclosure;

10 FIG. 2 is a partial enlarged view of A in FIG. 1;

FIG. 3 is a front view of a sliding ring in a sealing apparatus for gauge-changing wheelset according to an embodiment of the present disclosure; and

15 FIG. 4 is a sectional view of A-A in FIG. 3;

[0019] Reference numerals:

20 1 axle-box body	2 axle-box rear cover;
3 sliding mechanism	31 inner sleeve
32 rolling bearing	33 outer sleeve
34 positioning key	4 sliding ring
41 through groove	42 annular groove
25 5 sealing baffle	6 first sealing ring
7 second sealing ring	8 axle

DETAILED DESCRIPTION

30 **[0020]** The specific embodiments of the present application are further described in detail below in conjunction with the drawings and embodiments. The following embodiments are intended to illustrate the present application, but are not intended to limit the scope of the present application.

35 **[0021]** In the description of the present application, it should be noted that the orientation or positional relationships indicated by terms such as "center", "longitudinal", "lateral", "upper", "lower", "front", "rear", "left", "right", "vertical", "horizontal", "top", "bottom", "inside", "outside" and the like are based on the orientation or positional relationships shown in the drawings, and are merely for the convenience of describing the present application and simplifying the description, rather than indicating or implying that the device or component stated must have a particular orientation, be constructed and operated in a particular orientation, and thus should not be construed as limiting the present application. Moreover, the terms "first", "second", "third", and the like are used for descriptive purposes only and are not to be construed as indicating or implying relative importance.

40 **[0022]** In the description of the present application, it should be noted that unless otherwise explicitly stated and defined, the terms "installed", "connected with", and "connected" shall be understood in a broad sense, for example, it may be either fixedly connected or detachably connected, or may be integrally connected; it may be

mechanically connected, or electrically connected; it may be directly connected, or indirectly connected through an intermediate medium, or the communication between the interior of two elements. The specific meanings of the terms above in the present application can be understood by a person skilled in the art in accordance with specific conditions.

[0023] In addition, in the description of the present application, "multiple", "a plurality of", and "multiple groups" mean two or more unless otherwise specified.

[0024] As shown in FIGS. 1 to 4, an embodiment of the present disclosure provides a sealing apparatus for gauge-changing wheelset. The gauge-changing wheelset includes a sliding mechanism 3 and an axle-box body 1. The sliding mechanism 3 can move back and forth relative to the axial direction of the axle-box body 1 to meet the requirements of gauge change. In order to ensure the basic sealing requirements of the axle-box body 1, one end of the axle-box body 1 is provided with an axle-box front cover, and the other end of the axle-box body 1 is provided with an axle-box rear cover 2. The sliding mechanism 3 is located in the axle-box body 1, passes out of the axle-box rear cover 2 and is connected with the wheel. During the normal operation of the gauge-changing wheelset, the sliding mechanism 3 rotates with the wheel, and the axle-box body 1 is relatively fixed, so that the sliding mechanism 3 may rotate relative to the axle-box body 1, that is, the sliding mechanism 3 has the rotational degree of freedom and translational degree of freedom for movement along the axle-box 1. The sealing apparatus is arranged between the sliding mechanism 3 of the gauge-changing wheelset and the axle-box rear cover 2 of the axle-box body 1; in an embodiment, the sealing apparatus includes a sliding seal and a rotating seal, the sliding seal includes a sliding ring 4 sleeved outside the sliding mechanism 3 and hermetically connected to the axle-box rear cover 2. As shown in FIG. 3, an inner wall of the sliding ring 4 is axially provided with a through groove 41, and an outer wall of the sliding mechanism 3 is axially provided with a protrusion which is slidably fitted with the through groove 41. When the sliding mechanism 3 moves, the protrusion moves along the through groove 41, so as to ensure that the sliding ring 4 and the sliding mechanism 3 may rotate together, and slide relative to each other along the axial direction; the rotating seal includes a sealing baffle 5 fixed on an outer side of the axle-box rear cover 2. As shown in FIG. 4, an outer wall of the sliding ring 4 is circumferentially provided with an annular groove 42, and a lower end of the sealing baffle 5 extends into the annular groove 42 to provide axial positioning for the sliding ring 4, so that the sliding ring 4 does not move axially, as a result, the sliding ring 4 may only rotate circumferentially relative to the axle-box rear cover 2, and can only slide axially relative to the sliding mechanism 3. In the present disclosure, the double-degree-of-freedom sealing is decoupled into a two-stage single-degree-of-freedom sealing, in which each layer of sealing is only for relative translation

or relative rotation, so as to improve the sealing environment and enhance the sealing effects. It is also conducive to the optimization of the seals under a single influence factor, so as to finally seal the composite-degree-of-freedom structure.

[0025] In an embodiment of the present disclosure, as shown in FIG. 1, in order to realize the sealing connection between the axle-box rear cover 2 and the sliding ring 4, a first sealing ring 6 is also included. The first sealing ring 6 may be a rubber sealing ring, the axle-box rear cover 2 is provided with an axial through hole and is also provided with a first mounting groove on an inner circumference of the axial through hole. The first mounting hole is annular, the outer circumference of the first sealing ring 6 is installed by interference in the first mounting groove, and the inner circumference of the first sealing ring 6 is pressed against an outer circumference of the sliding ring 4. When the sliding ring 4 is rotated, the outer circumference of the sliding ring 4 is rotatably and hermetically connected to the first sealing ring 6.

[0026] In an embodiment of the present disclosure, in order to facilitate the formation of the protrusion, the outer wall of the sliding mechanism 3 is axially provided with a positioning groove in which a positioning key 34 protruding from the positioning groove is placed, the length of the positioning key 34 matches the length of the positioning groove, and the thickness of the positioning key 34 is greater than the depth of the positioning groove, so that after the positioning key 34 is installed in the positioning groove, an upper surface of the positioning key 34 is higher than the positioning groove to form the protrusion, through which the sliding ring 4 and the sliding mechanism 3 may rotate together, and the protrusion does not restrict the axial movement of the sliding mechanism 3.

[0027] In an embodiment of the present disclosure, one through groove 41 may be arranged on the circumferential direction of the inner wall of the sliding ring 4, but in order to make the force deployed on the sliding ring 4 evenly, a plurality of through grooves 41 are preferably arranged on the circumferential direction of the inner wall of the sliding ring 4. The plurality of through grooves 41 may be evenly distributed on the inner wall of the sliding ring 4 along the circumferential direction, and the protrusions corresponding to the through grooves 41 in a one-to-one manner are provided on the outer wall of the sliding mechanism 3 along the circumferential direction.

[0028] In an embodiment of the present disclosure, in order to simplify the structure, the inner wall of the sliding ring 4 is circumferentially provided with two through grooves 41, which are arranged on two radial sides of the inner wall of the sliding ring 4.

[0029] In an embodiment of the present disclosure, in order to fit with the annular groove 42 outside the sliding ring 4 and fully seal the circumferential direction of the annular groove 42, the sealing baffle 5 includes a first baffle and a second baffle butted end to end to form a ring. The sealing baffle 5 is divided into a first baffle and

a second baffle so as to facilitate the installation from the top and bottom, and the inner circumference of the ring formed by the butting of the first baffle and the second baffle is located in the annular groove 42 of the sliding ring 4. When the sliding ring 4 is rotated, the inner circumference of the first baffle and the second baffle is rotationally sealed to the annular groove 42.

[0030] In an embodiment of the present disclosure, the first baffle and the second baffle have specifically L-shaped radial cross sections, a shorter side of the L-shape is fastened on an outer circumference of the axle-box rear cover 2 by fasteners such as bolts, and a longer side of the L-shape is arranged proximate to an outer side of the axle-box rear cover 2 and extends into the annular groove 42.

[0031] In an embodiment of the present disclosure, provided between the sliding ring 4 and the sliding mechanism 3 is a slender gap, which has a labyrinth function. As shown in FIG. 2, a second sealing ring 7, such as a sealing rubber O-ring, is arranged between the sliding ring 4 and the sliding mechanism 3, and the second sealing ring 7 is fixedly sleeved in the second mounting groove on the outer circumference of the sliding mechanism 3. When the sliding ring 4 moves, the inner circumference of the sliding ring 4 is in sealing contact with the second sealing ring 7 to further enhance the sealing effects.

[0032] An embodiment of the present disclosure also provides a gauge-changing wheelset, which includes sliding mechanisms 3, axle-box bodies 1 and the above-mentioned sealing apparatus for gauge-changing wheelset. The sealing apparatus is arranged between the sliding mechanism 3 and the axle-box rear cover 2 of the axle-box body 1, and is configured to provide the axial sliding sealing and the rotating sealing of the sliding mechanism. In the present disclosure, sealing is performed in each single degree of freedom separately by decomposing the degrees of freedom, thereby reducing the difficulty in sealing, and ensuring the high-speed operation performance of the gauge-changing wheelset while ensuring the sealing performance of the multi-degree-of-freedom movement.

[0033] In an embodiment of the present disclosure, as shown in FIG. 1, the gauge-changing wheelset further includes wheels and an axle 8, and the wheels are slidably arranged at both ends of the axle 8. In an embodiment, the wheel is provided with inner splines on the inner circumference thereof, the axle 8 is provided with outer splines at both ends thereof, and the wheels are fitted and connected with the two ends of the axle 8 through the inner splines and the outer splines, which is convenient for both torque transmission and wheel movement. The sliding mechanisms 3 are respectively connected with the wheels, and are located in the axle-box bodies 1 at both ends of the axle 8. The wheel is unlocked and locked through the sliding mechanism 3. The sliding mechanism 3 includes an inner sleeve 31 sleeved on the axle 8 and in clearance fit with the axle 8, and the sealing

apparatus is arranged between the inner sleeve 31 and the axle-box rear cover 2, the protrusion is thus arranged outside the inner sleeve 31, and the positioning groove is arranged on the inner sleeve 31; an end of the inner sleeve 31 towards the wheel extends out of the axle-box body 1 and is fixedly connected to the wheel through fasteners, and a gauge change space is reserved between the extending end of the inner sleeve 31 and the axle 8, so as to ensure that the inner sleeve 31 has enough distance to move along the axle 8 without interference with the axle 8 when the gauge is changed. The sliding mechanism 3 further includes a rolling bearing 32 and an outer sleeve 33, and the inner sleeve 31, the rolling bearing 32 and the outer sleeve 33 are tightly sleeved in sequence from inside to outside. When the wheel rotates, the inner sleeve 31 and the inner ring of the rolling bearing 32 rotate with the wheel, while the outer sleeve 33 and the outer ring of the rolling bearing 32 remain relatively fixed. The outer sleeve 33 and the inner surface of the axle-box body 1 are in clearance fit, so that the outer sleeve 33, the inner sleeve 31 and the rolling bearing 32 can move along the axle-box body 1 as a whole. By arranging the sealing apparatus between the inner sleeve 31 and the axle-box rear cover 2 of the axle-box body 1, a good sealing can be achieved when the inner sleeve 31 moves or rotates, and each layer of sealing is only for relative translation or relative rotation, thereby improving the sealing environment and enhancing the sealing effects.

[0034] As can be seen from the above embodiments, in the present disclosure, sealing is performed in each single degree of freedom separately by decomposing the degrees of freedom, thus reducing the difficulty of sealing and ensuring the high-speed performance of gauge-changing wheelset while ensuring the sealing performance of the multi-degree-of-freedom movement.

[0035] The descriptions above are only preferred embodiments of the present disclosure and are not intended to limit the present disclosure. Any modification, equivalent substitution or improvement made within the spirit and principle of the present disclosure should be included within the protection scope of the present disclosure.

Claims

1. A sealing apparatus for a gauge changing wheelset, **characterized in that**, the sealing apparatus is arranged between a sliding mechanism of the gauge changing wheelset and an axle-box rear cover of an axle-box body; the sliding mechanism is axially movable relative to the axle-box body and rotatable relative to the axle-box body, the sealing apparatus comprising a sliding seal and a rotating seal; the sliding seal comprises a sliding ring sleeved outside the sliding mechanism and hermetically connected to the axle-box rear cover; an inner wall of the sliding ring is axially provided with a through groove, and

an outer wall of the sliding mechanism is axially provided with a protrusion which is slidably fitted with the through groove; the rotating seal comprises a sealing baffle fixed on an outer side of the axle-box rear cover, an outer wall of the sliding ring is circumferentially provided with an annular groove, and a lower end of the sealing baffle extends into the annular groove.

2. The sealing apparatus for a gauge changing wheelset of claim 1, further comprising a first sealing ring, the axle-box rear cover is provided with an axial through hole and is also provided with a first mounting groove on an inner circumference of the axial through hole, an outer circumference of the first sealing ring is installed by interference in the first mounting groove, and an inner circumference of the first sealing ring is pressed against an outer circumference of the sliding ring. 10
3. The sealing apparatus for a gauge changing wheelset of claim 1, **characterized in that**, the outer wall of the sliding mechanism is axially provided with a positioning groove, in which a positioning key protruding from the positioning groove is placed to form the protrusion. 15
4. The sealing apparatus for a gauge changing wheelset of claim 1, **characterized in that**, the inner wall of the sliding ring is circumferentially provided with a plurality of the through grooves, and the outer wall of the sliding mechanism is circumferentially provided with protrusions corresponding to the through grooves in a one-to-one manner. 20
5. The sealing apparatus for a gauge changing wheelset of claim 4, **characterized in that**, the inner wall of the sliding ring is circumferentially provided with two said through grooves, and the two through grooves are arranged on two radial sides of the inner wall of the sliding ring. 25
6. The sealing apparatus for a gauge changing wheelset of claim 1, **characterized in that**, the sealing baffle comprises a first baffle and a second baffle butted end to end to form a ring, and an inner circumference of the ring formed by the butting of the first baffle and the second baffle is located in the annular groove of the sliding ring. 30
7. The sealing apparatus for a gauge changing wheelset of claim 6, **characterized in that**, the first baffle and the second baffle have L-shaped cross sections, a shorter side of the L-shape is fastened on an outer circumference of the axle-box rear cover by fasteners, and a longer side of the L-shape is arranged proximate to an outer side of the axle-box rear cover. 35

8. The sealing apparatus for a gauge changing wheelset of claim 1, **characterized in that**, a second sealing ring is arranged between the sliding ring and the sliding mechanism, and the second sealing ring is fixedly sleeved in a second mounting groove on an outer circumference of the sliding mechanism. 40
9. A gauge changing wheelset, comprising sliding mechanisms, axle-box bodies and sealing apparatus for a gauge changing wheelset of any one of claims 1 to 8, wherein the sealing apparatus is arranged between the sliding mechanism and an axle-box rear cover of the axle-box body, and is configured to provide an axial sliding sealing and a rotating sealing of the sliding mechanism. 45
10. The gauge changing wheelset of claim 9, further comprising wheels and an axle, wherein the wheels are slidably arranged at both ends of the axle, the sliding mechanisms are respectively connected with the wheels, and are located in the axle-box bodies at both ends of the axle, the wheels are unlocked and locked through the sliding mechanisms, and the sliding mechanism includes an inner sleeve sleeved on the axle and in clearance fit with the axle, and the sealing apparatus is arranged between the inner sleeve and the axle-box rear cover of the axle-box body. 50

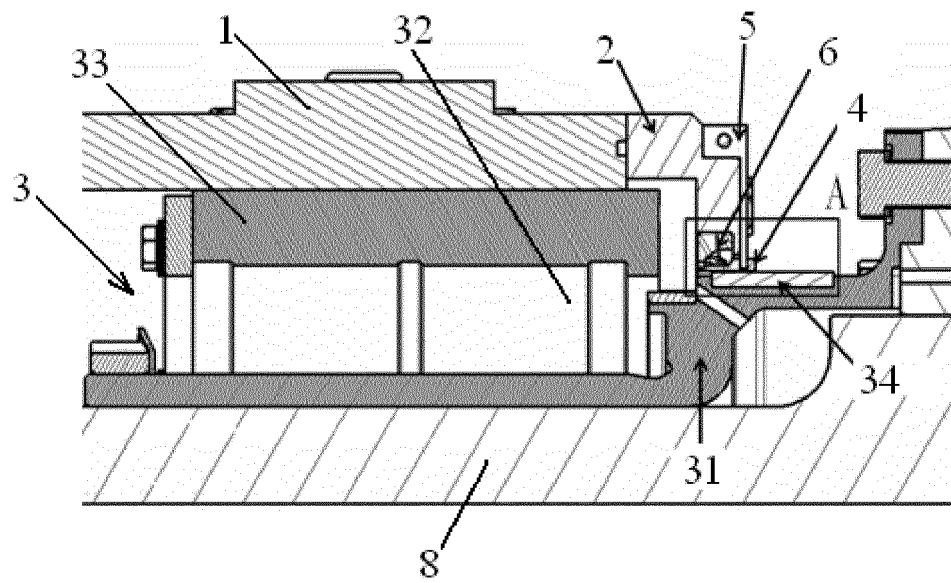


Fig. 1

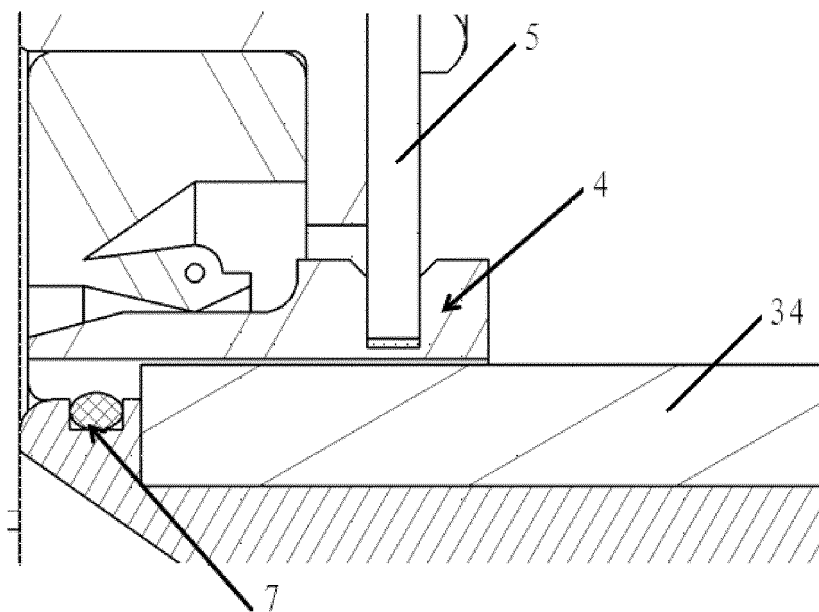


Fig. 2

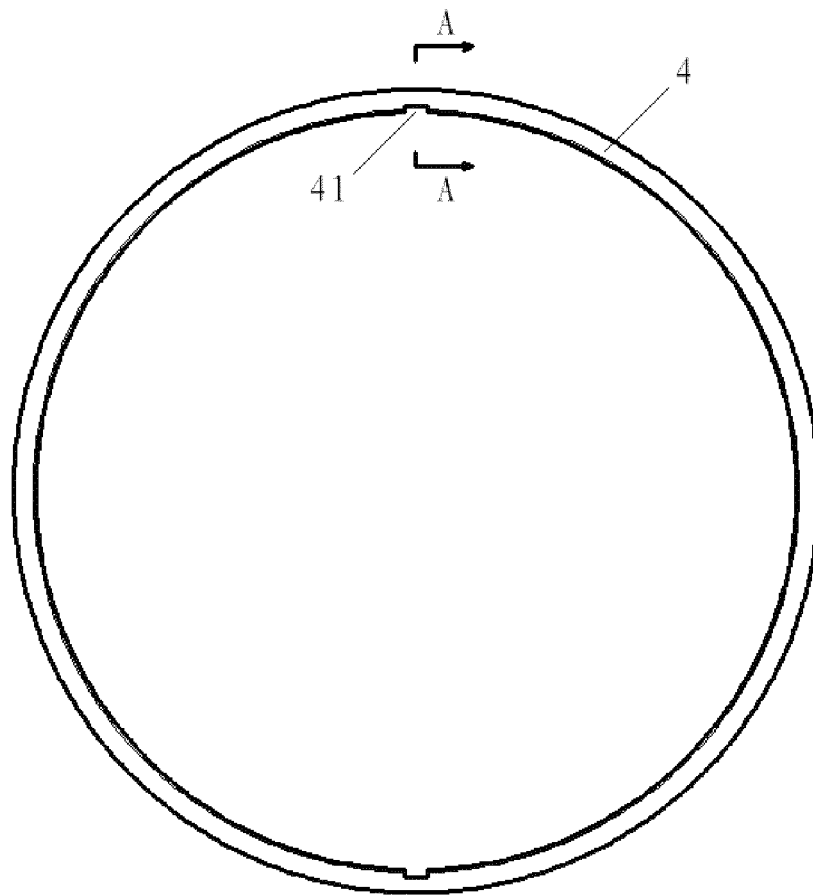


Fig. 3

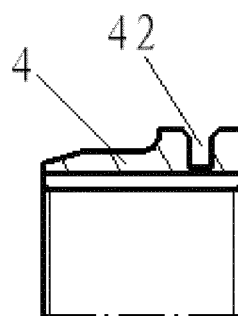


Fig. 4

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2019/108096

A. CLASSIFICATION OF SUBJECT MATTER

B61F 15/26(2006.01)i; B61F 15/22(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

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)

CNPAT, CNKI, WPI, EPODOC: 中车青岛四方机车车辆股份有限公司, 变轨, 轮对, 密封, 轴向, 滑移, 盖, 滑动, 转, 槽, 键, 挡板, 圈, 环, railway, variable, gage, wheel, seal+, slid+, rotat+, protruding, baffle, plate, slot, groove, ring

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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A	CN 107856692 A (CRRC CHANGCHUN RAILWAY VEHICLES CO., LTD.) 30 March 2018 (2018-03-30) description, paragraphs [0009]-[0012], and figures 1-4	1-10
A	CN 207191061 U (SOUTHWEST JIAOTONG UNIVERSITY et al.) 06 April 2018 (2018-04-06) entire document	1-10
A	CN 104340237 A (SKF AB) 11 February 2015 (2015-02-11) entire document	1-10
A	CN 108407839 A (CRRC QINGDAO SIFANG LOCOMOTIVE & ROLLING STOCK CO., LTD.) 17 August 2018 (2018-08-17) entire document	1-10
A	CN 107856693 A (CRRC CHANGCHUN RAILWAY VEHICLES CO., LTD.) 30 March 2018 (2018-03-30) entire document	1-10



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:	"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
"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
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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	

Date of the actual completion of the international search

10 December 2019

Date of mailing of the international search report

27 December 2019

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Facsimile No. (86-10)62019451

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

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2019/108096**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

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