



(11)

**EP 3 689 701 B1**

(12)

## EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention of the grant of the patent:

**08.03.2023 Bulletin 2023/10**

(21) Application number: **17926767.9**

(22) Date of filing: **25.12.2017**

(51) International Patent Classification (IPC):  
**B61C 9/44 (2006.01)**

(52) Cooperative Patent Classification (CPC):  
**B61C 9/44; B61F 5/28; B61F 5/52; B61F 17/30**

(86) International application number:  
**PCT/CN2017/118289**

(87) International publication number:  
**WO 2019/061895 (04.04.2019 Gazette 2019/14)**

(54) **BOGIE**

DREHGESTELL

BOGGIE

(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**

(30) Priority: **26.09.2017 CN 201710880269**

(43) Date of publication of application:  
**05.08.2020 Bulletin 2020/32**

(73) Proprietor: **CRRC Zhuzhou Locomotive Co., Ltd. Zhuzhou, Hunan 412001 (CN)**

(72) Inventors:

- **ZHANG, Chong**  
Zhuzhou  
Hunan 412001 (CN)
- **LI, Guanjun**  
Zhuzhou  
Hunan 412001 (CN)
- **ZOU, Wenhui**  
Zhuzhou  
Hunan 412001 (CN)
- **YAN, Zhijun**  
Zhuzhou  
Hunan 412001 (CN)
- **ZHU, He**  
Zhuzhou  
Hunan 412001 (CN)
- **WEI, Hongtu**  
Zhuzhou  
Hunan 412001 (CN)

- **YI, Xingli**  
Zhuzhou  
Hunan 412001 (CN)
- **CHEN, Qingming**  
Zhuzhou  
Hunan 412001 (CN)
- **CHEN, Guosheng**  
Zhuzhou  
Hunan 412001 (CN)
- **ZHANG, Youkong**  
Zhuzhou  
Hunan 412001 (CN)
- **HE, Ye**  
Zhuzhou  
Hunan 412001 (CN)
- **GAO, Bin**  
Zhuzhou  
Hunan 412001 (CN)
- **XIE, Jiahui**  
Zhuzhou  
Hunan 412001 (CN)
- **CHEN, Yuxiang**  
Zhuzhou  
Hunan 412001 (CN)
- **XIAO, Zehua**  
Zhuzhou  
Hunan 412001 (CN)
- **GUO, Qingsheng**  
Zhuzhou  
Hunan 412001 (CN)

Note: Within nine months of the publication of the mention of the grant of the European patent in the European Patent Bulletin, any person may give notice to the European Patent Office of opposition to that patent, in accordance with the Implementing Regulations. Notice of opposition shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

**EP 3 689 701 B1**

(74) Representative: **Kilburn & Strode LLP**  
**Lacon London**  
**84 Theobalds Road**  
**Holborn**  
**London WC1X 8NL (GB)**

(56) References cited:

|                          |                          |
|--------------------------|--------------------------|
| <b>EP-A1- 1 116 634</b>  | <b>WO-A1-2017/133954</b> |
| <b>CN-A- 101 823 492</b> | <b>CN-A- 101 973 277</b> |
| <b>CN-A- 103 010 226</b> | <b>CN-A- 103 640 587</b> |
| <b>CN-A- 104 228 866</b> | <b>CN-A- 104 608 787</b> |
| <b>CN-A- 106 274 919</b> | <b>CN-A- 106 476 841</b> |
| <b>CN-U- 201 882 093</b> | <b>CN-U- 201 901 134</b> |

## Description

### Field of the Invention

[0001] The present invention belongs to the field of rail traffic, and particularly relates to a bogie.

### Background of the Invention

[0002] At present, the running speed of a heavy-duty freight electric locomotive is generally below 120km/h, and its driving device (including a traction motor, a gear box and the like) is generally installed in an axle suspension manner. As shown in Fig. 1, one end of the traction motor 3 is rigidly fixed with an axle suspension box 300 via a hexagon bolt, and the axle suspension bearing box 300 is suspended on an axle 5 through two sets of axle suspension bearings; and the other end of the traction motor 3 is elastically suspended on a middle cross beam of a framework through a set of suspension rods. A driven gear 21 is assembled with a gear hub 400 by bolts, the gear hub 400 is installed on the axle 5 in an interference fit manner and drives a wheel pair to rotate together while moving, so as to drive the vehicle to advance. This manner results in a large load on the axle, which is acceptable for a low-speed freight electric locomotive, but for a high-speed freight electric locomotive, when the running speed reaches 120km/h or more, its transverse force is greatly increased, and if the driving device still adopts the axle suspension arrangement manner, the transverse stability of the locomotive cannot be effectively controlled during running.

[0003] The current rapid passenger electric locomotive uses a traction motor elastic frame suspension structure, as shown in Fig. 2. A hollow shaft of a six-link hollow shaft is sleeved on the axle 5, the six-link of the six-link hollow shaft is fixedly connected with the wheel pair, and a suspension cross beam is sleeved on an outer surface of the hollow shaft. In a longitudinal direction, one end of the suspension cross beam 8 is connected with the traction motor 3, and the traction motor 3 is suspended on a middle cross beam 11 of the framework 1 through a suspension rod 9. A gear box 2 is arranged on the same side of the suspension cross beam and the traction motor, an output shaft of the traction motor 3 is connected with a driving gear in the gear box 2, and one side of the gear box body is fixedly connected with a side face of the suspension cross beam 8 by bolts. A suspension point is arranged at the other end of the suspension cross beam 8, another suspension point is arranged at one end of the gear box body away from the traction motor 3, and the two suspension points are elastically suspended on a framework end beam 12 through the suspension rod.

[0004] The gear box 2 is installed on the gear hub 400 through a bearing and forms an integral unit with the traction motor 3.

[0005] It can be seen from the above structural description that the gear box bears a part of force. For the fast

heavy-duty electric locomotive, if the gear box adopts the above load bearing structure, the heavy load will increase the complexity of the structural stress of the gear box, resulting in easier damage to the gear box.

[0006] In addition, as the running speed of the locomotive is improved, the air pressure distribution in the gear box changes more uncertainly, and since an oil lubrication manner is adopted, the oil leakage risk of the gear box is greatly increased.

[0007] With respect to the definition of direction vocabularies mentioned in this case, in the field of railway vehicles, there are usually three directions recognized by technicians: Vertical direction: a direction vertical to a rail surface.

[0008] Longitudinal direction: a direction along a rail.

[0009] Transverse direction: a direction vertical to the rail in the horizontal plane.

[0010] CN 104608787 A discloses a broad gauge three axle combustion engine steering frame.

### Summary of the Invention

[0011] In view of the above problems, the present invention aims at providing a bogie that can ensure the transverse stability, avoid stress on a gear box, prevent the damage to the gear box, is reasonable in structural stress and is suitable for fast heavy-duty freight electric locomotives with running speeds higher than 120km/h.

[0012] The technical solution for solving the problems of the present invention is as follows: a bogie, including a frame, a gear box, a traction motor, a wheel pair, an axle, a six-link hollow shaft, and a suspension cross beam, the wheel pair and the axle are arranged at the bottom of the frame, a hollow shaft of the six-link hollow shaft is sleeved on the axle, the suspension cross beam includes a beam body, a through groove transversely provided in the beam body, and a bearing seat, which is transversely arranged at a groove opening of the through groove in an overhang manner and which is fixedly connected to the beam body, the groove opening is located at one end of the through groove;

one end, with the through groove, of the beam body is fixedly connected to one end of the traction motor in a longitudinal direction, so as to form a closed cavity after connection which is in sleeve connection with an outer surface of the hollow shaft; the other end of the traction motor is suspended on a middle cross beam of the frame; one other end, without the through groove, of the beam body is hooked with a frame end beam through two suspension rods, and rubber joints are arranged in the suspension rods; and

a driven gear of the gear box is in sleeve connection with the bearing seat via a bearing, and a driving gear of the gear box is connected with an output shaft of the traction motor. The above measures make it possible for high-speed running of the heavy-

duty freight electric locomotive, the traditional shaft suspension type structure is replaced by a six-link hollow shaft frame suspension type structure for mounting the driving device, which avoids excessive weight bearing of the axle, so that the transverse force during the high-speed running of the heavy-duty freight electric locomotive is reduced, and the transverse stability during running is ensured. At the same time, a new suspension cross beam structure is adopted, and the suspension position is changed, so that the gear box becomes a non-load structure, and the failure probability of the gear box is greatly reduced.

**[0013]** Further, in a transverse direction, a first six-link at one end of the six-link hollow shaft close to the gear box is connected with an end face of the driven gear through a first transmission pin, and a second six-link at the other end of the six-link hollow shaft is connected with the wheel pair through a second transmission pin.

**[0014]** The traditional transmission mode is shown in Fig. 2, one end of the six-link is connected with the gear hub of the driven gear via bolts, and the other end of the six-link is connected with the wheel pair to transmit force through the gear hub. While in the present solution, the driven gear is directly connected with the six-link through the transmission pin, so that the transmission of force is more direct, the middle part is reduced, the stress is better, and the failure rate is lower.

**[0015]** Further, one end, without the through groove, of the beam body is provided with a symmetrical pair of transverse backstop mounting seats, a transverse backstop is installed on each transverse backstop mounting seat, and the top of the transverse backstop is fixedly connected with the frame end beam.

**[0016]** Due to the structural change of the suspension cross beam, from the perspective of structural layout and stress angle, the layout of structural components on the corresponding bogies shall be adjusted accordingly.

**[0017]** Preferably, the gear box is lubricated with grease to avoid the problem of oil leakage of the driving device, and the sealing structure of the gear box can also be simplified. Preferably, the bearing seat is integrally formed with the beam body.

**[0018]** The significant effects of the present invention are as follows:

1. By means of elastic frame suspension of the driving device, the problem of transverse instability of the heavy-duty freight electric locomotive during high-speed traveling is solved.
2. The gear box uses a non-load structure so as to solve the problems of the gear box having a complicated structure and being subject to a relatively heavy load.
3. The gear box is lubricated with grease to solve the problem of oil leakage of the gear box and to ensure the safe running of the locomotive.

## Brief Description of the Drawings

**[0019]** The present invention is further described below in combination with the drawings.

Fig. 1 is a schematic diagram of shaft suspension type mounting of a driving device of a heavy-duty freight electric locomotive in the prior art.

Fig. 2 is a schematic diagram of elastic frame suspension type mounting of a driving device of a passenger locomotive in the prior art.

Fig. 3 is a bottom view of a local structure of a bogie of the present invention.

Fig. 4 is an A direction view in Fig. 3.

Fig. 5 is a local top view of the present invention after a framework is removed.

Fig. 6 is a structural diagram of a suspension cross beam.

**[0020]** In which: 1-framework, 2-gear box, 3-traction motor, 4-wheel pair, 5-axle, 6-hollow shaft, 7-first six-link, 71-second six-link, 8-suspension cross beam, 9-suspension rod, 10-first transmission pin, 101-second transmission pin, 11-middle cross beam, 12-framework end beam, 21-driven gear, 22-bearing, 81-beam body, 82-through groove, 83-bearing seat, 100-transverse backstop mounting seat, 200-transverse backstop, 300-axle suspension box, 400-gear hub.

## Detailed Description of the Embodiments

**[0021]** As shown in Fig. 3 to Fig. 6, a bogie, including a framework 1, a gear box 2, a traction motor 3, a wheel pair 4, an axle 5, a six-link hollow shaft, and a suspension cross beam 8, the wheel pair 4 and the axle 5 are arranged at the bottom of the framework 1. A hollow shaft 6 of the six-link hollow shaft is sleeved on the axle 5.

**[0022]** The suspension cross beam 8 includes a beam body 81, a through groove 82 transversely provided in the beam body 81, and a bearing seat 83, which is transversely arranged at a groove opening of the through groove 82 in an overhang manner and which is fixedly connected to the beam body 81, the groove opening is located at one end of the through groove 82. The bearing seat 83 and the beam body 81 are integrally formed.

**[0023]** One end, with the through groove 82, of the beam body 81 is fixedly connected to the traction motor 3 in a longitudinal direction, so as to form a closed cavity after connection which is in sleeve connection with an outer surface of the hollow shaft 6; the other end of the traction motor 3 is suspended on a middle cross beam 11 of the framework 1 through a motor suspension seat. One end, without the through groove, of the beam body 81 is hooked with a framework end beam 12 through two suspension rods 9. Rubber joints are arranged in the suspension rods 9.

**[0024]** By adopting a suspension manner of the suspension rods, it can be ensured that the transverse force

of the driving device is reasonably released, so as to improve the transverse stability during the running of the locomotive.

[0025] A driven gear 21 of the gear box 2 is in sleeve connection with the bearing seat 83 via a bearing 22, and a driving gear of the gear box 2 is connected with an output shaft of the traction motor 3.

[0026] In a transverse direction, a first six-link 7 at one end of the six-link hollow shaft close to the gear box 2 is connected with an end face of the driven gear 21 through a first transmission pin 10, and a second six-link 71 at the other end of the six-link hollow shaft is connected with the wheel pair 4 through a second transmission pin 101. The output shaft of the traction motor 3 drives the driving gear to rotate, the driving gear drives the driven gear 21 to drive the first six-link 7 on one side close to the gear box 2 to rotate through the first transmission pin 10, thereby driving the entire six-link hollow shaft to move, and the second six-link 71 fixed with the wheel pair drives the wheel pair to move.

[0027] One end, without the through groove 82, of the beam body 81 is provided with a symmetrical pair of transverse backstop mounting seats 100, a transverse backstop 200 is installed on each transverse backstop mounting seat 100, and the top of the transverse backstop 200 is fixedly connected with the framework end beam 12.

[0028] The gear box 2 is lubricated with grease.

## Claims

1. A bogie, comprising a frame (1), a gear box (2), a traction motor (3), a wheel pair (4), an axle (5), a six-link hollow shaft, and a suspension cross beam (8), the wheel pair (4) and the axle (5) are arranged at the bottom of the frame (1), a hollow shaft (6) of the six-link hollow shaft is sleeved on the axle (5), **characterised in that** the suspension cross beam (8) comprises a beam body (81), a through groove (82) transversely provided in the beam body (81), and a bearing seat (83), which is transversely arranged at a groove opening of the through groove (82) in an overhang manner and which is fixedly connected to the beam body (81), the groove opening is located at one end of the through groove (82);

one end, with the through groove (82), of the beam body (81) is fixedly connected to one end of the traction motor (3) in a longitudinal direction, so as to form a closed cavity after connection which is in sleeve connection with an outer surface of the hollow shaft (6); the other end of the traction motor (3) is suspended on a middle cross beam (11) of the frame (1); one other end, without the through groove (82), of the beam body (81) is hooked with a frame end beam (12) through two suspension rods (9), and rubber

joints are arranged in the suspension rods (9); and

a driven gear (21) of the gearbox (2) is in sleeve connection with the bearing seat (83) via a bearing (22), and a driving gear of the gear box (2) is connected with an output shaft of the traction motor (3).

2. The bogie according to claim 1, wherein in a transverse direction, a first six-link (7) at one end of the six-link hollow shaft close to the gear box (2) is connected with an end face of the driven gear (21) through a first transmission pin (10), and a second six-link (71) at the other end of the six-link hollow shaft is connected with the wheel pair (4) through a second transmission pin (101)
3. The bogie according to claim 1 or 2, wherein one end, without the through groove (82), of the beam body (81) is provided with a symmetrical pair of transverse backstop mounting seats (100), a transverse backstop (200) is installed on each transverse backstop mounting seat (100), and the top of the transverse backstop (200) is fixedly connected with the frame end beam (12).
4. The bogie according to claim 1, wherein the gear box (2) is lubricated with grease.
5. The bogie according to claim 1, wherein the bearing seat (83) is integrally formed with the beam body (81).

## Patentansprüche

1. Drehgestell, umfassend einen Rahmen (1), ein Getriebe (2), einen Antriebsmotor (3), ein Radpaar (4), eine Achse (5), eine Sechsenker-Hohlwelle und einen Aufhängungsquerträger (8), wobei das Radpaar (4) und die Achse (5) am Boden des Rahmens (1) angeordnet sind und eine Hohlwelle (6) der Sechsenker-Hohlwelle auf die Achse (5) aufgeschoben ist, **dadurch gekennzeichnet, dass** der Aufhängungsquerträger (8) einen Trägerkörper (81), eine quer in dem Trägerkörper (81) vorgesehene Durchgangsnut (82) und einen Lagersitz (83) umfasst, der quer überhängend an einer Nutöffnung der Durchgangsnut (82) angeordnet und fest mit dem Trägerkörper (81) verbunden ist, wobei die Nutöffnung an einem Ende der Durchgangsnut (82) angeordnet ist,

ein Ende des Trägerkörpers (81) mit der Durchgangsnut (82) fest mit einem Ende des Antriebsmotors (3) in einer Längsrichtung verbunden ist, um nach Verbindung mit einer Außenfläche der Hohlwelle (6), wobei es sich um eine aufgeschobene Verbindung handelt, einen geschlossenen

Hohlraum zu bilden,  
das andere Ende des Antriebsmotors (3) an einem mittleren Querträger (11) des Rahmens (1) aufgehängt ist,  
ein anderes Ende des Trägerkörpers (81) ohne die Durchgangsnut (82) durch zwei Hängestangen (9) mit einem Rahmenendträger (12) verhakt ist und Gummigelenke in den Hängestangen (9) angeordnet sind, und  
ein Abtriebsrad (21) des Getriebes (2) über ein Lager (22) in aufgeschobener Verbindung mit dem Lagersitz (83) steht und ein Abtriebsrad des Getriebes (2) mit einer Abtriebswelle des Antriebsmotors (3) verbunden ist.

2. Drehgestell nach Anspruch 1, wobei in einer Querrichtung ein erster Sechsenker (7) an einem Ende der Sechsenker-Hohlwelle in der Nähe des Getriebes (2) durch einen ersten Übertragungsstift (10) mit einer Endfläche des Abtriebsrads (21) verbunden ist und ein zweiter Sechsenker (71) an dem anderen Ende der Sechsenker-Hohlwelle durch einen zweiten Übertragungsstift (101) mit dem Radpaar (4) verbunden ist.
3. Drehgestell nach Anspruch 1 oder 2, wobei ein Ende des Trägerkörpers (81) ohne die Durchgangsnut (82) mit einem symmetrischen Paar Quergesperre-Montagesitze (100) versehen ist, ein Quergesperre (200) an jedem Quergesperre-Montagesitz (100) installiert ist und die Oberseite des Quergesperres (200) fest mit dem Rahmenendträger (12) verbunden ist.
4. Drehgestell nach Anspruch 1, wobei das Getriebe (2) mit Schmierfett geschmiert ist.
5. Drehgestell nach Anspruch 1, wobei der Lagersitz (83) integral mit dem Trägerkörper (81) ausgebildet ist.

## Revendications

1. Bogie, comprenant un châssis (1), une boîte de vitesses (2), un moteur de traction (3), une paire de roues (4), un essieu (5), un arbre creux à mécanismes de liaison à six composants et une traverse de suspension (8), la paire de roues (4) et l'essieu (5) étant placés au niveau de la partie inférieure du châssis (1), un arbre creux (6) de l'arbre creux à mécanismes de liaison à six composants étant manchonné sur l'essieu (5), **caractérisé en ce que** la traverse de suspension (8) comprend un corps de traverse (81), une rainure traversante (82) formée de manière transversale dans le corps de traverse (81) et un siège de palier (83), qui est placé transversalement au niveau d'une ouverture de rainure de la rainure

traversante (82) en porte-à-faux et qui est raccordé de manière fixe au corps de traverse (81), l'ouverture de rainure étant située à une extrémité de la rainure traversante (82) ;

une extrémité, comportant la rainure traversante (82), du corps de traverse (81) est raccordée de manière fixe à une extrémité du moteur de traction (3) dans une direction longitudinale, de façon à former, après le raccordement, une cavité fermée qui est manchonnée sur une surface extérieure de l'arbre creux (6) ; l'autre extrémité du moteur de traction (3) est suspendue sur une traverse intermédiaire (11) du châssis (1) ; une autre extrémité, ne comportant pas la rainure traversante (82), du corps de traverse (81) est accrochée à une poutre d'extrémité de châssis (12) par le biais de tiges de suspension (9), et des joints en caoutchouc sont placés dans les tiges de suspension (9) ; et  
une roue d'engrenage menée (21) de la boîte de vitesses (2) est manchonnée sur le siège de palier (83) par le biais d'un palier (22) et une roue d'engrenage menante de la boîte de vitesses (2) est raccordée à un arbre de sortie du moteur de traction (3).

2. Bogie selon la revendication 1, dans lequel, dans une direction transversale, un premier mécanisme de liaison à six composants (7) à une extrémité de l'arbre creux à mécanismes de liaison à six composants proche de la boîte de vitesses (2) est raccordé à une face d'extrémité de la roue d'engrenage menée (21) par le biais d'une première broche de transmission (10), et un second mécanisme de liaison à six composants (71) à l'autre extrémité de l'arbre creux à mécanismes de liaison à six composants est raccordé à la paire de roues (4) par le biais d'une seconde broche de transmission (101) .
3. Bogie selon la revendication 1 ou 2, dans lequel une extrémité, ne comportant pas la rainure traversante (82), du corps de traverse (81) est pourvue d'une paire symétrique de sièges de fixation de butées arrière transversales (100), une butée arrière transversale (200) est installée sur chaque siège de fixation de butée arrière transversale (100) et la partie supérieure de la butée arrière transversale (200) est raccordée de manière fixe à la poutre d'extrémité de châssis (12).
4. Bogie selon la revendication 1, dans lequel la boîte de vitesses (2) est lubrifiée avec de la graisse.
5. Bogie selon la revendication 1, dans lequel le siège de palier (83) est réalisé d'un seul tenant avec le corps de traverse (81).

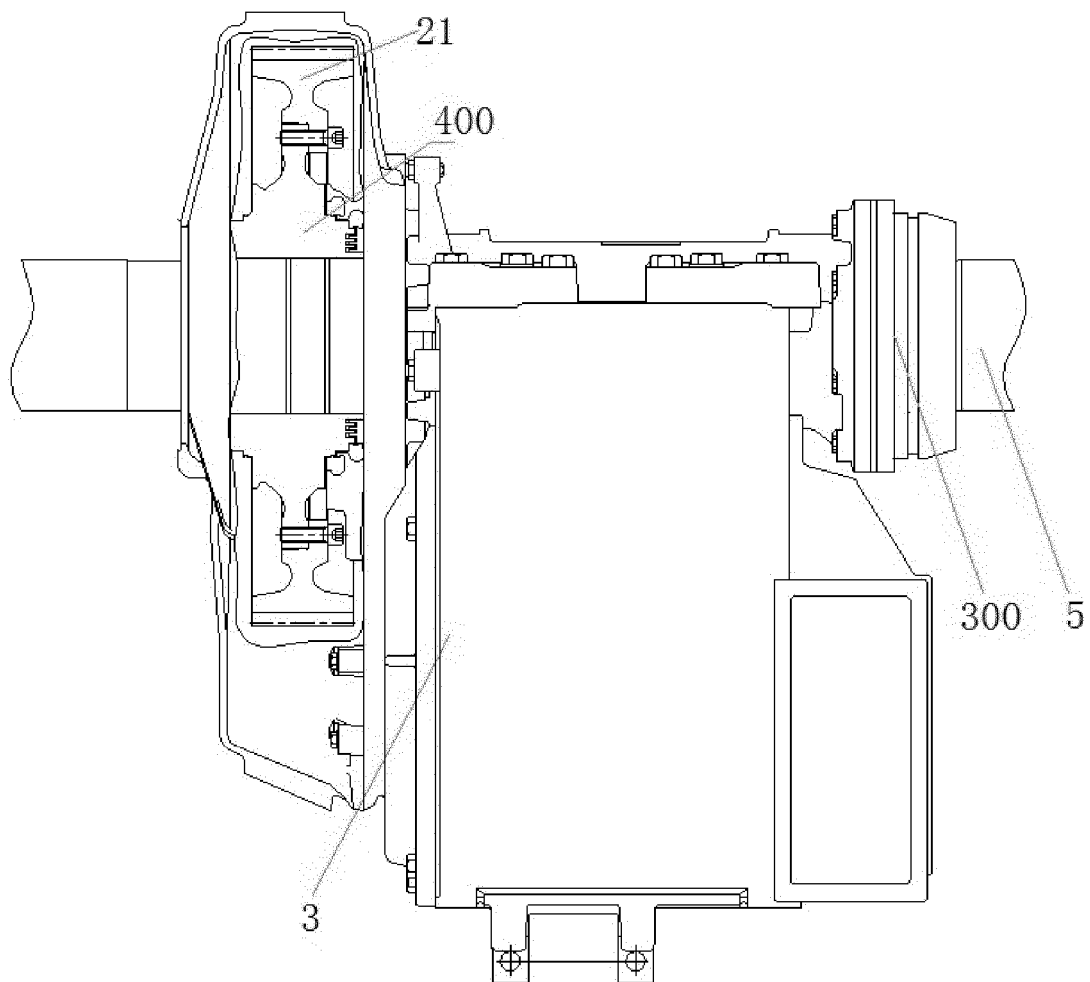


Fig. 1

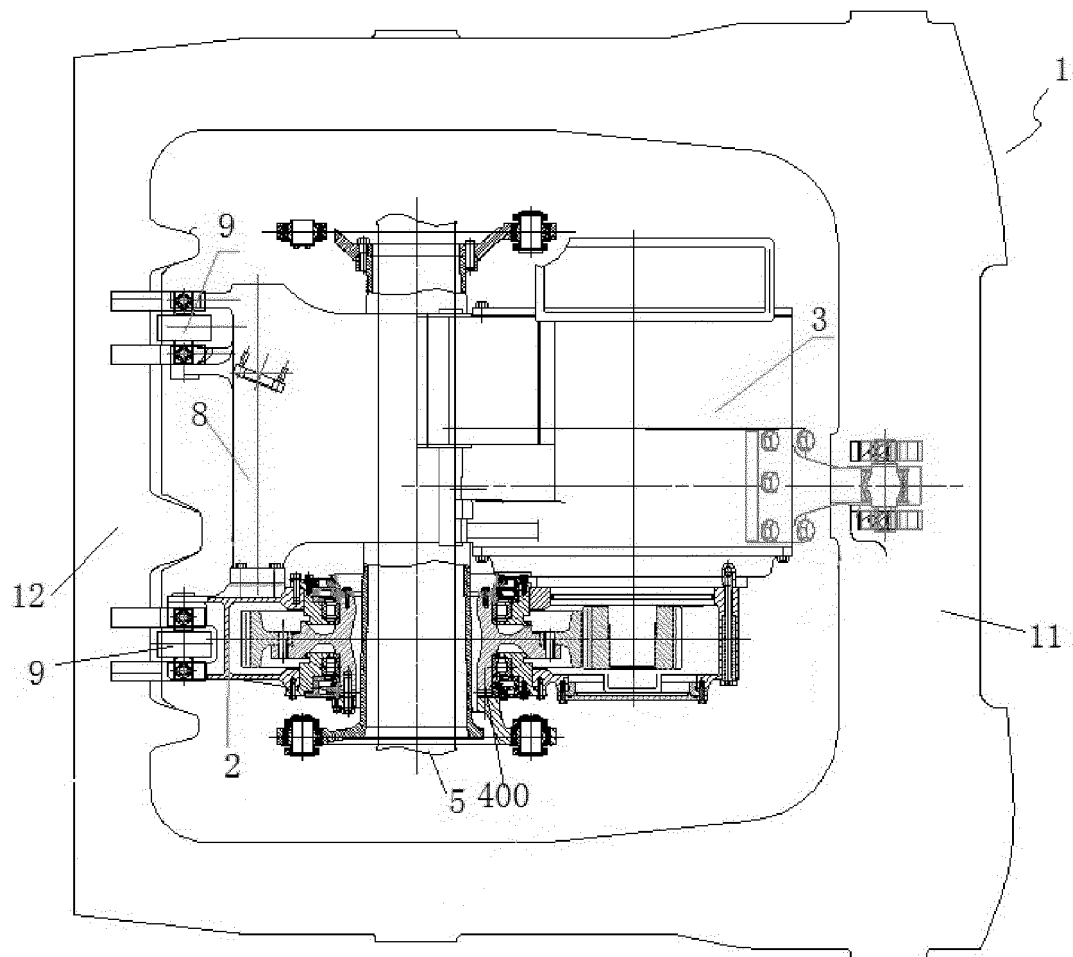


Fig. 2

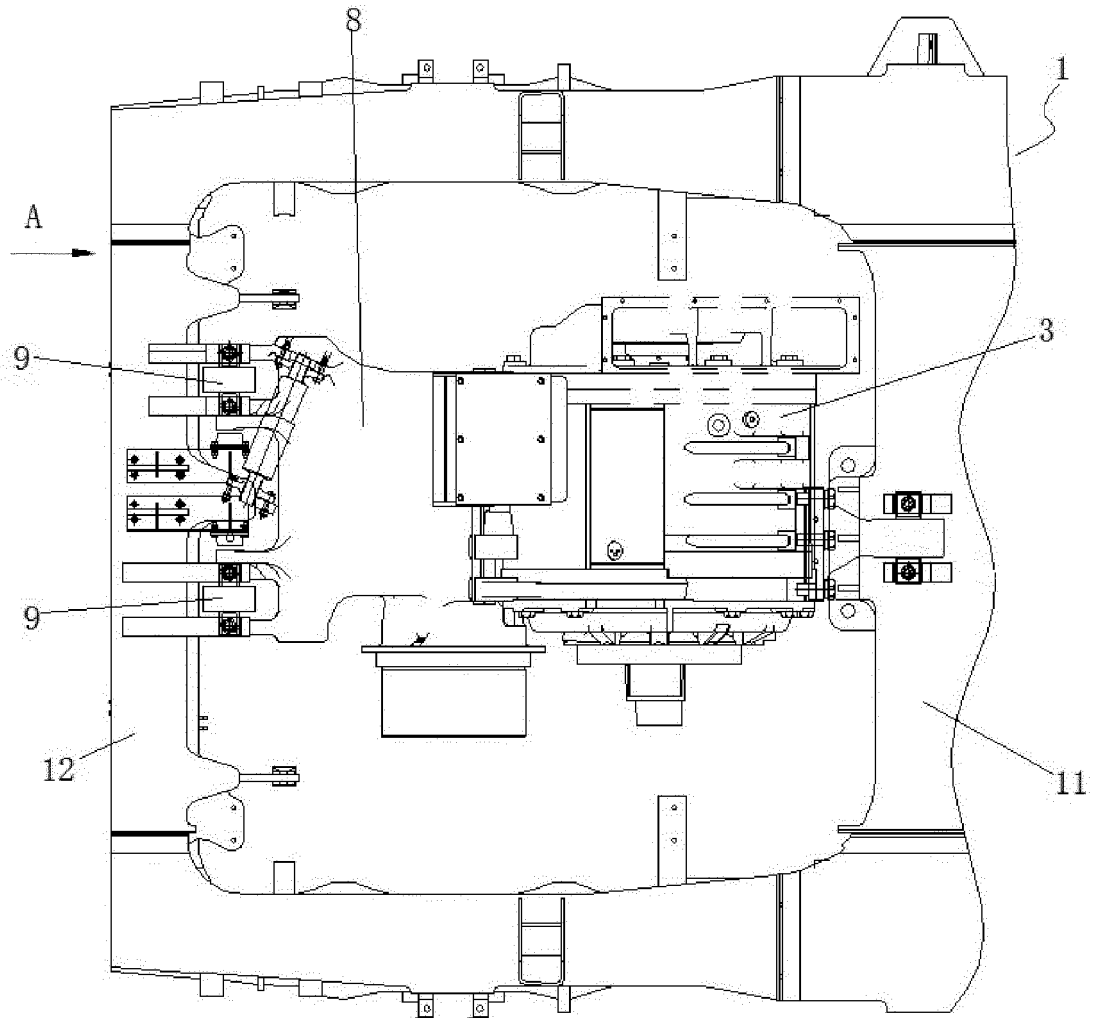


Fig. 3

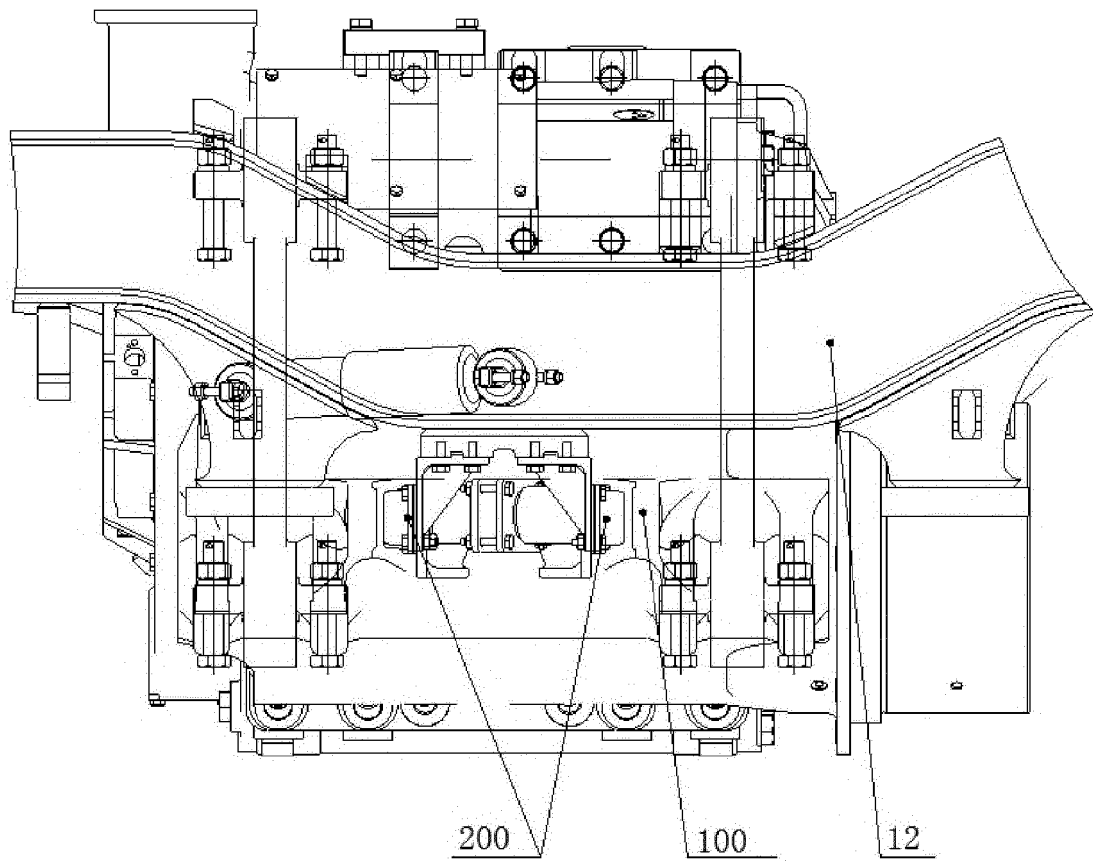


Fig. 4

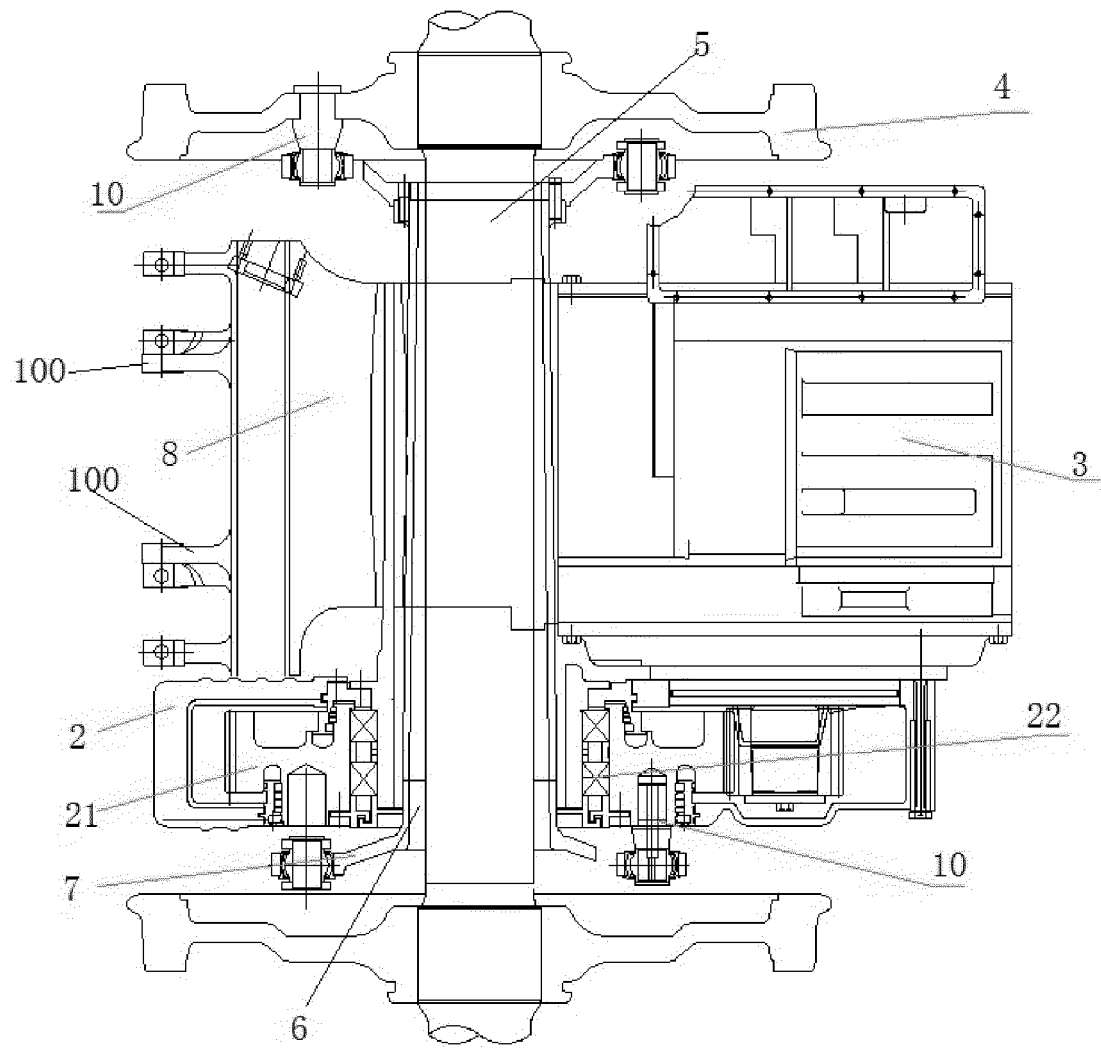


Fig. 5

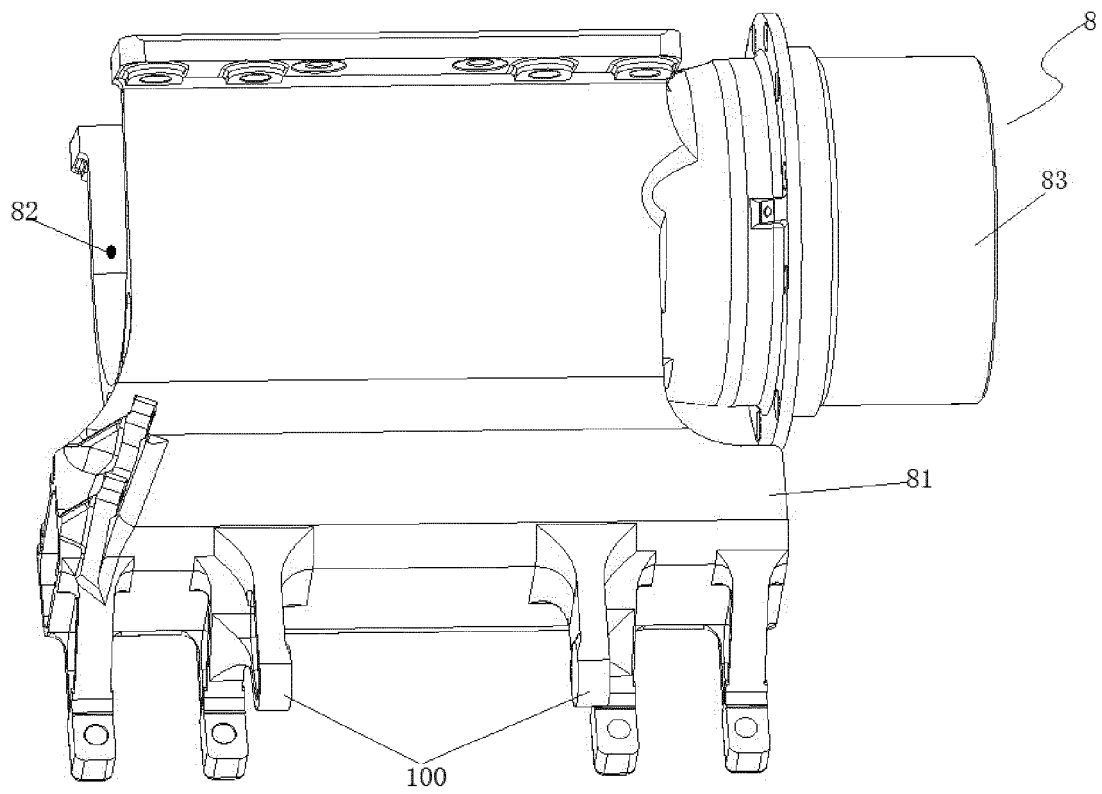


Fig. 6

**REFERENCES CITED IN THE DESCRIPTION**

*This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.*

**Patent documents cited in the description**

- CN 104608787 A [0010]