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

(11) **EP 4 335 804 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
09.07.2025 Bulletin 2025/28

(21) Application number: **23195014.8**

(22) Date of filing: **04.09.2023**

(51) International Patent Classification (IPC):
B66B 23/02 *(2006.01)*

(52) Cooperative Patent Classification (CPC):
B66B 23/02

(54) A DRIVING DEVICE FOR AN ESCALATOR

ANTRIEBSVORRICHTUNG FÜR EINE FAHRTREPPE

DISPOSITIF D'ENTRAÎNEMENT POUR UN ESCALIER ROULANT

(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 ME MK MT NL NO PL PT RO RS SE SI SK SM TR

(30) Priority: **09.09.2022 CN 202211101033**

(43) Date of publication of application:
13.03.2024 Bulletin 2024/11

(73) Proprietor: **KONE Corporation**
00330 Helsinki (FI)

(72) Inventors:
- **LV, Ke**
  Kunshan, Jiangsu, 215300 (CN)
- **GAO, Xiang**
  Kunshan, Jiangsu, 215300 (CN)
- **YU, Bo**
  Kunshan, Jiangsu, 215300 (CN)
- **YIN, FuZhen**
  Kunshan, Jiangsu, 215300 (CN)
- **LI, Feng**
  Kunshan, Jiangsu, 215300 (CN)

(74) Representative: **Kolster Oy Ab**
Salmisaarenaukio 1
P.O. Box 204
00181 Helsinki (FI)

(56) References cited:
GB-A- 1 445 555
JP-A- 2000 177 964
JP-B2- 4 473 359

EP 4 335 804 B1

Description

TECHNICAL FIELD

[0001] The present disclosure relates to a driving device, in particular to a driving device for escalator. This driving device is used to drive the step assembly and handrail belt assembly of the escalator.

BACKGROUND TECHNOLOGY

[0002] At present, the maximum lifting height that the existing escalator drive device can meet is only 28 meters or less, which can no longer meet market demand. In order to further increase the lifting height (such as increasing to 40 meters or higher), the number and/or power of the driving motors can only be increased.

[0003] However, increasing the power of the driving motor results in a significant increase in the size of the driving motor, which makes the original space used to accommodate the original driving motor unable to meet this requirement, and increasing the original space is not feasible in reality. Increasing the number of driving motors will also bring the problem that the original motor accommodation space cannot meet the requirements.

[0004] In order to further increase the lifting height, there is also a technical problem of the original structure of the driving spindle in the driving device being unable to adapt.

[0005] JP 2000177964 A discloses a passenger conveyor with two motors attached to a reduction gear. JP 4473359 B2 discloses a drive part of an escalator.

[0006] GB 1445555 A discloses driving means for escalators.

SUMMARY OF THE INVENTION

[0007] In order to solve one or more defects in the prior art, according to one aspect of the present invention, a driving device for escalator is provided, and comprising a first driving motor, a second driving motor, a third driving motor, a fourth driving motor, a driving spindle and a handrail belt spindle, wherein the first driving motor and the second driving motor are connected with a first gear box, and the third driving motor and the fourth driving motor are connected with a second gear box, the driving torque of the first driving motor and the second driving motor is transmitted to the driving spindle through the first gear box, and the driving torque of the third driving motor and the fourth driving motor are transmitted to the driving spindle through the second gear box, wherein the driving device further comprises at least one fifth driving motor and at least one sixth driving motor.

[0008] The fifth driving motor and the sixth driving motor are connected with at least one third gear box.

[0009] The driving torque of the fifth driving motor and the sixth driving motor is transmitted to the driving spindle and the handrail belt spindle through the third gear box.

[0010] According to the above aspects of the present invention, the fifth driving motor is arranged between the driving spindle and the handrail belt spindle.

[0011] The handrail belt spindle is arranged between the fifth driving motor and the sixth driving motor.

[0012] The third gear box is disposed between the first gear box and the second gear box and is disposed closer to the first gear box than the second gear box.

[0013] According to the above aspects of the present invention, in a direction parallel to an axis of the handrail belt spindle, the fifth driving motor and the sixth driving motor are both located between the handrail belt assemblies arranged on two axial ends of the handrail belt spindle.

[0014] According to the above aspects of the present invention, the third gear box comprises an output gear, a first input gear, a handrail belt spindle gear and a second input gear which are arranged in a housing of the third gear box.

[0015] The fifth driving motor drives the first input gear.

[0016] The sixth driving motor drives the second input gear.

[0017] The first input gear is matched with the output gear and the handrail belt spindle gear at the same time.

[0018] The second input gear is matched with the handrail belt spindle gear.

[0019] The driving torque of the fifth driving motor is transmitted to the driving spindle through the input gear and to the handrail belt spindle through the handrail belt spindle gear.

[0020] The driving torque of the sixth driving motor is transmitted to the handrail belt spindle through the handrail belt spindle gear.

[0021] According to the above aspects of the present invention, a spline structure is arranged on the outer circumferential surface of a part of handrail belt spindle.

[0022] The handrail belt spindle gear is provided with a handrail gear through hole, and a spline structure is arranged on the inner circumferential surface of the handrail gear through hole.

[0023] The handrail belt spindle is fitted in the handrail gear through hole, and the spline structure on the inner circumferential surface of the handrail gear through hole is fitted with the spline structure on the outer circumferential surface of the part of the handrail belt spindle.

[0024] According to the above aspects of the present invention, the handrail belt assembly are arranged on two axial ends of the handrail belt spindle.

[0025] The rotation of the handrail belt spindle drives the handrail belt assembly to move.

[0026] According to the above aspects of the present invention, the handrail belt spindle is also provided with a third sealing piece and a fourth sealing piece.

[0027] The third sealing piece and the fourth sealing piece are respectively and fixedly connected to two sides of the housing of the third gear box through fasteners.

[0028] According to the above aspects of the present invention, a spline structure is arranged on the outer

circumferential surface of the first axial end of the driving spindle.

[0029] The output gear of the first gear box is provided with an output gear through hole, and the inner circumferential surface of the output gear through hole is provided with a spline structure.

[0030] The first axial end of the driving spindle is fitted in the output gear through hole of the output gear of the first gearbox, and the spline structure of the first axial end of the driving spindle is fitted with the spline structure of the output gear through hole.

[0031] According to the above aspects of the present invention, a first axial protrusion extending outward from the first axial end of the driving spindle.

[0032] A first axial end cap is fixedly fitted on the first axial protrusion through a fastener and abuts against the output gear of the first gear box.

[0033] According to the above aspects of the present disclosure, a first annular recess is arranged on the driving spindle adjacent to the first axial end of the driving spindle.

[0034] A first cylindrical section is arranged on the driving spindle adjacent to the first annular recess of the driving spindle.

[0035] A first ferrule is arranged on the outer circumferential surface of the first cylindrical section, and the first ferrule is located between an extended part of the output gear of the first gearbox and the outer circumferential surface of the first cylindrical section.

[0036] A first double-row roller bearing is arranged on the first cylindrical section.

[0037] A first spacer is arranged between an inner ring of the first double-row roller bearing and the extended part of the output gear of the first gear box.

[0038] The extended part of the output gear of the first gear box abuts against the inner ring of the first double-row roller bearing through the first spacer.

[0039] According to the above aspects of the present invention, a second cylindrical section is arranged on the driving spindle adjacent to the first cylindrical section of the driving spindle.

[0040] A first step sprocket assembly is fitted on the second cylindrical section.

[0041] The first step sprocket assembly comprises a step flange and a step sprocket, wherein the step sprocket is connected to the step flange through a fastener and is matched with the steps of the escalator.

[0042] The step flange is provided with a step flange through hole.

[0043] The step flange is matched with the spline structure arranged on the outer circumferential surface of the second cylindrical section through the spline structure arranged on the inner circumferential surface of the step flange through hole.

[0044] According to the above aspects of the present invention, a second ferrule is arranged on the outer circumferential surface of the first cylindrical section, and the second ferrule is located between the step flange and the outer circumferential surface of the first cylindrical section.

[0045] A second spacer is arranged between the inner ring of the first double-row roller bearing and the step flange.

[0046] The inner ring of the first double-row roller bearing abuts against the step flange through the second spacer.

[0047] According to the above aspects of the present invention, a third cylindrical section is arranged on the driving spindle adjacent to the second cylindrical section of the driving spindle.

[0048] A ring-shaped third spacer is arranged on the outer circumferential surface of the third cylindrical section.

[0049] Two single-row rolling bearings are respectively arranged on the outer circumferential surfaces of the two axial ends of the third spacer.

[0050] A first steering plate mounting part is arranged on the outer rings of the two single-row rolling bearings.

[0051] A first steering plate is installed on the first steering plate mounting part through convex-concave fit, and one of the step runner of the escalator is rolling fitted on the first steering plate.

[0052] The stepped flange abuts against the inner ring of one of the single-row rolling bearings and abuts against the third spacer.

[0053] A first stopper is connected to the first steering plate mounting part through a fastener and extends to the rolling body of another single-row rolling bearing along the radial direction of the third cylindrical section, thereby blocking the outer ring of the other single-row rolling bearing in the axial direction.

[0054] A first mounting part boss is arranged on the first steering plate mounting part.

[0055] A spacer boss facing the first mounting part boss is arranged on the third spacer.

[0056] The outer rings of the two single-row rolling bearings respectively abut against the two axial ends of the first mounting part boss.

[0057] The inner rings of the two single-row rolling bearings respectively abut against the two axial ends of the spacer boss.

[0058] According to the above aspects of the present invention, a fourth cylindrical section and a fifth cylindrical section are sequentially arranged on the driving spindle adjacent to the third cylindrical section of the driving spindle.

[0059] A fourth spacer in the shape of a ring is arranged on an outer circumferential surface of the fourth cylindrical section.

[0060] A first axial end of the fourth spacer is fitted on the third cylindrical section.

[0061] A second axial end of the fourth spacer is fitted on the fifth cylindrical section.

[0062] According to the above aspects of the present invention, the inner ring of the other single-row rolling bearing and the third spacer abut against the first axial

end of the fourth spacer.

[0063] The output gear of the third gear box abuts against a step portion provided on the second axial end of the fourth spacer.

[0064] A first closing part is also arranged on the outer surface of the fourth spacer.

[0065] The first closing member is fixedly connected to the first side of the housing of the third gear box by fastener.

[0066] According to the above aspects of the present invention, a sixth cylindrical section is arranged on the driving spindle adjacent to the fifth cylindrical section of the driving spindle.

[0067] A spline structure is arranged on the outer circumferential surface of the sixth cylindrical section.

[0068] The output gear of the third gearbox is provided with an output gear through hole, and the inner circumferential surface of the output gear through hole of the output gear of the third gearbox is provided with a spline structure.

[0069] The sixth cylindrical section of the driving spindle is splined in the output gear through hole of the output gear of the third gearbox.

[0070] According to the above aspects of the present invention, a second annular recess is arranged on the driving spindle adjacent to the sixth cylindrical section of the driving spindle.

[0071] A seventh cylindrical section and an eighth cylindrical section are sequentially arranged on the driving spindle adjacent to the second annular recess of the driving spindle.

[0072] The output gear of the third gear box is fitted on the seventh cylindrical section and abuts against a step portion formed between the seventh cylindrical section and the eighth cylindrical section.

[0073] A second closing part is also arranged on the outer surface of the eighth cylindrical section.

[0074] The second closing member is fixedly connected to the second side of the housing of the third gear box by fastener.

[0075] According to the above aspects of the present invention, a spline structure is arranged on the outer circumferential surface of the second axial end of the driving spindle.

[0076] The output gear of the second gearbox is provided with an output gear through hole, and the inner circumferential surface of the output gear through hole is provided with a spline structure.

[0077] The second axial end of the driving spindle is fitted in the output gear through hole of the output gear of the second gearbox, and the spline structure of the second axial end of the driving spindle is fitted with the spline structure of the output gear through hole.

[0078] According to the above aspects of the present invention, a second axial protrusion extending outward from the second axial end of the driving spindle.

[0079] A second axial end cap is fixedly fitted on the second axial protrusion through a fastener and abuts against the output gear of the second gearbox.

[0080] According to the above aspects of the present invention, a third annular recess is arranged on the driving spindle adjacent to the second axial end of the driving spindle.

[0081] A ninth cylindrical section is arranged on the driving spindle adjacent to the third annular recess of the driving spindle.

[0082] A third collar is arranged on the outer circumferential surface of the ninth cylindrical section, and the third collar is located between an extended part of the output gear of the second gearbox and the outer circumferential surface of the ninth cylindrical section.

[0083] A second double-row roller bearing is arranged on the ninth cylindrical section.

[0084] A fifth spacer is arranged between the inner ring of the second double-row roller bearing and the extended part of the output gear of the second gearbox.

[0085] The extended part of the output gear of the second gear box abuts against the inner ring of the second double-row roller bearing through the fifth spacer.

[0086] According to the above aspects of the present invention, a tenth cylindrical section is arranged on the driving spindle adjacent to the ninth cylindrical section of the driving spindle.

[0087] A second step sprocket assembly is fitted on the tenth cylindrical section.

[0088] The second step sprocket assembly comprises a step flange and a step sprocket, wherein the step sprocket is connected to the step flange through a fastener and is matched with the steps of the escalator.

[0089] The step flange is provided with a step flange through hole.

[0090] The step flange is matched with the spline structure arranged on the outer circumferential surface of the tenth cylindrical section through the spline structure arranged on the inner circumferential surface of the step flange through hole.

[0091] According to the above aspects of the present invention, a fourth collar is also arranged on the outer circumferential surface of the ninth cylindrical section, and the fourth collar is located between the step flange and the outer circumferential surface of the ninth cylindrical section.

[0092] A sixth spacer is arranged between the inner ring of the second double-row roller bearing and the step flange of the second step sprocket assembly.

[0093] The inner ring of the second double-row roller bearing abuts against the step flange of the second step sprocket assembly through the sixth spacer.

[0094] According to the above aspects of the present invention, an eleventh cylindrical section is arranged on the driving spindle adjacent to the tenth cylindrical section of the driving spindle.

[0095] An annular seventh spacer is arranged on the outer circumferential surface of the eleventh cylindrical section.

[0096] Two single-row rolling bearings are respectively

arranged on the outer circumferential surfaces of the two axial ends of the seventh spacer.

[0097] A second steering plate mounting part is arranged on the outer rings of the two single-row rolling bearings.

[0098] A second steering plate is installed on the second steering plate mounting part through convex-concave fit, and another step runner of the escalator steps is rolled and matched on the second steering plate.

[0099] The stepped flange abuts against the inner ring of one of the single-row rolling bearings and abuts against the seventh spacer.

[0100] A second stopper is connected to the second steering plate mounting part through a fastener and extends to the rolling body of another single-row rolling bearing along the radial direction of the eleventh cylindrical section, thereby blocking the outer ring of the other single-row rolling bearing in the axial direction.

[0101] A second mounting part boss is arranged on the second steering plate mounting part.

[0102] A spacer boss facing the second mounting part boss is arranged on the seventh spacer.

[0103] The outer rings of the two single-row rolling bearings respectively abut against the two axial ends of the second mounting part boss.

[0104] The inner rings of the two single-row rolling bearings respectively abut against the two axial ends of the spacer boss.

[0105] According to the above aspects of the present invention, the seventh spacer abuts against a step portion formed between the eleventh cylindrical section of the driving spindle and the eighth cylindrical section of the driving spindle.

[0106] According to the above aspects of the present invention, the first driving motor and the second driving motor are connected with the first gear box through a gear transmission mechanism.

[0107] The third driving motor and the fourth driving motor are connected with the second gear box through a gear transmission mechanism.

[0108] The fifth driving motor and the sixth driving motor are connected with said at least one third gear box through a gear transmission mechanism.

[0109] According to the technical scheme of the present invention, the fifth and sixth driving motors are added to the driving device of the escalator, so that the total lifting power of the driving device is improved, and the requirement of increasing the lifting height can be met.

[0110] The size of each original driving motor remains unchanged, and there is no need to transform the original space for accommodating the original driving motors.

[0111] The added fifth driving motor is arranged between the driving spindle and the handrail belt spindle, thus making full use of the original unused space between the driving spindle and the handrail belt spindle.

[0112] The handrail belt spindle is arranged between and driven by the fifth and sixth driving motors, thereby increasing the driving torque that can be applied to the handrail belt spindle.

[0113] So far, in order that the detailed description of the disclosure herein can be better understood and the contribution of the disclosure to the prior art can be better realized, the disclosure has outlined the contents of the disclosure quite broadly. Of course, embodiments of the present disclosure will be described below and will form the subject of the appended claims.

[0114] Likewise, those skilled in the art will recognize that the concept on which this disclosure is based can be easily used as a basis for designing other structures, methods and systems for carrying out the several purposes of this disclosure.

BRIEF DESCRIPTION OF DRAWINGS

[0115] Those skilled in the art will have a better understanding of this disclosure through the following drawings, and the advantages of this disclosure can be more clearly reflected. The drawings described here are only for illustrative purposes of selected embodiments, not all possible implementations, and are not intended to limit the scope of the present disclosure.

Fig. 1 shows a schematic perspective view of a driving device of an escalator according to the present disclosure;

Fig. 2 shows an overall schematic plan view of a driving device of an escalator according to the present disclosure, in which a part of components are shown in cross section;

Fig. 3 shows a schematic diagram of the integral assembly of the driving spindle and the first, second and third gear boxes of the driving device according to the present disclosure;

Figs. 4 to 8 show main parts of a driving spindle of a driving device according to the present disclosure;

Fig. 9 shows an overall schematic view of the handrail belt spindle of the driving device according to the present disclosure;

Figs. 10 to 11 show schematic assembly diagrams of the handrail belt spindle, the fifth driving motor, the sixth driving motor and the third gear box of the driving device according to the present disclosure.

Specific Embodiments

[0116] The following is a detailed explanation of the specific implementation according to the disclosed content, combined with various drawings.

[0117] Figure 1 shows a three-dimensional schematic diagram of a driving device for an escalator according to an embodiment of the present disclosure, wherein the driving device comprises a first driving motor 1, a second driving motor 2, a third driving motor 3, a fourth driving motor 4, a driving spindle 7, and a handrail belt spindle 8. The first driving motor 1 and the second driving motor 2 are connected to a first gearbox 10 through their respec-

tive planetary gear trains (not shown). The third driving motor and the fourth driving motor are connected to a second gearbox 11 through their respective planetary gear trains.

[0118] Technicians in this field can understand that each planetary gear train can also be set in corresponding gearboxes.

[0119] The driving torques of the first and second driving motors 1 and 2 are transmitted to the driving spindle 7 through the first gear box 10, and the driving torques of the third and fourth driving motors 3 and 4 are transmitted to the driving spindle 7 through the second gear box 11.

[0120] The first gear box 10 and the second gear box 11 each include a respective input gear, an intermediate transmission gear (not shown) and an output gear. The first driving motor 1 and the second driving motor 2 are engaged with the corresponding input gears of the first gear box 10 and the second gear box through their respective planetary gear trains, and the driving torque is transmitted to the corresponding output gears through the corresponding intermediate transmission gears, and then to the driving spindle 7.

[0121] As shown in figs. 1 and 2, the driving device further includes a fifth driving motor 5 and a sixth driving motor 6.

[0122] The fifth driving motor 5 and the sixth driving motor 6 are connected with the third gear box 12 through respective planetary gear trains.

[0123] The driving torques of the fifth driving motor 5 and the sixth driving motor 6 are transmitted to the driving spindle 7 and the handrail belt spindle 8 through the third gear box 12.

[0124] The fifth driving motor 5 is arranged between the driving spindle 7 and the handrail belt spindle 8.

[0125] The handrail belt spindle 8 is arranged between the fifth driving motor 5 and the sixth driving motor 6.

[0126] The third gear box 12 is disposed between the first gear box 10 and the second gear box 11 and is disposed closer to the first gear box 10 than the second gear box 11.

[0127] The driving spindle 7 and the handrail spindle 8 are arranged in parallel with each other.

[0128] According to the above embodiment of the present disclosure, in the direction parallel to the axis of the handrail belt spindle 8, the fifth driving motor 5 and the sixth driving motor 6 are both located between the handrail belt assemblies 9 provided at both axial ends of the handrail belt spindle 8.

[0129] Fig. 1 also shows six braking devices acting on the first to sixth driving motors respectively.

[0130] According to the above embodiments of the present disclosure, as shown in figs. 3 and 4, a spline structure is provided on the outer circumferential surface of a first axial end 7-1 of the driving spindle 7.

[0131] The output gear 10-1 of the first gear box 10 has an output gear through hole 10-2, and a spline structure is provided on the inner circumferential surface of the output gear through hole 10-2.

[0132] The first axial end 7-1 of the driving spindle 7 is fitted into the output gear through hole 10-2 of the output gear 10-1 of the first gear box 10, and the spline structure of the first axial end 7-1 of the driving spindle 7 is fitted with the spline structure of the output gear through hole 10-2.

[0133] According to the above-mentioned embodiments of the present disclosure, as shown in fig. 4, a first axial protrusion 7-2 extends outward from the first axial end 7-1 of the driving spindle 7.

[0134] A first axial end cap 7-3 is fixedly fitted on the first axial protrusion 7-2 by fasteners and abuts against the output gear 10-1 of the first gear box 10.

[0135] According to the above embodiments of the present disclosure, as shown in fig. 4, a first annular recess 7-4 is provided on the driving spindle 7 adjacent to the first axial end 7-1 of the driving spindle 7.

[0136] A first cylindrical section 7-5 is provided on the driving spindle 7 adjacent to the first annular recess 7-4 of the driving spindle 7.

[0137] On the outer circumferential surface of the first cylindrical section 7-5, a first ferrule 7-6 is provided, which is located between the axial extension of the output gear 10-1 of the first gear box 10 and the outer circumferential surface of the first cylindrical section 7-5.

[0138] The output gear 10-1 is supported by the driving spindle 7 at its two ends along the axial direction of the driving spindle 7 (for example, one end is supported by the first ferrule 7-6 and the other end is supported by the first axial end cap 7-3 provided on the driving spindle 7), so that the spline structure of the first axial end 7-1 of the driving spindle 7 does not bear radial pressure, but only bears driving torque.

[0139] A first double-row roller bearing 13 is provided on the first cylindrical section 7-5.

[0140] A first spacer 7-7 is provided between an inner ring 13-1 of the first double-row roller bearing 13 and the extended portion of the output gear 10-1 of the first gear box 10.

[0141] The extended portion of the output gear 10-1 of the first gear box 10 abuts against the inner ring 13-1 of the first double-row roller bearing 13 through the first spacer 7-7.

[0142] According to the above embodiments of the present disclosure, as shown in fig. 5, a second cylindrical section 7-8 is provided on the driving spindle 7 adjacent to the first cylindrical section 7-5 of the driving spindle 7.

[0143] A first step sprocket assembly 14 is fitted on the second cylindrical section 7-8.

[0144] The first step sprocket assembly 14 includes a step flange 14-1 and a step sprocket 14-2, wherein the step sprocket 14-2 is connected to the step flange 14-1 through fasteners and cooperates with the steps 15 of the escalator.

[0145] The step flange 14-1 has a step flange through hole 14-3.

[0146] The step flange 14-1 is matched with the spline structure provided on the outer circumferential surface of

the second cylindrical section 7-8 through the spline structure provided on the inner circumferential surface of the step flange through hole 14-3.

[0147] According to the above embodiments of the present disclosure, as shown in figs. 4 and 5, a second ferrule 7-9 is also provided on the outer circumferential surface of the first cylindrical section 7-5, and the second ferrule 7-9 is located between the step flange 14-1 and the outer circumferential surface of the first cylindrical section 7-5.

[0148] A second spacer 7-10 is provided between the inner ring 13-1 of the first double-row roller bearing 13 and the stepped flange 14-1.

[0149] The inner ring 13-1 of the first double-row roller bearing 13 abuts against the step flange 14-1 through the second spacer 7-10.

[0150] According to the above embodiments of the present disclosure, as shown in fig. 5, a third cylindrical section 7-11 is provided on the driving spindle 7 adjacent to the second cylindrical section 7-8 of the driving spindle 7.

[0151] An annular third spacer 7-12 is provided on an outer circumferential surface of the third cylindrical section 7-11.

[0152] Two single-row rolling bearings 16 are respectively provided on the outer circumferential surfaces of the two axial ends of the third spacers 7-12.

[0153] A first steering plate mounting portion 17 is provided on the outer ring 16-1 of the two single-row rolling bearings 16.

[0154] A first steering plate 18 is mounted on the first steering plate mounting portion 17 through convex-concave fit, and one of the step wheels (not shown) of the steps 15 of the escalator is rolling fitted on the first steering plate 18.

[0155] The stepped flange 14-1 abuts against the inner ring 16-2 of one of the single-row rolling bearings 16 and abuts against the third spacer 7-12.

[0156] A first stopper 7-13 is connected to the first steering plate mounting portion 17 by fasteners and extends to the rolling body of another single-row rolling bearing 16 along the radial direction of the third cylindrical section 7-11, thereby blocking the outer ring 16-1 of the other single-row rolling bearing 16 in the axial direction.

[0157] The stepped flange 14-1 is supported by the driving spindle 7 at its two ends along the axial direction of the driving spindle 7 (for example, one end is supported by the second ferrule 7-9 and the other end is supported by the outer circumferential surface of the third cylindrical section 7-11), so that the spline structure provided on the outer circumferential surface of the second cylindrical section 7-8 does not bear radial pressure, but only bears driving torque.

[0158] According to the above embodiments of the present disclosure, as shown in fig. 5, the first steering plate mounting portion 17 is provided with a first mounting portion boss 17-1.

[0159] The third spacer 7-12 is provided with a spacer boss 7-12-1 facing the first mounting boss 17-1.

[0160] The outer rings 16-1 of the two single-row rolling bearings 16 respectively abut against two axial ends of the first mounting boss 17-1.

[0161] The inner rings 16-2 of the two single-row rolling bearings 16 abut against two axial ends of the spacer boss 7-12-1, respectively.

[0162] According to the above embodiments of the present disclosure, as shown in fig. 6, a fourth cylindrical section 7-14 and a fifth cylindrical section 7-15 are sequentially provided on the driving spindle 7 adjacent to the third cylindrical section 7-11 of the driving spindle 7.

[0163] On the outer circumferential surface of the fourth cylindrical section 7-14, a ring-shaped fourth spacer 7-16 is provided.

[0164] As shown in fig. 5, the first axial end of the fourth spacer 7-16 is fitted on the third cylindrical section 7-11.

[0165] A second axial end of the fourth spacer 7-16 is fitted on the fifth cylindrical section 7-15.

[0166] According to the above embodiments of the present disclosure, as shown in figs. 5 and 6, the inner ring 16-2 of the other single-row rolling bearing 16 and the third spacer 7-12 abut on the first axial end of the fourth spacer 7-16.

[0167] The output gear 12-1 of the third gear box 12 abuts against a step portion 7-16-1 provided on the second axial end of the fourth spacer 7-16.

[0168] A first closing member 19 is also provided on the outer surface of the fourth spacer 7-16.

[0169] The first closing member 19 is fixedly connected to a first side 12-3 of the housing 12-2 of the third gear box 12 by fasteners.

[0170] According to the above embodiments of the present disclosure, as shown in fig. 6, a sixth cylindrical section 7-17 is provided on the driving spindle 7 adjacent to the fifth cylindrical section 7-15 of the driving spindle 7.

[0171] A spline structure is provided on an outer circumferential surface of the sixth cylindrical section 7-17.

[0172] The output gear 12-1 of the third gear box 12 has an output gear through hole 12-4, and a spline structure is provided on the inner circumferential surface of the output gear through hole 12-4 of the output gear 12-1 of the third gear box 12.

[0173] The sixth cylindrical section 7-17 of the driving spindle 7 is splined in the output gear through hole 12-4 of the output gear 12-1 of the third gear box 12.

[0174] According to the above embodiments of the present disclosure, as shown in fig. 6, a second annular recess 7-18 is provided on the driving spindle 7 adjacent to the sixth cylindrical section 7-17 of the driving spindle 7.

[0175] A seventh cylindrical section 7-19 and an eighth cylindrical section 7-20 are sequentially arranged on the driving spindle 7 adjacent to the second annular recess 7-18 of the driving spindle 7.

[0176] The output gear 12-1 of the third gear box 12 is fitted on the seventh cylindrical section 7-19 and abuts against a step portion 7-21 formed between the seventh

cylindrical section 7-19 and the eighth cylindrical section 7-20.

[0177] A second closing member 20 is also provided on the outer surface of the eighth cylindrical section 7-20.

[0178] The second closing member 20 is fixedly connected to a second side 12-5 of the housing 12-2 of the third gear box 12 by fasteners.

[0179] The output gear 12-1 is supported by the driving spindle 7 at its two ends in the axial direction of the driving spindle 7 (for example, one end is supported by the seventh cylindrical section 7-19 and the other end is supported by the step portion 7-16-1 of the fourth spacer 7-16), so that the spline structure provided on the outer circumferential surface of the sixth cylindrical section 7-17 does not bear radial pressure, but only bears driving torque.

[0180] According to the above embodiments of the present disclosure, as shown in fig. 8, a spline structure is provided on the outer circumferential surface of the second axial end 7-22 of the driving spindle 7.

[0181] The output gear 11-1 of the second gear box 11 has an output gear through hole 11-2, and a spline structure is provided on the inner circumferential surface of the output gear through hole 11-2.

[0182] The second axial end 7-22 of the driving spindle 7 is fitted in the output gear through hole 11-2 of the output gear 11-1 of the second gearbox 11, and the spline structure of the second axial end 7-22 of the driving spindle 7 is fitted with the spline structure of the output gear through hole 11-2.

[0183] According to the above-mentioned embodiments of the present disclosure, as shown in fig. 8, a second axial protrusion 7-23 extends outwardly from the second axial end 7-22 of the driving spindle 7.

[0184] A second axial end caps 7-24 are fixedly fitted on the second axial protrusions 7-23 by fasteners and abut against the output gear 11-1 of the second gear box 11.

[0185] According to the above embodiments of the present disclosure, as shown in fig. 8, a third annular recess 7-25 is provided on the driving spindle 7 adjacent to the second axial end 7-22 of the driving spindle 7.

[0186] A ninth cylindrical section 7-26 is provided on the driving spindle 7 adjacent to the third annular recess 7-25 of the driving spindle 7.

[0187] On the outer circumferential surface of the ninth cylindrical section 7-26, a third ferrule 7-27 is provided, which is located between an extended portion of the output gear 11-1 of the second gearbox 11 and the outer circumferential surface of the ninth cylindrical section 7-26.

[0188] A second double-row roller bearing 21 is arranged on the ninth cylindrical section 7-26.

[0189] A fifth spacer 7-28 is provided between the inner ring 21-1 of the second double-row roller bearing 21 and the extended portion of the output gear 11-1 of the second gear box 11.

[0190] The extended portion of the output gear 11-1 of the second gear box 11 abuts against the inner ring 21-1 of the second double-row roller bearing 21 through the fifth spacer 7-28.

[0191] The output gear 11-1 is supported by the driving spindle 7 at its two ends along the axial direction of the driving spindle 7 (for example, one end is supported by the third ferrule 7-27 and the other end is supported by the second axial end cap 7-24 provided on the driving spindle 7), so that the spline structure of the second axial end 7-22 of the driving spindle 7 is not subjected to radial pressure, but only to driving torque.

[0192] According to the above embodiments of the present disclosure, as shown in fig. 7, a tenth cylindrical section 7-29 is provided on the driving spindle 7 adjacent to the ninth cylindrical section 7-26 of the driving spindle 7.

[0193] A second step sprocket assembly 22 is fitted on the tenth cylindrical section 7-29.

[0194] The second step sprocket assembly 22 includes a step flange 22-1 and a step sprocket 22-2, wherein the step sprocket 22-2 is connected to the step flange 22-1 through fasteners and cooperates with the steps 15 of the escalator.

[0195] The step flange 22-1 has a step flange through hole 22-3.

[0196] The step flange 22-1 is matched with the spline structure provided on an outer circumferential surface of the tenth cylindrical section 7-29 through the spline structure provided on an inner circumferential surface of the step flange through hole 22-3.

[0197] According to the above embodiments of the present disclosure, as shown in figs. 7 and 8, a fourth ferrule 7-30 is further provided on the outer circumferential surface of the ninth cylindrical section 7-26, and the fourth ferrule 7-30 is located between the step flange 22-1 and the outer circumferential surface of the ninth cylindrical section 7-26.

[0198] A sixth spacer 7-31 is provided between the inner ring 21-1 of the second double-row roller bearing 21 and the step flange 22-1 of the second step sprocket assembly 22.

[0199] The inner ring 21-1 of the second double-row roller bearing 21 abuts against the step flange 22-1 of the second step sprocket assembly 22 and against the fourth ferrule 7-30 through the sixth spacer 7-31.

[0200] According to the above embodiments of the present disclosure, as shown in fig. 7, an eleventh cylindrical section 7-32 are provided on the driving spindle 7 adjacent to the tenth cylindrical section 7-29 of the driving spindle 7.

[0201] An annular seventh spacer 7-33 is provided on the outer circumferential surface of the eleventh cylindrical section 7-32.

[0202] A single-row rolling bearing 16 is provided on the outer circumferential surface of the two axial ends of the seventh spacers 7-33, respectively.

[0203] A second steering plate mounting portion 23 is provided on the outer ring 16-1 of the two single-row

rolling bearings 16.

[0204] A second steering plate 24 is mounted on the second steering plate mounting portion 23 through convex-concave fit, and another step wheel (not shown) of the escalator step 15 is rolled and fitted on the second steering plate 24.

[0205] The step flange 22-1 of the second step sprocket assembly 22 abuts against the inner ring 16-2 of one of the single row rolling bearings 16 and abuts against the seventh spacer 7-33.

[0206] The stepped flange 22-1 is supported by the driving spindle 7 at its two ends in the axial direction of the driving spindle 7 (for example, one end is supported by the fourth ferrule 7-30 and the other end is supported by the outer circumferential surface of a part of the tenth cylindrical section 7-29), so that the spline structure provided on the outer circumferential surface of the tenth cylindrical section 7-29 does not bear radial pressure, but only bears driving torque.

[0207] As shown in fig. 7, a second stopper 7-34 is connected to the second steering plate mounting portion 23 by fasteners and extends to the rolling body of another single-row rolling bearing 16 along the radial direction of the eleventh cylindrical section 7-32, thereby blocking the outer ring 16-1 of the other single-row rolling bearing 16 in the axial direction.

[0208] The second steering plate mounting portion 23 is provided with a second mounting portion boss 23-1.

[0209] The seventh spacer 7-33 is provided with a spacer boss 7-33-1 facing the second mounting boss 23-1.

[0210] The outer ring 16-1 of the two single-row rolling bearings 16 respectively abuts against the two axial ends of the second mounting boss 23-1.

[0211] The inner ring 16-2 of the two single-row rolling bearings 16 abuts against the two axial ends of the spacer bosses 7-33-1, respectively.

[0212] According to the above embodiments of the present disclosure, as shown in fig. 7, the seventh spacer 7-33 abuts against a step portion 7-35 formed between the eleventh cylindrical section 7-32 and the eighth cylindrical section 7-20.

[0213] According to the above-mentioned embodiments of the present disclosure, as shown in figs. 9 to 10, the third gear box 12 includes an output gear 12-1, a first input gear 12-6, a handrail belt spindle gear 12-7 and a second input gear 12-8 arranged in its housing.

[0214] The fifth driving motor 5 drives the first input gear 12-6 through its gear transmission mechanism such as a planetary gear train (not shown).

[0215] The sixth driving motor 6 drives the second input gear 12-8 through its gear transmission mechanism such as a planetary gear train (not shown).

[0216] The first input gear 12-6 is simultaneously matched with the output gear 12-1 and the handrail belt spindle gear 12-7.

[0217] The second input gear 12-8 is engaged with the handrail belt spindle gear 12-7.

[0218] The driving torque of the fifth driving motor 5 is transmitted to the driving spindle 7 through the input gear 12-1 and to the handrail belt spindle 8 through the handrail belt spindle gear 12-7.

[0219] The driving torque of the sixth driving motor 6 is transmitted to the handrail belt spindle 8 through the handrail belt spindle gear 12-7.

[0220] According to the above embodiments of the present disclosure, as shown in fig. 11, a spline structure is provided on the outer circumferential surface of a part 8-1 of the handrail spindle 8.

[0221] The handrail belt spindle gear 12-7 has a handrail belt gear through hole 12-7-1, and a spline structure is arranged on the inner circumferential surface of the handrail belt gear through hole 12-7-1.

[0222] The handrail main shaft 8 is fitted in the handrail belt gear through hole 12-7-1, and the spline structure on the inner circumferential surface of the handrail belt gear through hole 12-7-1 is fitted with the spline structure on the outer circumferential surface of the part of the handrail belt spindle 8.

[0223] According to the above embodiments of the present disclosure, as shown in fig. 9, two handrail assemblies 9 are provided on both axial ends of the handrail belt spindle 8 respectively.

[0224] The rotation of the handrail belt spindle 8 drives the handrail assemblies 9 to move.

[0225] According to the above-mentioned embodiments of the present disclosure, as shown in fig. 11, a third closing member 25 and a fourth closing member 26 are further provided on the handrail belt spindle 8.

[0226] The third closing member 25 and the fourth closing member 26 are fixedly connected to both sides of the housing 12-2 of the third gear box 12 through fasteners.

[0227] As shown in fig. 11, the housing 12-2 of the third gear box 12 is provided with a third gear box opening 12-9. A handrail belt spindle gear axial extension 12-7-2 of the handrail belt spindle gear 12-7 is arranged in the third gear box opening 12-9 and extends out of the housing 12-2 of the third gear box 12 from the third gear box opening 12-9.

[0228] The handrail belt spindle gear axial extension 12-7-2 is supported by the handrail belt spindle 8 at its two ends along the axial direction of the handrail belt spindle 8 (for example, one end is supported by the handrail belt spindle 8 and the other end is supported by the handrail belt spindle collar provided on the handrail spindle 8), so that the spline structure on the outer circumferential surface of the part of the handrail belt spindle 8 does not bear radial pressure, but only bears driving torque.

[0229] A radial spacer 27 is provided in the third gear box opening 12-9. The radial spacer 27 is located between the handrail belt spindle gear axial extension 12-7-2 and an inner circumferential surface of the third gear box opening 12-9 in the radial direction of the third gear box opening 12-0.

[0230] The radial spacer 27 abuts against a step

formed on the handrail belt spindle gear axial extension 12-7-2 at one side thereof. The third closing member 25 and the fourth closing member 26 abut against the other side of the radial spacer 27 through a stopper.

Claims

1. A driving device for escalators, comprising a first driving motor (1), a second driving motor (2), a first gearbox (10), a driving spindle (7) and a handrail belt spindle (8), wherein the first driving motor and the second driving motor are connected with the first gear box (10), the driving torque of the first driving motor and the second driving motor is transmitted to the driving spindle through the first gear box,

characterized in that the driving device further comprises a third driving motor (3), a fourth driving motor (4) and a second gearbox (11), wherein the third driving motor and the fourth driving motor are connected with the second gear box (11), and the driving torque of the third driving motor and the fourth driving motor are transmitted to the driving spindle through the second gear box;
at least one fifth driving motor (5), at least one sixth driving motor (6) and at least one third gearbox (12); the fifth driving motor and the sixth driving motor are connected with the third gear box (12);
the driving torque of the fifth driving motor and the sixth driving motor is transmitted to the driving spindle and the handrail belt spindle through the third gear box.

2. The driving device according to claim 1, wherein,

the fifth driving motor (5) is arranged between the driving spindle (7) and the handrail belt spindle (8);
the handrail belt spindle is arranged between the fifth driving motor and the sixth driving motor (6);
the third gear box (12) is disposed between the first gear box (10) and the second gear box (11) and is disposed closer to the first gear box than the second gear box; and wherein,
in a direction parallel to an axis of the handrail belt spindle, the fifth driving motor and the sixth driving motor (6) are both located between the handrail belt assemblies (9) arranged on two axial ends of the handrail belt spindle; and
wherein,
the first driving motor (1) and the second driving motor (2) are connected with the first gear box (10) through a gear transmission mechanism;
the third driving motor (3) and the fourth driving motor (4) are connected with the second gear box (11) through a gear transmission mechanism;
the fifth driving motor (5) and the sixth driving motor (6) are connected with said at least one third gear box (12) through a gear transmission mechanism.

3. The driving device according to claim 2, wherein,

the third gear box (12) comprises an output gear (12-1), a first input gear (12-6), a handrail belt spindle gear (12-7) and a second input gear (12-8) which are arranged in a housing of the third gear box;
the fifth driving motor (5) drives the first input gear;
the sixth driving motor (6) drives the second input gear;
the first input gear is matched with the output gear and the handrail belt spindle gear at the same time;
the second input gear is matched with the handrail belt spindle gear;
the driving torque of the fifth driving motor is transmitted to the driving spindle (7) through the input gear and to the handrail belt spindle (8) through the handrail belt spindle gear;
the driving torque of the sixth driving motor is transmitted to the handrail belt spindle through the handrail belt spindle gear.

4. The driving device according to claim 3, wherein,

a spline structure is arranged on the outer circumferential surface of a part (8-1) of handrail belt spindle (8);
the handrail belt spindle gear (12-7) is provided with a handrail gear through hole (12-7-1) , and a spline structure is arranged on the inner circumferential surface of the handrail gear through hole;
the handrail belt spindle is fitted in the handrail gear through hole, and the spline structure on the inner circumferential surface of the handrail gear through hole is fitted with the spline structure on the outer circumferential surface of the part of the handrail belt spindle, and
wherein,
the handrail belt assembly (9) are arranged on two axial ends of the handrail belt spindle;
the rotation of the handrail belt spindle drives the handrail belt assembly to move.

5. The driving device according to claim 4, wherein,

the handrail belt spindle (8) is also provided with a third sealing piece and a fourth sealing piece;
the third sealing piece and the fourth sealing

piece are respectively and fixedly connected to two sides of the housing of the third gear box through fasteners.

6. The driving device according to claim 5, wherein,

a spline structure is arranged on the outer circumferential surface of the first axial end (7-1) of the driving spindle (7);
the output gear (10-1) of the first gear box (10) is provided with an output gear through hole (10-2) , and the inner circumferential surface of the output gear through hole is provided with a spline structure;
the first axial end of the driving spindle is fitted in the output gear through hole of the output gear of the first gearbox, and the spline structure of the first axial end of the driving spindle is fitted with the spline structure of the output gear through hole.

7. The driving device according to claim 6, wherein,

a first axial protrusion (7-2) extending outward from the first axial end (7-1) of the driving spindle (7);
a first axial end cap (7-3) is fixedly fitted on the first axial protrusion through a fastener and abuts against the output gear (10-1) of the first gear box (10), and wherein,
a first annular recess (7-4) is arranged on the driving spindle adjacent to the first axial end of the driving spindle;
a first cylindrical section (7-5) is arranged on the driving spindle adjacent to the first annular recess of the driving spindle;
a first ferrule (7-6) is arranged on the outer circumferential surface of the first cylindrical section, and the first ferrule is located between an extended part of the output gear of the first gearbox and the outer circumferential surface of the first cylindrical section;
a first double-row roller bearing (13) is arranged on the first cylindrical section; a first spacer (7-7) is arranged between an inner ring (13-1) of the first double-row roller bearing and the extended part of the output gear of the first gear box; the extended part of the output gear of the first gear box abuts against the inner ring of the first double-row roller bearing through the first spacer.

8. The driving device according to claim 7, wherein,

a second cylindrical section (7-8) is arranged on the driving spindle (7) adjacent to the first cylindrical section (7-5) of the driving spindle;
a first step sprocket assembly (14) is fitted on the second cylindrical section;
the first step sprocket assembly comprises a step flange (14-1) and a step sprocket (14-2), wherein the step sprocket is connected to the step flange through a fastener and is matched with the steps (15) of the escalator;
the step flange is provided with a step flange through hole (14-3);
the step flange is matched with the spline structure arranged on the outer circumferential surface of the second cylindrical section through the spline structure arranged on the inner circumferential surface of the step flange through hole.

9. The driving device according to claim 8, wherein,

a second ferrule (7-9) is arranged on the outer circumferential surface of the first cylindrical section (7-5), and the second ferrule is located between the step flange (14-1) and the outer circumferential surface of the first cylindrical section (7-5);
a second spacer (7-10) is arranged between the inner ring (13-1) of the first double-row roller bearing (13) and the step flange;
the inner ring of the first double-row roller bearing abuts against the step flange through the second spacer.

10. The driving device according to claim 9, wherein,

a third cylindrical section (7-11) is arranged on the driving spindle (7) adjacent to the second cylindrical section (7-8) of the driving spindle;
a ring-shaped third spacer (7-12) is arranged on the outer circumferential surface of the third cylindrical section;
two single-row rolling bearings (16) are respectively arranged on the outer circumferential surfaces of the two axial ends of the third spacer;
a first steering plate mounting part (17) is arranged on the outer rings (16-1) of the two single-row rolling bearings;
a first steering plate (18) is installed on the first steering plate mounting part through convex-concave fit, and one of the step runner of the escalator is rolling fitted on the first steering plate;
the stepped flange (14-1) abuts against the inner ring (16-2) of one of the single-row rolling bearings and abuts against the third spacer;
a first stopper (7-13) is connected to the first steering plate mounting part through a fastener and extends to the rolling body of another single-row rolling bearing along the radial direction of the third cylindrical section (7-11), thereby blocking the outer ring of the other single-row rolling bearing in the axial direction;

a first mounting part boss (17-1) is arranged on the first steering plate mounting part;
a spacer boss (7-12-1) facing the first mounting part boss is arranged on the third spacer;
the outer rings of the two single-row rolling bearings respectively abut against the two axial ends of the first mounting part boss;
the inner rings of the two single-row rolling bearings respectively abut against the two axial ends of the spacer boss.

11. The driving device according to claim 10, wherein,

a fourth cylindrical section (7-14) and a fifth cylindrical section (7-15) are sequentially arranged on the driving spindle (7) adjacent to the third cylindrical section (7-11) of the driving spindle;
a fourth spacer (7-16) in the shape of a ring is arranged on an outer circumferential surface of the fourth cylindrical section;
a first axial end of the fourth spacer is fitted on the third cylindrical section;
a second axial end of the fourth spacer is fitted on the fifth cylindrical section, and
wherein,
the inner ring (16-2) of the other single-row rolling bearing (16) and the third spacer (7-12) abut against the first axial end of the fourth spacer;
the output gear (12-1) of the third gear box (12) abuts against a step portion (7-16-1) provided on the second axial end of the fourth spacer;
a first closing part (19) is also arranged on the outer surface of the fourth spacer; the first closing member (19) is fixedly connected to the first side (12-3) of the housing (12-2) of the third gear box by fastener, and
wherein,
a sixth cylindrical section (7-17) is arranged on the driving spindle (7) adjacent to the fifth cylindrical section of the driving spindle;
a spline structure is arranged on the outer circumferential surface of the sixth cylindrical section;
the output gear of the third gearbox is provided with an output gear through hole (12-4), and the inner circumferential surface of the output gear through hole of the output gear of the third gearbox is provided with a spline structure;
the sixth cylindrical section of the driving spindle is splined in the output gear through hole of the output gear of the third gearbox.

12. The driving device according to claim 11, wherein,

a second annular recess (7-18) is arranged on the driving spindle (7) adjacent to the sixth cylindrical section (7-17) of the driving spindle;
a seventh cylindrical section (7-19) and an eighth cylindrical section (7-20) are sequentially arranged on the driving spindle adjacent to the second annular recess of the driving spindle;
the output gear (12-1) of the third gear box (12) is fitted on the seventh cylindrical section and abuts against a step portion (7-21) formed between the seventh cylindrical section and the eighth cylindrical section;
a second closing part (20) is also arranged on the outer surface of the eighth cylindrical section;
the second closing member (20) is fixedly connected to the second side (12-5) of the housing (12-2) of the third gear box by fastener.

13. The driving device according to claim 12, wherein,

a spline structure is arranged on the outer circumferential surface of the second axial end (7-22) of the driving spindle (7);
the output gear (11-1) of the second gearbox (11) is provided with an output gear through hole (11-2), and the inner circumferential surface of the output gear through hole is provided with a spline structure;
the second axial end of the driving spindle is fitted in the output gear through hole of the output gear of the second gearbox, and the spline structure of the second axial end of the driving spindle is fitted with the spline structure of the output gear through hole, and
wherein,
a second axial protrusion (7-23) extending outward from the second axial end of the driving spindle;
a second axial end cap (7-24) is fixedly fitted on the second axial protrusion through a fastener and abuts against the output gear of the second gearbox.

14. The driving device according to claim 13, wherein,

a third annular recess (7-25) is arranged on the driving spindle (7) adjacent to the second axial end (7-22) of the driving spindle;
a ninth cylindrical section (7-26) is arranged on the driving spindle adjacent to the third annular recess of the driving spindle;
a third collar (7-27) is arranged on the outer circumferential surface of the ninth cylindrical section, and the third collar is located between an extended part of the output gear (11-1) of the second gearbox (11) and the outer circumferential surface of the ninth cylindrical section;
a second double-row roller bearing (21) is arranged on the ninth cylindrical section;
a fifth spacer (7-28) is arranged between the

inner ring (21-1) of the second double-row roller bearing and the extended part of the output gear of the second gearbox;
the extended part of the output gear of the second gear box abuts against the inner ring of the second double-row roller bearing through the fifth spacer.

15. The driving device according to claim 14, wherein,

a tenth cylindrical section (7-29) is arranged on the driving spindle (7) adjacent to the ninth cylindrical section (7-26) of the driving spindle;
a second step sprocket assembly (22) is fitted on the tenth cylindrical section; the second step sprocket assembly comprises a step flange (22-1) and a step sprocket (22-2), wherein the step sprocket is connected to the step flange through a fastener and is matched with the steps (15) of the escalator;
the step flange is provided with a step flange through hole (22-3);
the step flange is matched with the spline structure arranged on the outer circumferential surface of the tenth cylindrical section through the spline structure arranged on the inner circumferential surface of the step flange through hole, and
wherein,
a fourth collar (7-30) is also arranged on the outer circumferential surface of the ninth cylindrical section, and the fourth collar is located between the step flange and the outer circumferential surface of the ninth cylindrical section;
a sixth spacer (7-31) is arranged between the inner ring (21-1) of the second double-row roller bearing (21) and the step flange of the second step sprocket assembly;
the inner ring of the second double-row roller bearing abuts against the step flange of the second step sprocket assembly through the sixth spacer.

16. The driving device according to claim 15, wherein,

an eleventh cylindrical section (7-32) is arranged on the driving spindle (7) adjacent to the tenth cylindrical section (7-29) of the driving spindle;
an annular seventh spacer (7-33) is arranged on the outer circumferential surface of the eleventh cylindrical section;
two single-row rolling bearings (16) are respectively arranged on the outer circumferential surfaces of the two axial ends of the seventh spacer;
a second steering plate mounting part (23) is arranged on the outer rings (16-1) of the two single-row rolling bearings;
a second steering plate (24) is installed on the second steering plate mounting part through convex-concave fit, and another step runner of the escalator steps (15) is rolled and matched on the second steering plate;
the stepped flange (22-1) abuts against the inner ring (16-2) of one of the single-row rolling bearings and abuts against the seventh spacer (7-33);
a second stopper (7-34) is connected to the second steering plate mounting part through a fastener and extends to the rolling body of another single-row rolling bearing along the radial direction of the eleventh cylindrical section, thereby blocking the outer ring of the other single-row rolling bearing in the axial direction;
a second mounting part boss (23-1) is arranged on the second steering plate mounting part;
a spacer boss (7-33-1) facing the second mounting part boss is arranged on the seventh spacer;
the outer rings of the two single-row rolling bearings respectively abut against the two axial ends of the second mounting part boss;
the inner rings of the two single-row rolling bearings respectively abut against the two axial ends of the spacer boss, and
wherein,
the seventh spacer abuts against a step portion (7-35) formed between the eleventh cylindrical section of the driving spindle and the eighth cylindrical section (7-20) of the driving spindle.

Patentansprüche

1. Antriebsvorrichtung für Fahrtreppen, die einen ersten Antriebsmotor (1), einen zweiten Antriebsmotor (2), ein erstes Getriebe (10), eine Antriebsspindel (7) und eine Handlaufgurtspindel (8) umfasst, wobei der erste Antriebsmotor und der zweite Antriebsmotor mit dem ersten Getriebe (10) verbunden sind, das Antriebsmoment des ersten Antriebsmotors und des zweiten Antriebsmotors über das erste Getriebe zur Antriebsspindel übertragen wird,

dadurch gekennzeichnet, dass die Antriebsvorrichtung ferner Folgendes umfasst
einen dritten Antriebsmotor (3), einen vierten Antriebsmotor (4) und ein zweites Getriebe (11), wobei der dritte Antriebsmotor und der vierte Antriebsmotor mit dem zweiten Getriebe (11) verbunden sind und das Antriebsmoment des dritten Antriebsmotors und des vierten Antriebsmotors über das zweite Getriebe zur Antriebsspindel übertragen werden;
mindestens einen fünften Antriebsmotor (5), mindestens einen sechsten Antriebsmotor (6)

und mindestens ein drittes Getriebe (12);
der fünfte Antriebsmotor und der sechste Antriebsmotor sind mit dem dritten Getriebe (12) verbunden;
das Antriebsmoment des fünften Antriebsmotors und des sechsten Antriebsmotors wird über das dritte Getriebe zur Antriebsspindel und zur Handlaufgurtspindel übertragen.

2. Antriebsvorrichtung nach Anspruch 1, wobei,

der fünfte Antriebsmotor (5) zwischen der Antriebsspindel (7) und der Handlaufgurtspindel (8) angeordnet ist;
die Handlaufgurtspindel zwischen dem fünften Antriebsmotor und dem sechsten Antriebsmotor (6) angeordnet ist;
das dritte Getriebe (12) zwischen dem ersten Getriebe (10) und dem zweiten Getriebe (11) angebracht ist und näher am ersten Getriebe als am zweiten Getriebe angebracht ist; und wobei,
in einer Richtung parallel zu einer Achse der Handlaufgurtspindel der fünfte Antriebsmotor und der sechste Antriebsmotor (6) sich beide zwischen den Handlaufgurtanordnungen (9) befinden, die an zwei axialen Enden der Handlaufgurtspindel angeordnet sind; und
wobei,
der erste Antriebsmotor (1) und der zweite Antriebsmotor (2) über einen Zahnradübertragungsmechanismus mit dem ersten Getriebe (10) verbunden sind;
der dritte Antriebsmotor (3) und der vierte Antriebsmotor (4) über einen Zahnradübertragungsmechanismus mit dem zweiten Getriebe (11) verbunden sind;
der fünfte Antriebsmotor (5) und der sechste Antriebsmotor (6) über einen Zahnradübertragungsmechanismus mit dem mindestens einen dritten Getriebe (12) verbunden sind.

3. Antriebsvorrichtung nach Anspruch 2, wobei,

das dritte Getriebe (12) ein Abtriebsrad (12-1), ein erstes Antriebsrad (12-6), ein Handlaufgurtspindelrad (12-7) und ein zweites Antriebsrad (12-8) umfasst, die in einem Gehäuse des dritten Getriebes angeordnet sind;
der fünfte Antriebsmotor (5) das erste Antriebsrad antreibt;
der sechste Antriebsmotor (6) das zweite Antriebsrad antreibt;
das erste Antriebsrad an das Abtriebsrad und das Handlaufgurtspindelrad gleichzeitig angeglichen ist;
das zweite Antriebsrad an das Handlaufgurtspindelrad angeglichen ist;
das Antriebsmoment des fünften Antriebsmotors über das Antriebsrad zur Antriebsspindel (7) und über das Handlaufgurtspindelrad zur Handlaufgurtspindel (8) übertragen wird;
das Antriebsmoment des sechsten Antriebsmotors über das Handlaufgurtspindelrad zur Handlaufgurtspindel übertragen wird.

4. Antriebsvorrichtung nach Anspruch 3, wobei,

auf der Außenumfangsfläche eines Teils (8-1) einer Handlaufgurtspindel (8) eine Keilstruktur angeordnet ist;
das Handlaufgurtspindelrad (12-7) mit einem Handlaufraddurchgangsloch (12-7-1) versehen ist und auf der Innenumfangsfläche des Handlaufraddurchgangslochs eine Keilstruktur angeordnet ist;
die Handlaufgurtspindel in das Handlaufraddurchgangsloch eingesetzt ist und die Keilstruktur auf der Innenumfangsfläche des Handlaufraddurchgangslochs an der Keilstruktur auf der Außenumfangsfläche des Teils der Handlaufgurtspindel montiert ist, und
wobei,
die Handlaufgurtanordnung (9) an zwei axialen Ende der Handlaufgurtspindel angeordnet ist;
die Drehung der Handlaufgurtspindel treibt die Handlaufgurtanordnung zum Bewegen an.

5. Antriebsvorrichtung nach Anspruch 4, wobei,

die Handlaufgurtspindel (8) außerdem mit einem dritten Dichtungsstück und einem vierten Dichtungsstück versehen ist;
das dritte Dichtungsstück und das vierte Dichtungsstück jeweils über Befestigungsmittel fest mit zwei Seiten des Gehäuses des dritten Getriebes verbunden sind.

6. Antriebsvorrichtung nach Anspruch 5, wobei,

auf der Außenumfangsfläche des ersten axialen Endes (7-1) der Antriebsspindel (7) eine Keilstruktur angeordnet ist;
das Abtriebsrad (10-1) des ersten Getriebes (10) mit einem Abtriebsraddurchgangsloch (10-2) versehen und die Innenumfangsfläche des Abtriebsraddurchgangslochs mit einer Keilstruktur versehen ist;
das erste axiale Ende der Antriebsspindel in das Abtriebsraddurchgangsloch des Abtriebsrads des ersten Getriebes eingesetzt ist und die Keilstruktur Abtriebsraddurchgangslochs an der Keilstruktur des ersten axialen Endes der Antriebsspindel montiert ist.

7. Antriebsvorrichtung nach Anspruch 6, wobei,

ein erster axialer Vorsprung (7-2), der sich vom ersten axialen Ende (7-1) der Antriebsspindel (7) nach außen erstreckt;
eine erste axiale Endkappe (7-3) über ein Befestigungsmittel fest am ersten axialen Vorsprung montiert ist und am Abtriebsrad (10-1) des ersten Getriebes (10) anliegt, und
wobei,
an der Antriebsspindel neben dem ersten axialen Ende der Antriebsspindel eine erste ringförmige Ausnehmung (7-4) angeordnet ist;
an der Antriebsspindel neben der ersten ringförmigen Ausnehmung der Antriebsspindel ein erster zylindrischer Bereich (7-5) angeordnet ist;
auf der Außenumfangsfläche des ersten zylindrischen Bereichs eine erste Hülse (7-6) angeordnet ist und die erste Hülse sich zwischen einem verlängerten Teil des Abtriebsrads des ersten Getriebes und der Außenumfangsfläche des ersten zylindrischen Bereichs befindet;
auf dem zylindrischen Bereich ein erstes zweireihiges Wälzlager (13) angeordnet ist;
zwischen einem Innenring (13-1) des ersten zweireihigen Wälzlagers und dem verlängerten Teil des Abtriebsrads des ersten Getriebes ein erster Abstandhalter (7-7) angeordnet ist;
der verlängerte Teil des Abtriebsrads des ersten Getriebes am Innenring des ersten zweireihigen Wälzlagers über den ersten Abstandhalter anliegt.

8. Antriebsvorrichtung nach Anspruch 7, wobei,

auf der Antriebsspindel (7) neben dem ersten zylindrischen Bereich (7-5) der Antriebsspindel ein zweiter zylindrischer Bereich (7-8) angeordnet ist;
am zweiten zylindrischen Bereich eine erste Stufenritzelanordnung (14) eingesetzt ist;
die erste Stufenritzelanordnung einen Stufenflansch (14-1) und ein Stufenritzel (14-2) umfasst, wobei das Stufenritzel über ein Befestigungsmittel mit dem Stufenflansch verbunden und an die Stufen (15) der Fahrtreppe angeglichen ist;
der Stufenflansch mit einem Stufenflanschdurchgangsloch (14-3) versehen ist;
der Stufenflansch an die Keilstruktur angeglichen ist, die auf der Außenumfangsfläche des zweiten zylindrischen Bereichs durch die Keilstruktur angeordnet ist, die auf der Innenumfangsfläche des Stufenflanschdurchgangslochs angeordnet ist.

9. Antriebsvorrichtung nach Anspruch 8, wobei,

auf der Außenumfangsfläche des ersten zylindrischen Bereichs (7-5) eine zweite Hülse (7-9) angeordnet ist und die zweite Hülse sich zwischen dem Stufenflansch (14-1) und der Außenumfangsfläche des ersten zylindrischen Bereichs (7-5) befindet;
zwischen dem Innenring (13-1) des ersten zweireihigen Wälzlagers (13) und dem Stufenflansch ein zweiter Abstandhalter (7-10) angeordnet ist;
der Innenring des ersten zweireihigen Wälzlagers über den zweiten Abstandhalter am Stufenflansch anliegt.

10. Antriebsvorrichtung nach Anspruch 9, wobei,

auf der Antriebsspindel (7) neben dem zweiten zylindrischen Bereich (7-8) der Antriebsspindel ein dritter zylindrischer Bereich (7-11) angeordnet ist;
auf der Außenumfangsfläche des dritten zylindrischen Bereichs ein ringförmiger dritter Abstandhalter (7-12) angeordnet ist;
auf den Außenumfangsflächen der zwei axialen Enden des dritten Abstandhalters jeweils zwei einreihige Wälzlager (16) angeordnet sind;
auf den Außenringen (16-1) der zwei einreihigen Wälzlager ein erstes Lenkplattenmontageteil (17) angeordnet ist;
auf dem ersten Lenkplattenmontageteil mittels einer Konvex-konkav-Passung eine erste Lenkplatte (18) installiert ist und eine der Stufenkufen der Fahrtreppe auf der ersten Lenkplatte montiert rollt;
der gestufte Flansch (14-1) am Innenring (16-2) von einem der einreihigen Wälzlager anliegt und am dritten Abstandhalter anliegt;
ein erster Anschlag (7-13) mittels eines Befestigungsmittels mit dem ersten Lenkplattenmontageteil verbunden ist und sich entlang der Radialrichtung des dritten zylindrischen Bereichs (7-11) zum Wälzkörper eines anderen einreihigen Wälzlagers erstreckt, wodurch der Außenring des anderen einreihigen Wälzlagers in der Axialrichtung blockiert wird;
eine erste Montageteilerhöhung (17-1) auf dem ersten Lenkplattenmontageteil angeordnet ist;
eine Abstandhaltererhöhung (7-12-1), die der ersten Montageteilerhöhung zugewandt ist, auf dem dritten Abstandhalter angeordnet ist;
die Außenringe der zwei einreihigen Wälzlager jeweils an den zwei axialen Enden der ersten Montageteilerhöhung anliegen;
die Innenringe der zwei einreihigen Wälzlager jeweils an den zwei axialen Enden der Abstandhaltererhöhung anliegen.

11. Antriebsvorrichtung nach Anspruch 10, wobei,

ein vierter zylindrischer Bereich (7-14) und ein fünfter zylindrischer Bereich (7-15) auf der Antriebsspindel (7) neben dem dritten zylindrischen Bereich (7-11) der Antriebsspindel sequenziell angeordnet sind;
ein vierter Abstandhalter (7-16) in Form eines Rings auf einer Außenumfangsfläche des vierten zylindrischen Bereichs angeordnet ist;
ein erstes axiales Ende des vierten Abstandhalters auf dem dritten zylindrischen Bereich montiert ist;
ein zweites axiales Ende des vierten Abstandhalters auf dem fünften zylindrischen Bereich montiert ist, und
wobei,
der Innenring (16-2) des anderen einreihigen Wälzlagers (16) und der dritte Abstandhalter (7-12) am ersten axialen Ende des vierten Abstandhalters anliegen;
das Abtriebsrad (12-1) des dritten Getriebes (12) an einem Stufenabschnitt (7-16-1) anliegt, der am zweiten axialen Ende des vierten Abstandhalters bereitgestellt ist;
ein erstes Verschlussteil (19) auch auf der Außenfläche des vierten Abstandhalters angeordnet ist;
das erste Verschlusselement (19) mit der ersten Seite (12-3) des Gehäuses (12-2) des dritten Getriebes mittels eines Befestigungselements fest verbunden ist, und
wobei,
ein sechster zylindrischer Bereich (7-17) auf der Antriebsspindel (7) neben dem fünften zylindrischen Bereich der Antriebsspindel angeordnet ist;
auf der Außenumfangsfläche des sechsten zylindrischen Bereichs eine Keilstruktur angeordnet ist;
das Abtriebsrad des dritten Getriebes mit einem Abtriebsraddurchgangsloch (12-4) versehen ist und die Innenumfangsfläche des Abtriebsraddurchgangslochs des Abtriebsrads des dritten Getriebes mit einer Keilstruktur versehen ist;
der sechste zylindrische Bereich der Antriebsspindel im Abtriebsraddurchgangsloch des Abtriebsrads des dritten Getriebes verkeilt ist.

12. Antriebsvorrichtung nach Anspruch 11, wobei,

auf der Antriebsspindel (7) neben dem sechsten zylindrischen Bereich (7-17) der Antriebsspindel eine zweite ringförmige Ausnehmung (7-18) angeordnet ist;
auf der Antriebsspindel neben der zweiten ringförmigen Ausnehmung der Antriebsspindel ein siebter zylindrischer Bereich (7-19) und ein achter zylindrischer Bereich (7-20) sequenziell angeordnet sind;
das Abtriebsrad (12-1) des dritten Getriebes (12) auf dem siebten zylindrischen Bereich montiert ist und an einem Stufenabschnitt (7-21) anliegt, der zwischen dem siebten zylindrischen Bereich und dem achten zylindrischen Bereich gebildet ist;
ein zweites Verschlussteil (20) auch auf der Außenfläche des achten zylindrischen Bereichs angeordnet ist;
das zweite Verschlusselement (20) mit der zweiten Seite (12-5) des Gehäuses (12-2) des dritten Getriebes mittels eines Befestigungselements fest verbunden ist.

13. Antriebsvorrichtung nach Anspruch 12, wobei,

auf der Außenumfangsfläche des zweiten axialen Endes (7-22) der Antriebsspindel (7) eine Keilstruktur angeordnet ist;
das Abtriebsrad (11-1) des zweiten Getriebes (11) mit einem Abtriebsraddurchgangsloch (11-2) versehen und die Innenumfangsfläche des Abtriebsraddurchgangslochs mit einer Keilstruktur versehen ist;
das zweite axiale Ende der Antriebsspindel in das Abtriebsraddurchgangsloch des Abtriebsrads des zweiten Getriebes eingesetzt ist und die Keilstruktur des Abtriebsraddurchgangslochs an der Keilstruktur zweiten axialen Endes der Antriebsspindel montiert ist und
wobei,
ein zweiter axialer Vorsprung (7-23), der sich vom zweiten axialen Ende der Antriebsspindel nach außen erstreckt;
eine zweite axiale Endkappe (7-24) über ein Befestigungsmittel fest am zweiten axialen Vorsprung montiert ist und am Abtriebsrad des zweiten Getriebes anliegt.

14. Antriebsvorrichtung nach Anspruch 13, wobei,

auf der Antriebsspindel (7) neben dem zweiten axialen Ende (7-22) der Antriebsspindel eine dritte ringförmige Ausnehmung (7-25) angeordnet ist;
an der Antriebsspindel neben der dritten ringförmigen Ausnehmung der Antriebsspindel ein neunter zylindrischer Bereich (7-26) angeordnet ist;
auf der Außenumfangsfläche des neunten zylindrischen Bereichs ein dritter Bund (7-27) angeordnet ist und der dritte Bund sich zwischen dem verlängerten Teil des Abtriebsrads (11-1) des zweiten Getriebes (11) und der Außenumfangsfläche des neunten zylindrischen Bereichs befindet;
auf dem neunten zylindrischen Bereich ein zweites zweireihiges Wälzlager (21) angeord-

net ist;
zwischen dem Innenring (21-1) des zweiten zweireihigen Wälzlagers und dem verlängerten Teil des Abtriebsrads des zweiten Getriebes ein fünfter Abstandhalter (7-28) angeordnet ist;
der verlängerte Teil des Abtriebsrads des zweiten Getriebes am Innenring des ersten zweireihigen Wälzlagers über den fünften Abstandhalter anliegt.

15. Antriebsvorrichtung nach Anspruch 14, wobei,

auf der Antriebsspindel (7) neben dem neunten zylindrischen Bereich (7-26) der Antriebsspindel ein zehnter zylindrischer Bereich (7-29) angeordnet ist;
am zehnten zylindrischen Bereich eine zweite Stufenritzelanordnung (22) montiert ist;
die zweite Stufenritzelanordnung einen Stufenflansch (22-1) und ein Stufenritzel (22-2) umfasst, wobei das Stufenritzel über ein Befestigungsmittel mit dem Stufenflansch verbunden und an die Stufen (15) der Fahrtreppe angeglichen ist;
der Stufenflansch mit einem Stufenflanschdurchgangsloch (22-3) versehen ist;
der Stufenflansch an die Keilstruktur angeglichen ist, die auf der Außenumfangsfläche des zehnten zylindrischen Bereichs durch die Keilstruktur angeordnet ist, die auf der Innenumfangsfläche des Stufenflanschdurchgangslochs angeordnet ist, und
wobei,
auf der Außenumfangsfläche des neunten zylindrischen Bereichs außerdem ein vierter Bund (7-30) angeordnet ist und der vierte Bund sich zwischen dem Stufenflansch und der Außenumfangsfläche des neunten zylindrischen Bereichs befindet;
zwischen dem Innenring (21-1) des zweiten zweireihigen Wälzlagers (21) und dem Stufenflansch der zweiten Stufenritzelanordnung ein sechster Abstandhalter (7-31) angeordnet ist;
der Innenring des zweiten zweireihigen Wälzlagers am Stufenflansch der zweiten Stufenritzelanordnung über den sechsten Abstandhalter anliegt.

16. Antriebsvorrichtung nach Anspruch 15, wobei,

auf der Antriebsspindel (7) neben dem zahnten zylindrischen Bereich (7-29) der Antriebsspindel ein elfter zylindrischer Bereich (7-32) angeordnet ist;
auf der Außenumfangsfläche des elften zylindrischen Bereichs ein ringförmiger siebter Abstandhalter (7-33) angeordnet ist;
auf den Außenumfangsflächen der zwei axialen Enden des siebten Abstandhalters jeweils zwei einreihige Wälzlager (16) angeordnet sind;
auf den Außenringen (16-1) der zwei einreihigen Wälzlager ein zweites Lenkplattenmontageteil (23) angeordnet ist;
auf dem zweiten Lenkplattenmontageteil eine zweite Lenkplatte (24) über eine Konvex-konkav-Passung installiert ist und eine weitere Stufenkufe der Fahrtreppenstufen (15) auf der zweiten Lenkplatte gerollt wird und angeglichen ist;
der gestufte Flansch (22-1) am Innenring (16-2) von einem der einreihigen Wälzlager anliegt und am siebten Abstandhalter (7-33) anliegt;
ein zweiter Anschlag (7-34) mittels eines Befestigungsmittels mit dem zweiten Lenkplattenmontageteil verbunden ist und sich entlang der Radialrichtung des elften zylindrischen Bereichs zum Wälzkörper eines anderen einreihigen Wälzlagers erstreckt, wodurch der Außenring des anderen einreihigen Wälzlagers in der Axialrichtung blockiert wird;
eine zweite Montageteilerhöhung (23-1) auf dem zweiten Lenkplattenmontageteil angeordnet ist;
eine Abstandhaltererhöhung (7-33-1), die der zweiten Montageteilerhöhung zugewandt ist, auf dem siebten Abstandhalter angeordnet ist;
die Außenringe der zwei einreihigen Wälzlager jeweils an den zwei axialen Enden der zweiten Montageteilerhöhung anliegen;
die Innenringe der zwei einreihigen Wälzlager jeweils an den zwei axialen Enden der Abstandhaltererhöhung anliegen, und
wobei,
der siebte Abstandhalter an einem Stufenabschnitt (7-35) anliegt, der zwischen dem elften zylindrischen Bereich der Antriebsspindel und dem achten zylindrischen Bereich (7-20) der Antriebsspindel gebildet ist.

Revendications

1. Dispositif d'entraînement pour escaliers roulants, comprenant un premier moteur d'entraînement (1), un deuxième moteur d'entraînement (2), une première boîte d'engrenages (10), un axe d'entraînement (7) et un axe de courroie de main courante (8), dans lequel le premier moteur d'entraînement et le deuxième moteur d'entraînement sont raccordés avec la première boîte d'engrenages (10), le couple d'entraînement du premier moteur d'entraînement et du deuxième moteur d'entraînement est transmis à l'axe d'entraînement par le biais de la première boîte d'engrenages,
caractérisé en ce que le dispositif d'entraînement comprend en outre :

un troisième moteur d'entraînement (3), un quatrième moteur d'entraînement (4) et une deuxième boîte d'engrenages (11), dans lequel le troisième moteur d'entraînement et le quatrième moteur d'entraînement sont raccordés avec la deuxième boîte d'engrenages (11), et le couple d'entraînement du troisième moteur d'entraînement et du quatrième moteur d'entraînement transmis à l'axe d'entraînement par le biais de la deuxième boîte d'engrenages ;
au moins un cinquième moteur d'entraînement (5), au moins un sixième moteur d'entraînement (6) et au moins une troisième boîte d'engrenages (12) ;
le cinquième moteur d'entraînement et le sixième moteur d'entraînement sont raccordés avec la troisième boîte d'engrenages (12) ;
le couple d'entraînement du cinquième moteur d'entraînement et du sixième moteur d'entraînement est transmis à l'axe d'entraînement et à l'axe de courroie de main courante par le biais de la troisième boîte d'engrenages.

2. Dispositif d'entraînement selon la revendication 1, dans lequel :

le cinquième moteur d'entraînement (5) est agencé entre l'axe d'entraînement (7) et l'axe de courroie de main courante (8) ;
l'axe de courroie de main courante est agencé entre le cinquième moteur d'entraînement et le sixième moteur d'entraînement (6) ;
la troisième boîte d'engrenages (12) est disposée entre la première boîte d'engrenages (10) et la deuxième boîte d'engrenages (11) et est disposée plus à proximité de la première boîte d'engrenages que de la deuxième boîte d'engrenages ; et dans lequel :

dans une direction parallèle à un axe de l'axe de courroie de main courante, le cinquième moteur d'entraînement et le sixième moteur d'entraînement (6) sont tous deux situés entre les ensembles de courroie de main courante (9) agencés sur deux extrémités axiales de l'axe de courroie de main courante ; et
dans lequel :

le premier moteur d'entraînement (1) et le deuxième moteur d'entraînement (2) sont raccordés avec la première boîte d'engrenages (10) par le biais d'un mécanisme de transmission par engrenages ;
le troisième moteur d'entraînement (3) et le quatrième moteur d'entraînement (4) sont raccordés avec la deuxième boîte d'engrenages (11) par le biais d'un mécanisme de transmission par engrenages ;
le cinquième moteur d'entraînement (5) et le sixième moteur d'entraînement (6) sont raccordés avec ladite au moins une troisième boîte d'engrenages (12) par le biais d'un mécanisme de transmission par engrenages.

3. Dispositif d'entraînement selon la revendication 2, dans lequel :

la troisième boîte d'engrenages (12) comprend un engrenage de sortie (12-1), un premier engrenage d'entrée (12-6), un engrenage d'axe de courroie de main courante (12-7) et un second engrenage d'entrée (12-8) qui sont agencés dans un boîtier de la troisième boîte d'engrenages ;
le cinquième moteur d'entraînement (5) entraîne le premier engrenage d'entrée ;
le sixième moteur d'entraînement (6) entraîne le second engrenage de sortie ;
le premier engrenage d'entrée correspond à l'engrenage de sortie et à l'engrenage d'axe de courroie de main courante en même temps ;
le second engrenage d'entrée correspond à l'engrenage d'axe de courroie de main courante ;
le couple d'entraînement du cinquième moteur d'entraînement est transmis à l'axe d'entraînement (7) par le biais de l'engrenage d'entrée et à l'axe de courroie de main courante (8) par le biais de l'engrenage d'axe de courroie de main courante ;
le couple d'entraînement du sixième moteur est transmis à l'axe de courroie de main courante par le biais de l'engrenage d'axe de courroie de main courante.

4. Dispositif d'entraînement selon la revendication 3, dans lequel :

une structure à cannelures est agencée sur la surface circonférentielle externe d'une partie (8-1) de l'axe de courroie de main courante (8) ;
l'engrenage d'axe de courroie de main courante (12-7) est prévu avec un trou débouchant d'engrenage de main courante (12-7-1) et une structure à cannelures est agencée sur la surface circonférentielle interne du trou débouchant d'engrenage de main courante ;
l'axe de courroie de main courante est monté dans le trou débouchant d'engrenage de main courante, et la structure à cannelures sur la surface circonférentielle interne du trou débouchant d'engrenage de main courante est mon-

tée avec la structure à cannelures sur la surface circonférentielle externe de la partie de l'axe de courroie de main courante, et
dans lequel :

l'ensemble de courroie de main courante (9) est agencé sur deux extrémités axiales de l'axe de courroie de main courante ;
la rotation de l'axe de courroie de main courante entraîne le déplacement de l'ensemble de courroie de main courante.

5. Dispositif d'entraînement selon la revendication 4, dans lequel :

l'axe de courroie de main courante (8) est également prévu avec une troisième pièce de scellement et une quatrième pièce de scellement ;
la troisième pièce de scellement et la quatrième pièce de scellement sont respectivement et fixement raccordées aux deux côtés du boîtier de la troisième boîte d'engrenages par le biais de fixations.

6. Dispositif d'entraînement selon la revendication 5, dans lequel :

une structure à cannelures est agencée sur la surface circonférentielle externe de la première extrémité axiale (7-1) de l'axe d'entraînement (7) ;
l'engrenage de sortie (10-1) de la première boîte d'engrenages (10) est prévu avec un trou débouchant d'engrenage de sortie (10-2), et la surface circonférentielle interne du trou débouchant d'engrenage de sortie est prévue avec une structure à cannelures ;
la première extrémité axiale de l'axe d'entraînement est montée dans le trou débouchant d'engrenage de sortie de l'engrenage de sortie de la première boîte d'engrenages, et la structure à cannelures de la première extrémité axiale de l'axe d'entraînement est montée avec la structure à cannelures du trou débouchant d'engrenage de sortie.

7. Dispositif d'entraînement selon la revendication 6, dans lequel :

une première saillie axiale (7-2) s'étendant vers l'extérieur à partir de la première extrémité axiale (7-1) de l'axe d'entraînement (7) ;
un premier capuchon d'extrémité axiale (7-3) est monté, de manière fixe, sur la première saillie axiale par le biais d'une fixation et vient en butée contre l'engrenage de sortie (10-1) de la première boîte d'engrenages (10), et dans lequel :
un premier évidement annulaire (7-4) est agencé sur l'axe d'entraînement adjacent à la première extrémité axiale de l'axe d'entraînement ;
une première section cylindrique (7-5) est agencée sur l'axe d'entraînement adjacent au premier évidement annulaire de l'axe d'entraînement ;
une première virole (7-6) est agencée sur la surface circonférentielle externe de la première section cylindrique, et la première virole est située entre une partie étendue de l'engrenage de sortie de la première boîte d'engrenages et la surface circonférentielle externe de la première section cylindrique ;
un premier palier à double rangée de rouleaux (13) est agencé sur la première section cylindrique ;
un premier dispositif d'espacement (7-7) est agencé entre une bague interne (13-1) du premier palier à double rangée de rouleaux et la partie étendue de l'engrenage de sortie de la première boîte d'engrenages ; la partie étendue de l'engrenage de sortie de la première boîte d'engrenages vient en butée contre la bague interne du premier palier à double rangée de rouleaux par le biais du premier dispositif d'espacement.

8. Dispositif d'entraînement selon la revendication 7, dans lequel :

une deuxième section cylindrique (7-8) est agencée sur l'axe d'entraînement (7) adjacent à la première section cylindrique (7-5) de l'axe d'entraînement ;
un premier ensemble de pignon de marche (14) est monté sur la deuxième section cylindrique ;
le premier ensemble de pignon de marche comprend une bride de marche (14-1) et un pignon de marche (14-2), dans lequel le pignon de marche est raccordé à la bride de marche par le biais d'une fixation et correspond aux marches (15) de l'escalier roulant ;
la bride de marche est prévue avec un trou débouchant de bride de marche (14-3) ;
la bride de marche correspond à la structure à cannelures agencée sur la surface circonférentielle externe de la deuxième section cylindrique par le biais de la structure à cannelures agencée sur la surface circonférentielle interne du trou débouchant de bride de marche.

9. Dispositif d'entraînement selon la revendication 8, dans lequel :

une seconde virole (7-9) est agencée sur la surface circonférentielle externe de la première section cylindrique (7-5), et la seconde virole est située entre la bride de marche (14-1) et la surface circonférentielle externe de la première section cylindrique (7-5) ;
un deuxième dispositif d'espacement (7-10) est agencé entre la bague interne (13-1) du premier palier à double rangée de rouleaux (13) et la bride de marche ;
la bague interne du premier palier à double rangée de rouleaux vient en butée contre la bride de marche par le biais du deuxième dispositif d'espacement.

10. Dispositif d'entraînement selon la revendication 9, dans lequel :

une troisième section cylindrique (7-11) est agencée sur l'axe d'entraînement (7) adjacent à la deuxième section cylindrique (7-8) de l'axe d'entraînement ;
un troisième dispositif d'espacement de forme annulaire (7-12) est agencé sur la surface circonférentielle externe de la troisième section cylindrique ;
deux paliers à une rangée de rouleaux (16) sont respectivement agencés sur les surfaces circonférentielles des deux extrémités axiales du troisième dispositif d'espacement ;
une première partie de montage de plaque de direction (17) est agencée sur les bagues externes (16-1) des deux paliers à une rangée de rouleaux ;
une première plaque de direction (18) est installée sur la première partie de montage de plaque de direction par le biais d'un ajustement convexo-concave, et l'un parmi les galets mobiles de marche de l'escalier roulant est monté, en roulement, sur la première plaque de direction ;
la bride de marche (14-1) vient en butée contre la bague interne (16-2) de l'un des paliers à une rangée de rouleaux et vient en butée contre le troisième dispositif d'espacement ;
une première butée (7-13) est raccordée à la première partie de montage de plaque de direction par le biais d'une fixation et s'étend vers le corps de roulement d'un autre palier à une rangée de rouleaux le long de la direction radiale de la troisième section cylindrique (7-11), bloquant ainsi la bague externe de l'autre palier à une rangée de rouleaux dans la direction axiale ;
un premier bossage de partie de montage (17-1) est agencé sur la première partie de montage de plaque de direction ;
un bossage de dispositif d'espacement (7-12-1) faisant face au premier bossage de partie de montage est agencé sur le troisième dispositif d'espacement ;
les bagues externes des deux paliers à une rangée de rouleaux viennent respectivement en butée contre les deux extrémités axiales du premier bossage de partie de montage ;
les bagues internes des deux paliers à une rangée de roulement viennent respectivement en butée contre les deux extrémités axiales du bossage de dispositif d'espacement.

11. Dispositif d'entraînement selon la revendication 10, dans lequel :

une quatrième section cylindrique (7-14) et une cinquième section cylindrique (7-15) sont séquentiellement agencées sur l'axe d'entraînement (7) adjacent à la troisième section cylindrique (7-11) de l'axe d'entraînement ;
un quatrième dispositif d'espacement (7-16) se présentant sous la forme d'une bague est agencé sur une surface circonférentielle externe de la quatrième section cylindrique ;
une première extrémité axiale du quatrième dispositif d'espacement est montée sur la troisième section cylindrique ;
une seconde extrémité axiale du quatrième dispositif d'espacement est montée sur la cinquième section cylindrique, et
dans lequel :

la bague interne (16-2) de l'autre palier à une rangée de rouleaux (16) et le troisième dispositif d'espacement (7-12) viennent en butée contre la première extrémité axiale du quatrième dispositif d'espacement ;
l'engrenage de sortie (12-1) de la troisième boîte d'engrenages (12) vient en butée contre une partie de marche (7-16-1) prévue sur la seconde extrémité axiale du quatrième dispositif d'espacement ;
une première partie de fermeture (19) est également agencée sur la surface externe du quatrième dispositif d'espacement ;
le premier élément de fermeture (19) est fixement raccordé au premier côté (12-3) du boîtier (12-2) de la troisième boîte d'engrenages par la fixation, et
dans lequel :

une sixième section cylindrique (7-17) est agencée sur l'axe d'entraînement (7) adjacent à la cinquième section cylindrique de l'axe d'entraînement ;
une structure à cannelures est agencée sur la surface circonférentielle externe de la sixième section cylindrique ;
l'engrenage de sortie de la troisième boîte d'engrenages est prévu avec un

trou débouchant d'engrenage de sortie (12-4), et la surface circonférentielle interne du trou débouchant d'engrenage de sortie de l'engrenage de sortie de la troisième boîte d'engrenages est prévue avec une structure à cannelures ;
la sixième section cylindrique de l'axe d'entraînement est cannelée dans le trou débouchant d'engrenage de sortie de l'engrenage de sortie de la troisième boîte d'engrenages.

12. Dispositif d'entraînement selon la revendication 11, dans lequel :

un deuxième évidement annulaire (7-18) est agencé sur l'axe d'entraînement (7) adjacent à la sixième section cylindrique (7-17) de l'axe d'entraînement ;
une septième section cylindrique (7-19) et une huitième section cylindrique (7-20) sont séquentiellement agencées sur l'axe d'entraînement adjacent au deuxième évidement annulaire de l'axe d'entraînement ;
l'engrenage de sortie (12-1) de la troisième boîte d'engrenages (12) est monté sur la septième section cylindrique et vient en butée contre une partie de marche (7-21) formée entre la septième section cylindrique et la huitième section cylindrique ;
une seconde partie de fermeture (20) est également agencée sur la surface externe de la huitième section cylindrique ;
le second élément de fermeture (20) est fixement raccordé au second côté (12-5) du boîtier (12-2) de la troisième boîte d'engrenages par la fixation.

13. Dispositif d'entraînement selon la revendication 12, dans lequel :

une structure à cannelures est agencée sur la surface circonférentielle externe de la seconde extrémité axiale (7-22) de l'axe d'entraînement (7) ;
l'engrenage de sortie (11-1) de la deuxième boîte d'engrenages (11) est prévu avec un trou débouchant d'engrenage de sortie (11-2) et la surface circonférentielle interne du trou débouchant d'engrenage de sortie est prévue avec une structure à cannelures ;
la seconde extrémité axiale de l'axe d'entraînement est montée dans le trou débouchant d'engrenage de sortie de l'engrenage de sortie de la deuxième boîte d'engrenages, et la structure à cannelures de la seconde extrémité axiale de l'axe d'entraînement est montée avec la structure à cannelures du trou débouchant d'engrenage de sortie, et
dans lequel :

une seconde saillie axiale (7-23) s'étendant vers l'extérieur à partir de la seconde extrémité axiale de l'axe d'entraînement ;
un second capuchon d'extrémité axiale (7-24) est fixement monté sur la seconde saillie axiale par le biais d'une fixation et vient en butée contre l'engrenage de sortie de la deuxième boîte d'engrenages.

14. Dispositif d'entraînement selon la revendication 13, dans lequel :

un troisième évidement annulaire (7-25) est agencé sur l'axe d'entraînement (7) adjacent à la seconde extrémité axiale (7-22) de l'axe d'entraînement ;
une neuvième section cylindrique (7-26) est agencée sur l'axe d'entraînement adjacent au troisième évidement annulaire de l'axe d'entraînement ;
un troisième collier (7-27) est agencé sur la surface circonférentielle externe de la neuvième section cylindrique, et le troisième collier est situé entre une partie étendue de l'engrenage de sortie (11-1) de la deuxième boîte d'engrenages (11) et la surface circonférentielle externe de la neuvième section cylindrique ;
un second palier à double rangée de rouleaux (21) est agencé sur la neuvième section cylindrique ;
un cinquième dispositif d'espacement (7-28) est agencé entre la bague interne (21-1) du second palier à double rangée de rouleaux et la partie étendue de l'engrenage de sortie de la deuxième boîte d'engrenages ;
la partie étendue de l'engrenage de sortie de la deuxième boîte d'engrenages vient en butée contre la bague interne du second palier à double rangée de rouleaux par le biais du cinquième dispositif d'espacement.

15. Dispositif d'entraînement selon la revendication 14, dans lequel :

une dixième section cylindrique (7-29) est agencée sur l'axe d'entraînement (7) adjacent à la neuvième section cylindrique (7-26) de l'axe d'entraînement ;
un second ensemble de pignon de marche (22) est monté sur la dixième section cylindrique ;
le second ensemble de pignon de marche comprend une bride de marche (22-1) et un pignon de marche (22-2), dans lequel le pignon de marche est raccordé à la bride de marche par

le biais d'une fixation et correspond aux marches (15) de l'escalier roulant ;
la bride de marche est prévue avec un trou débouchant de bride de marche (22-3) ;
la bride de marche correspond à la structure à cannelures agencée sur la surface circonférentielle externe de la dixième section cylindrique par le biais de la structure à cannelures agencée sur la surface circonférentielle interne du trou débouchant de bride de marche, et
dans lequel :

un quatrième collier (7-30) est également agencé sur la surface circonférentielle externe de la neuvième section cylindrique et le quatrième collier est situé entre la bride de marche et la surface circonférentielle externe de la neuvième section cylindrique ;
un sixième dispositif d'espacement (7-31) est agencé entre la bague interne (21-1) du second palier à double rangée de rouleaux (21) et la bride de marche du second ensemble de pignon de marche ;
la bague interne du second palier à double rangée de rouleaux vient en butée contre la bride de marche du second ensemble de pignon de marche par le biais du sixième dispositif d'espacement.

16. Dispositif d'entraînement selon la revendication 15, dans lequel :

une onzième section cylindrique (7-32) est agencé sur l'axe d'entraînement (7) adjacent à la dixième section cylindrique (7-29) de l'axe d'entraînement ;
un septième dispositif d'espacement annulaire (7-33) est agencé sur la surface circonférentielle externe de la onzième section cylindrique ;
deux paliers à une rangée de rouleaux (16) sont respectivement agencés sur les surfaces circonférentielles externes des deux extrémités axiales du septième dispositif d'espacement ;
une seconde partie de montage de plaque de direction (23) est agencée sur les bagues externes (16-1) des deux paliers à double rangée de rouleaux ;
une seconde plaque de direction (24) est installée sur la seconde partie de montage de plaque de direction par le biais d'un ajustement convexo-concave, et un autre galet mobile de marche des marches d'escalier roulant (15) roule et correspond sur la seconde plaque de direction ;
la bride de marche (22-1) vient en butée contre la bague interne (16-2) de l'un des paliers à une rangée de rouleaux et vient en butée contre le septième dispositif d'espacement (7-33) ;
une seconde butée (7-34) est raccordée à la seconde partie de montage de plaque de direction par le biais d'une fixation et s'étend vers le corps de roulement d'un autre palier à une rangée de rouleaux le long de la direction radiale de la onzième section cylindrique, bloquant ainsi la bague externe de l'autre palier à une rangée de rouleaux dans la direction axiale ;
un second bossage de partie de montage (23-1) est agencé sur la seconde partie de montage de plaque de direction ;
un bossage de dispositif d'espacement (7-33-1) faisant face au second bossage de partie de montage est agencé sur le septième dispositif d'espacement ;
les bagues externes des deux paliers à une rangée de rouleaux viennent respectivement en butée contre les deux extrémités axiales du second bossage de partie de montage ;
les bagues internes des deux paliers à une rangée de rouleaux viennent respectivement en butée contre les deux extrémités axiales du bossage de dispositif d'espacement, et
dans lequel :
le septième dispositif d'espacement vient en butée contre une partie de marche (7-35) formée entre la onzième section cylindrique de l'axe d'entraînement et la huitième section cylindrique (7-20) de l'axe d'entraînement.

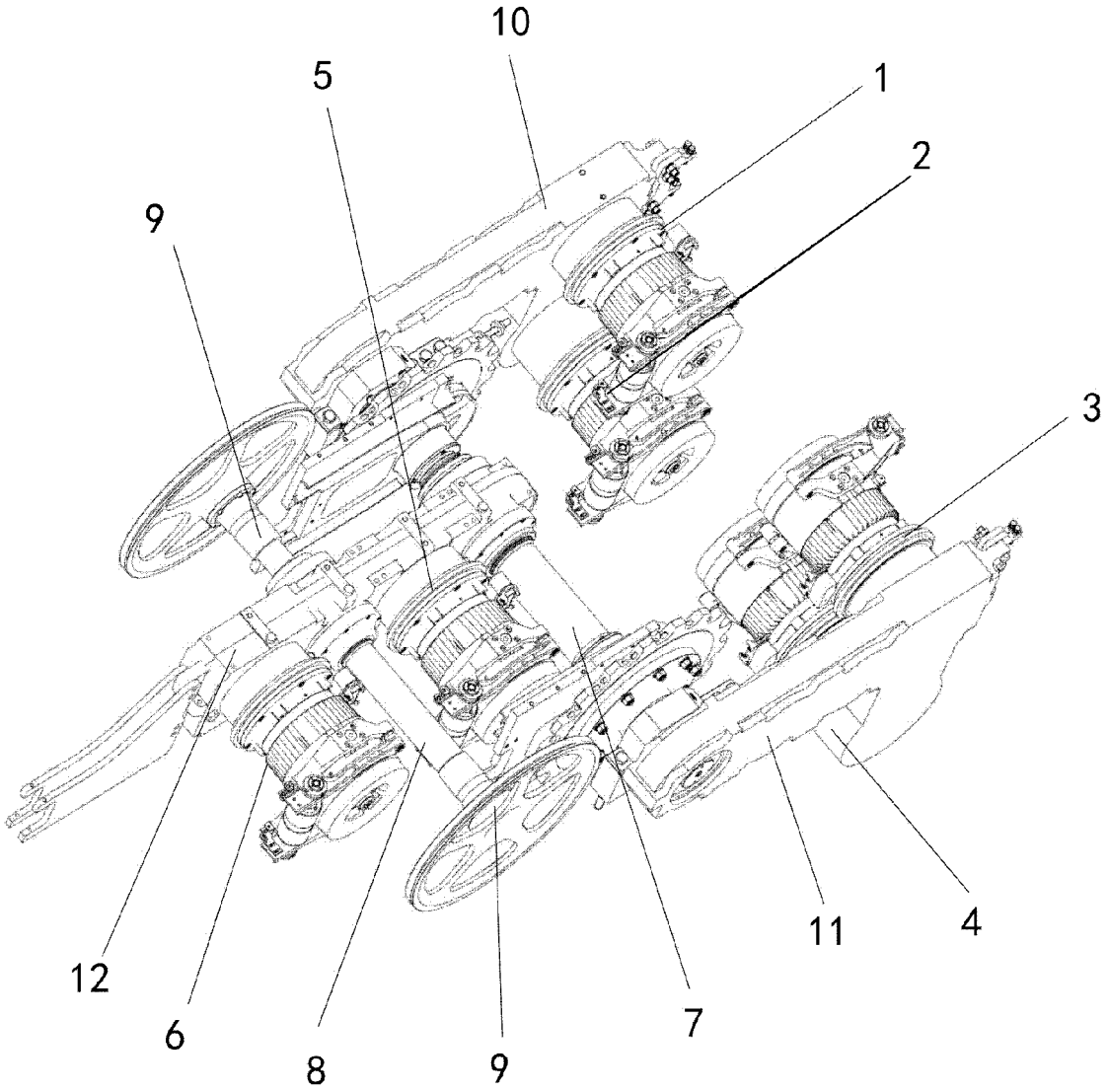

Fig. 1

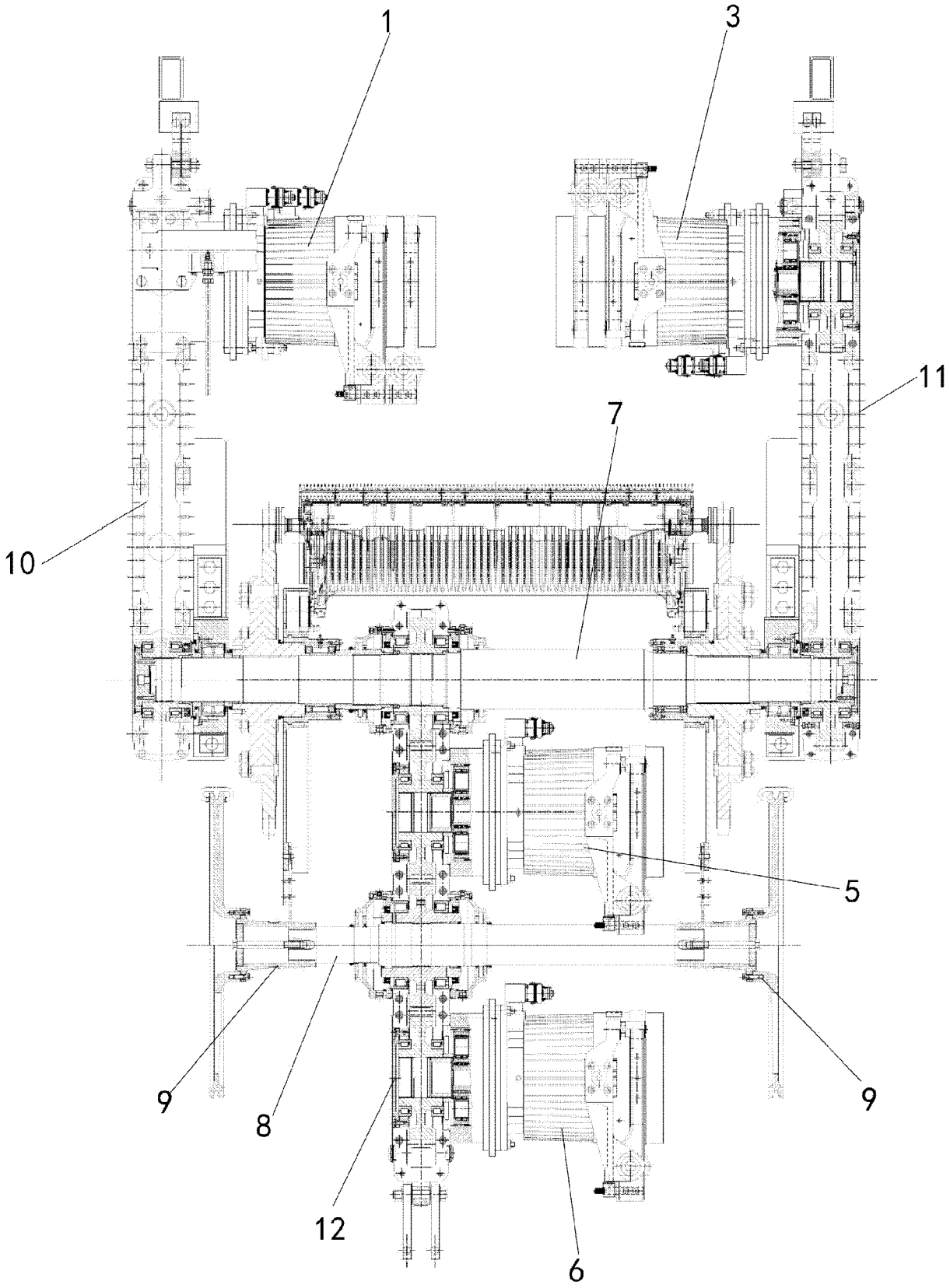

Fig. 2

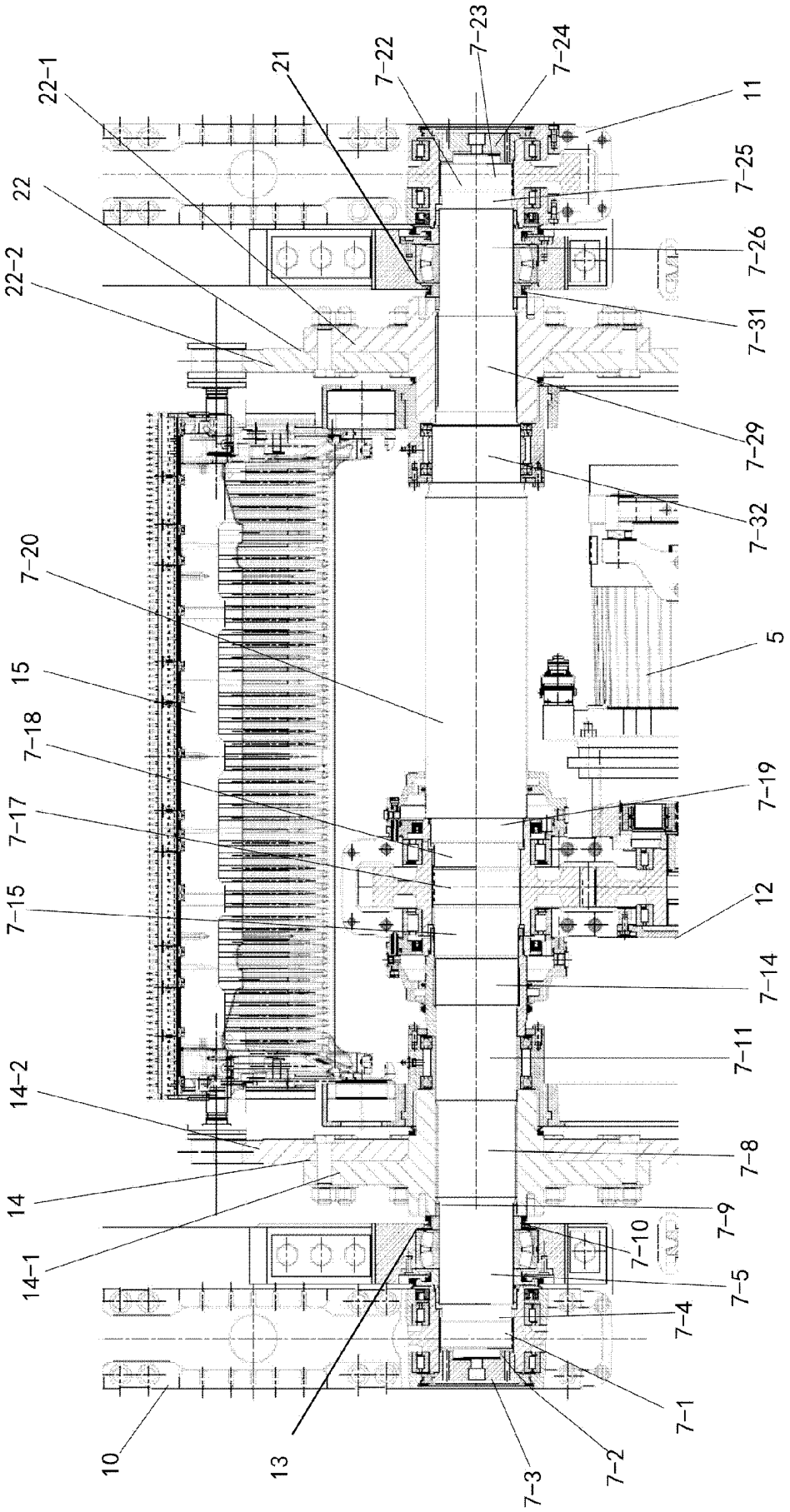
22-1
21
7-22
7-23
7-24
11
22
7-25
7-26
22-2
7-31
7-29
7-32
5
7-20
15
7-18
7-17
7-19
7-15
12
7-14
7-11
14-2
7-8
14
7-9
14-1
7-10
7-5
7-4
7-1
10
13
7-3
7-2

Fig. 3

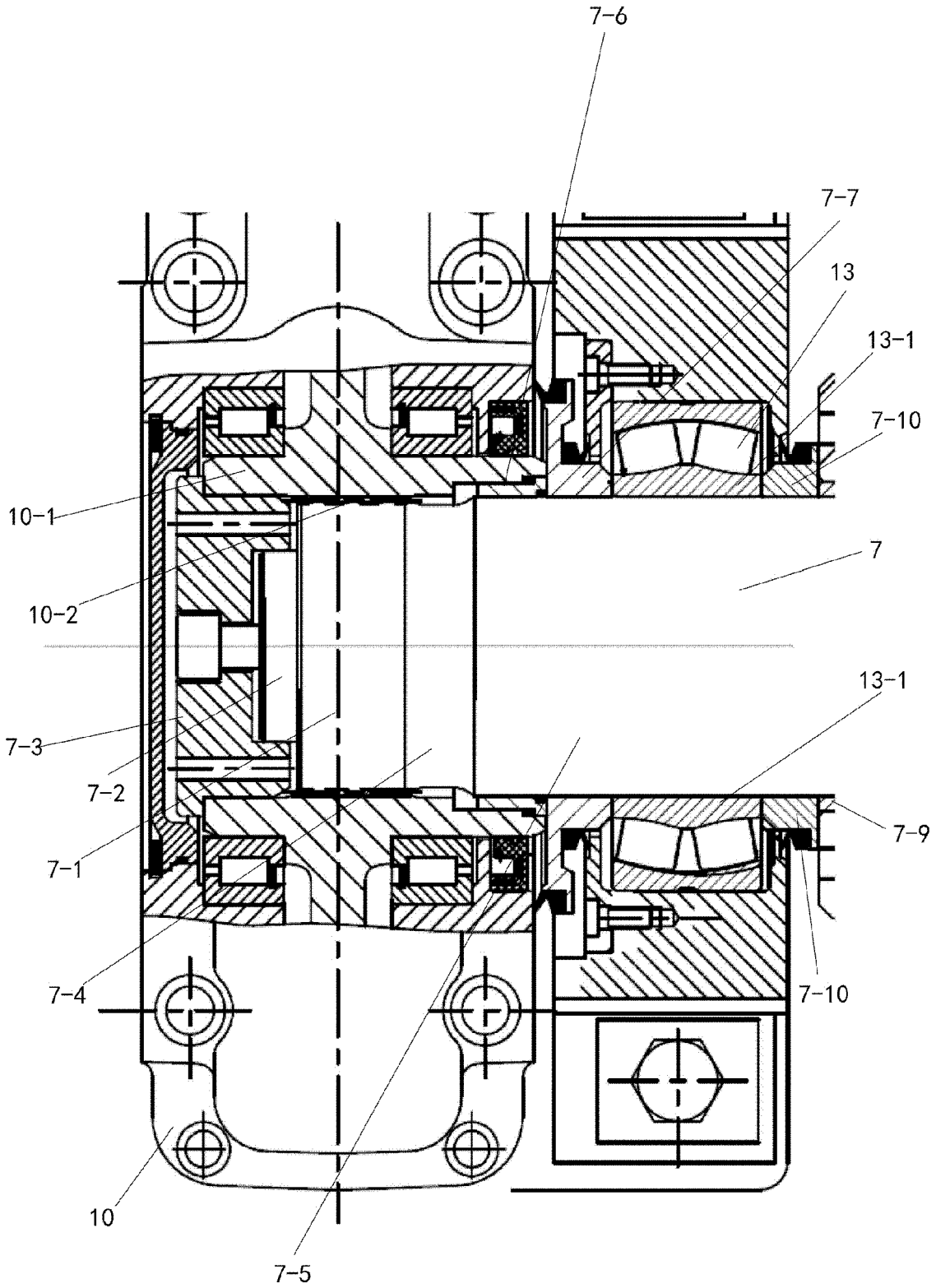

Fig. 4

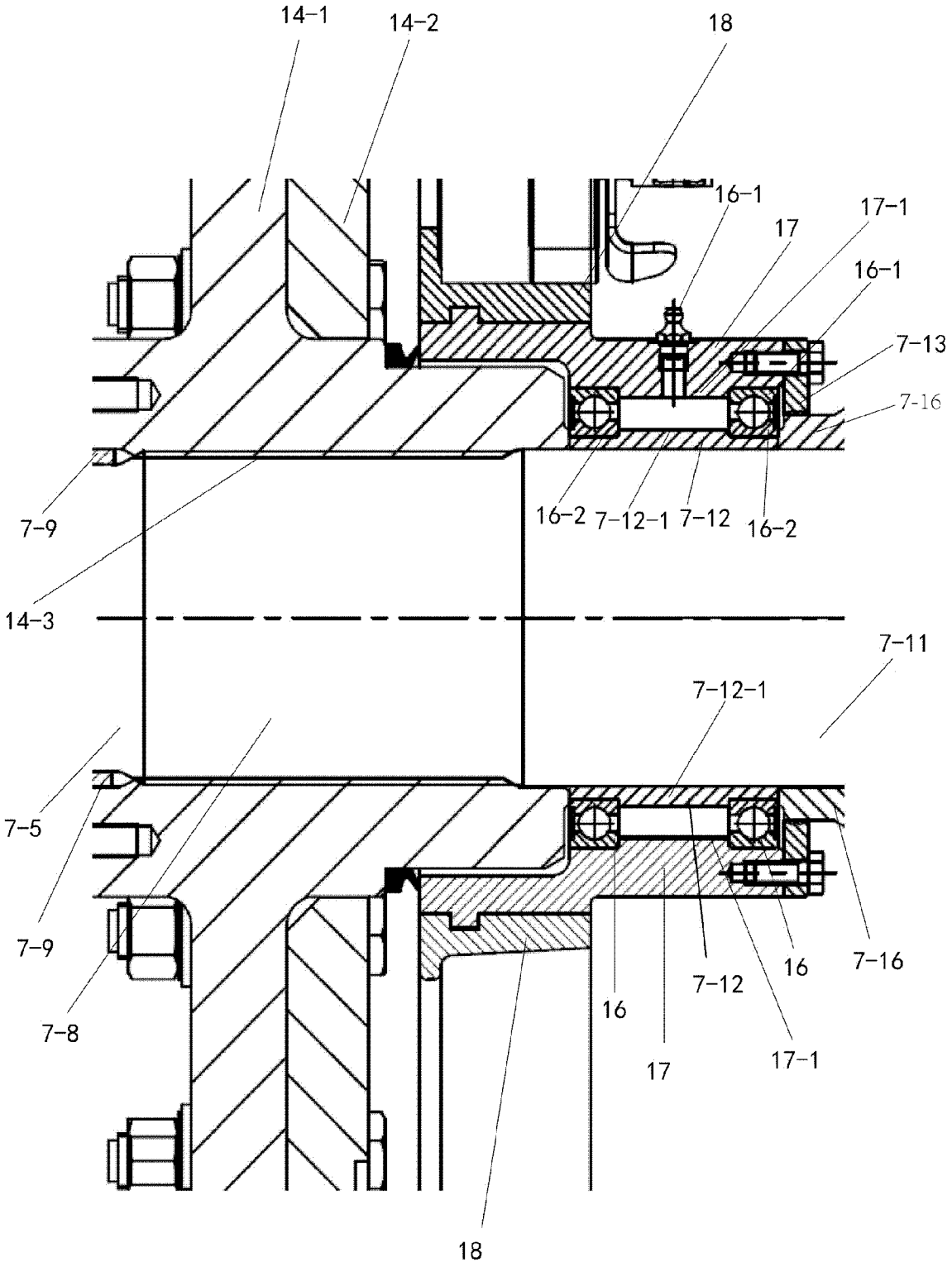
14-1
14-2
18
16-1
17
17-1
16-1
7-13
7-16
7-9
16-2
7-12-1
7-12
16-2
14-3
7-11
7-12-1
7-5
7-9
7-8
16
7-12
16
7-16
17
17-1
18

Fig. 5

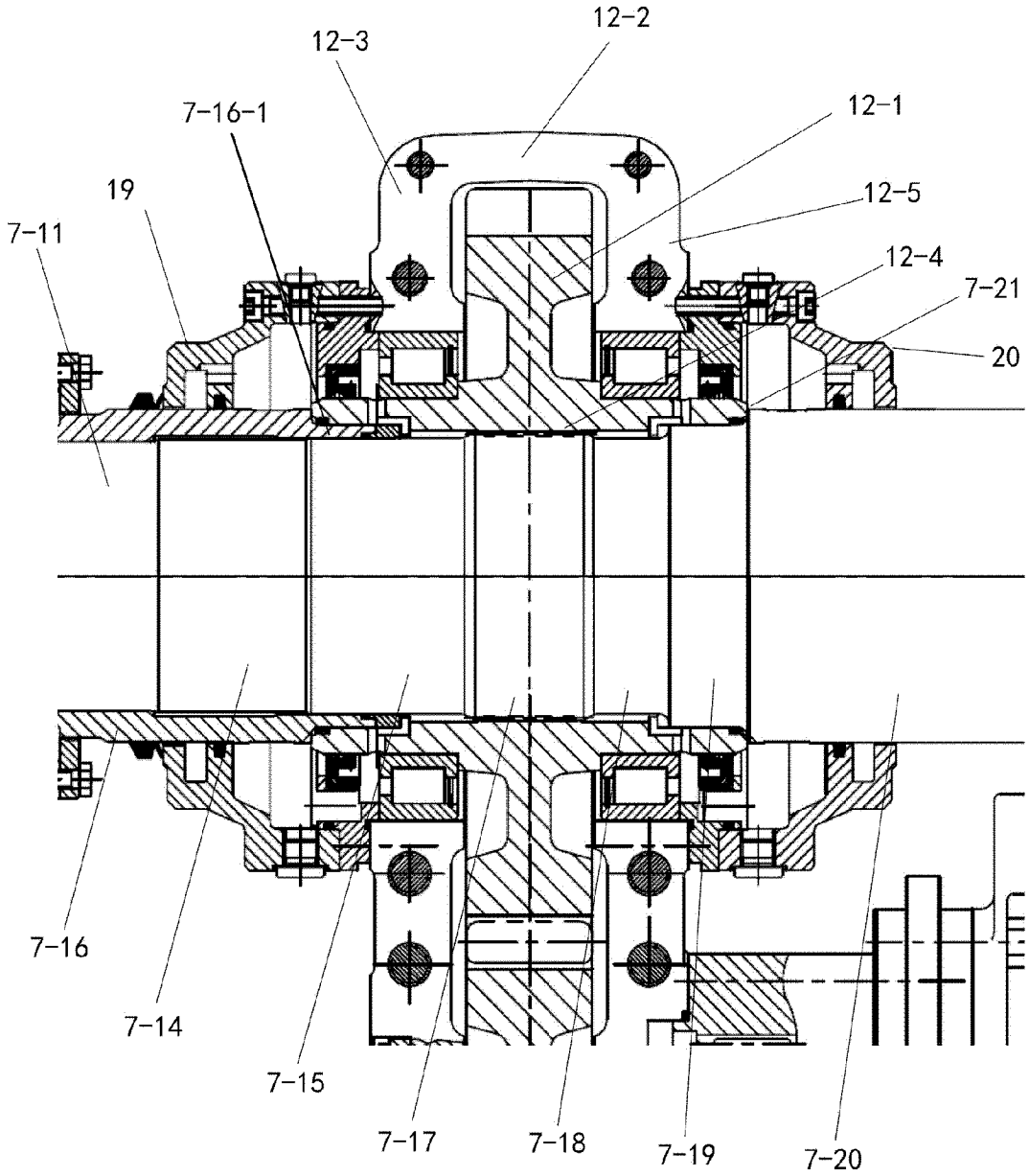
12-2
12-3
7-16-1
12-1
19
12-5
7-11
12-4
7-21
20
7-16
7-14
7-15
7-17
7-18
7-19
7-20

Fig. 6

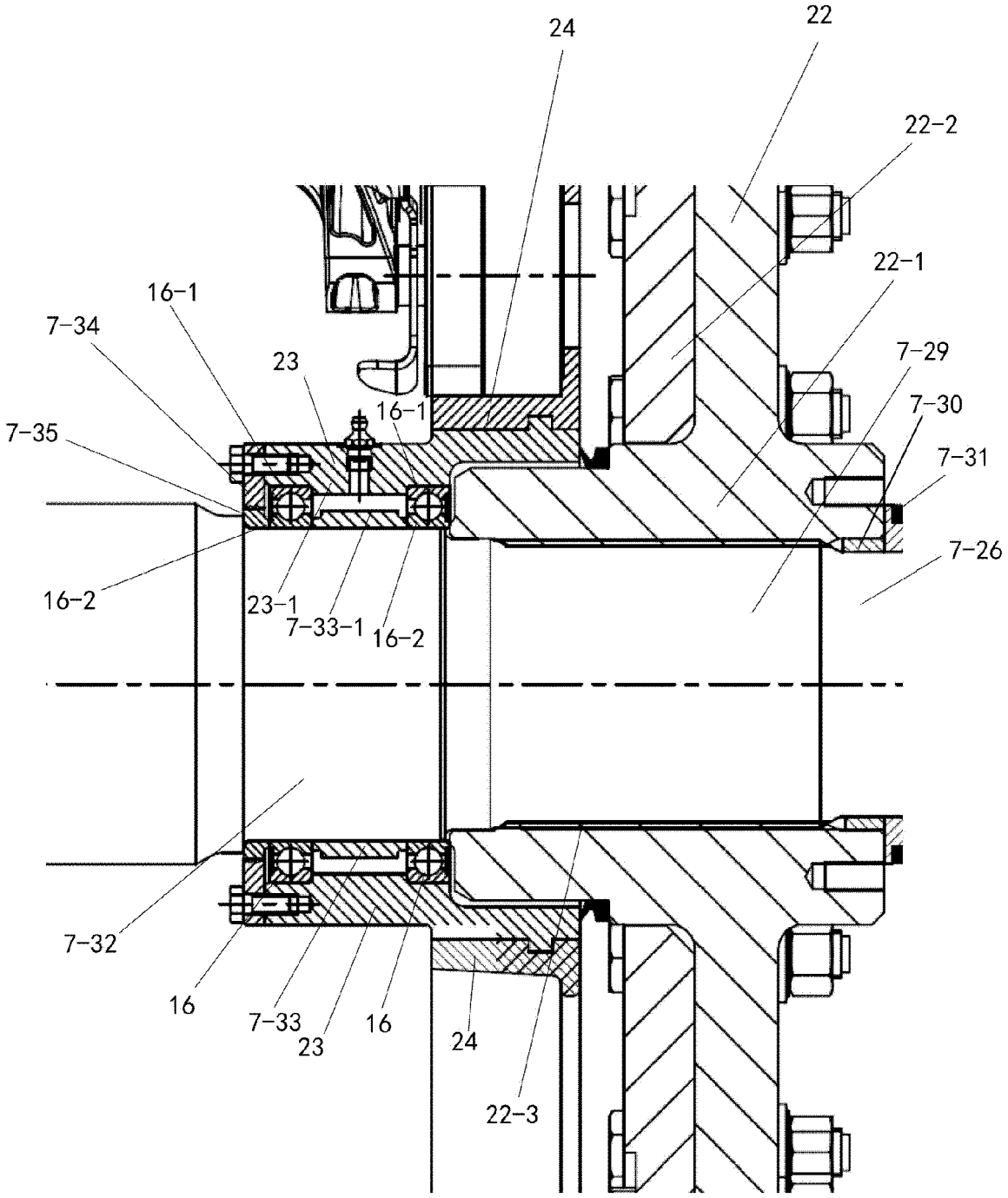
24
22
22-2
22-1
16-1
7-34
23
16-1
7-29
7-30
7-35
7-31
7-26
16-2
23-1
7-33-1
16-2
7-32
16
7-33
23
16
24
22-3

Fig. 7

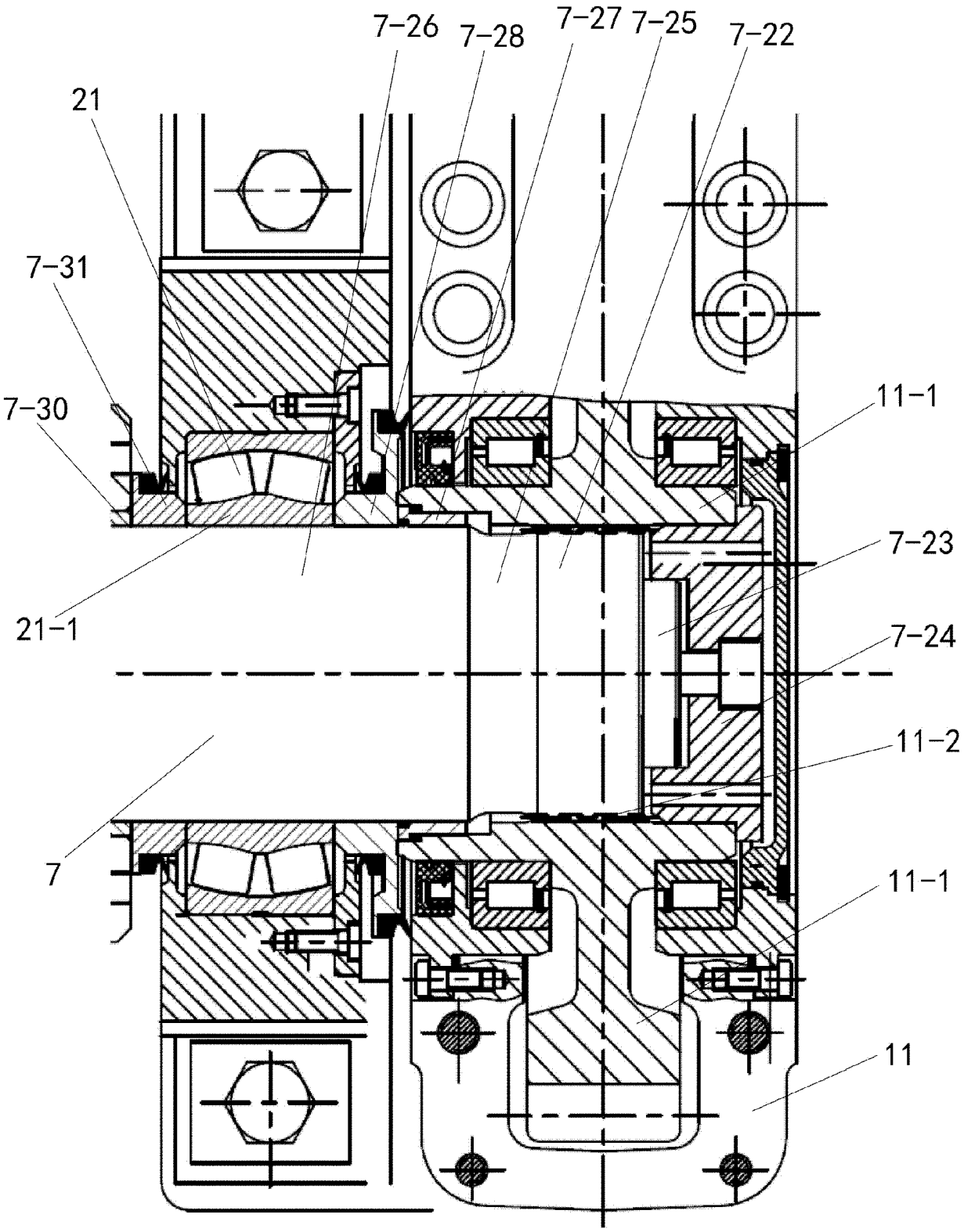

Fig. 8

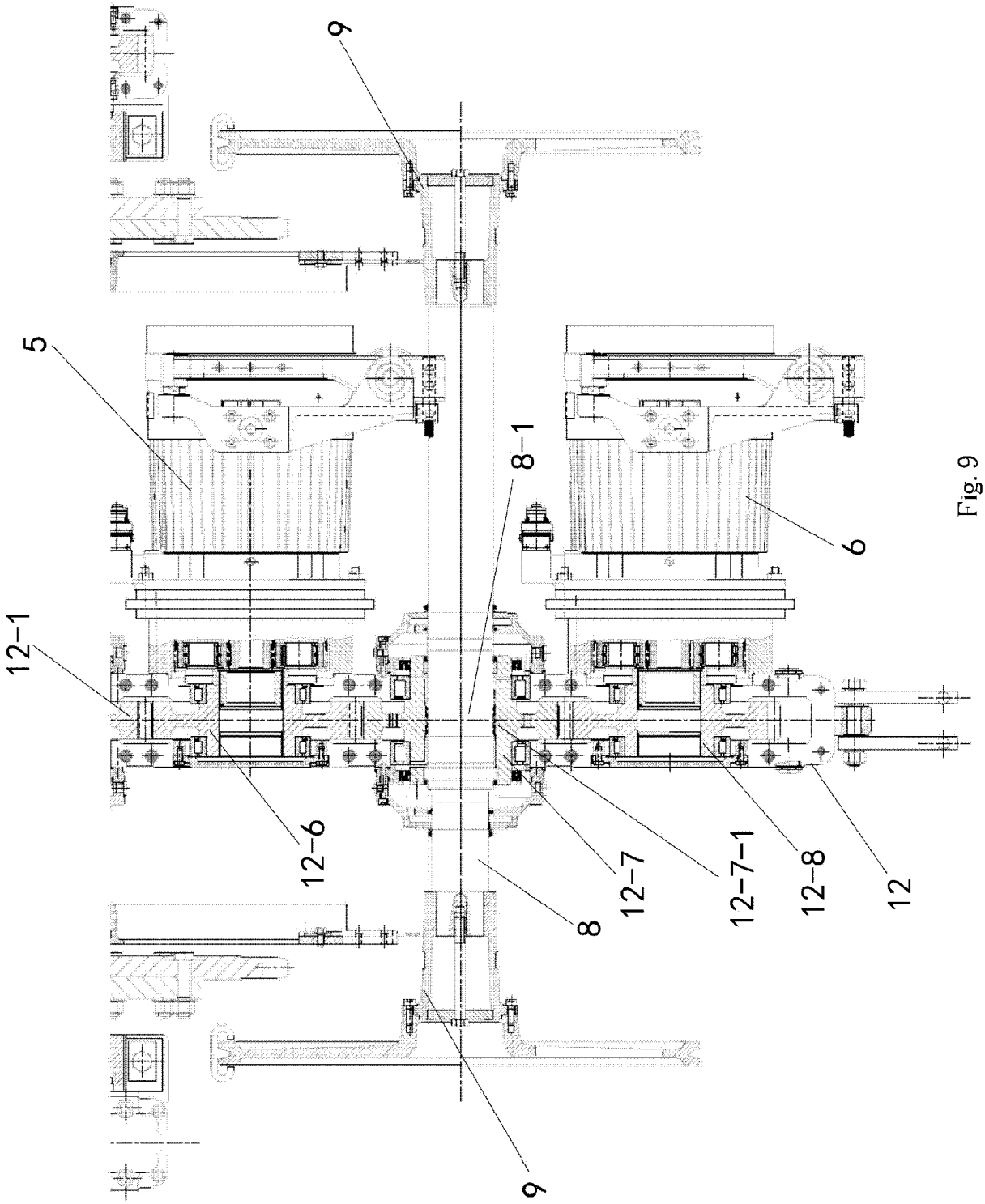

Fig. 9

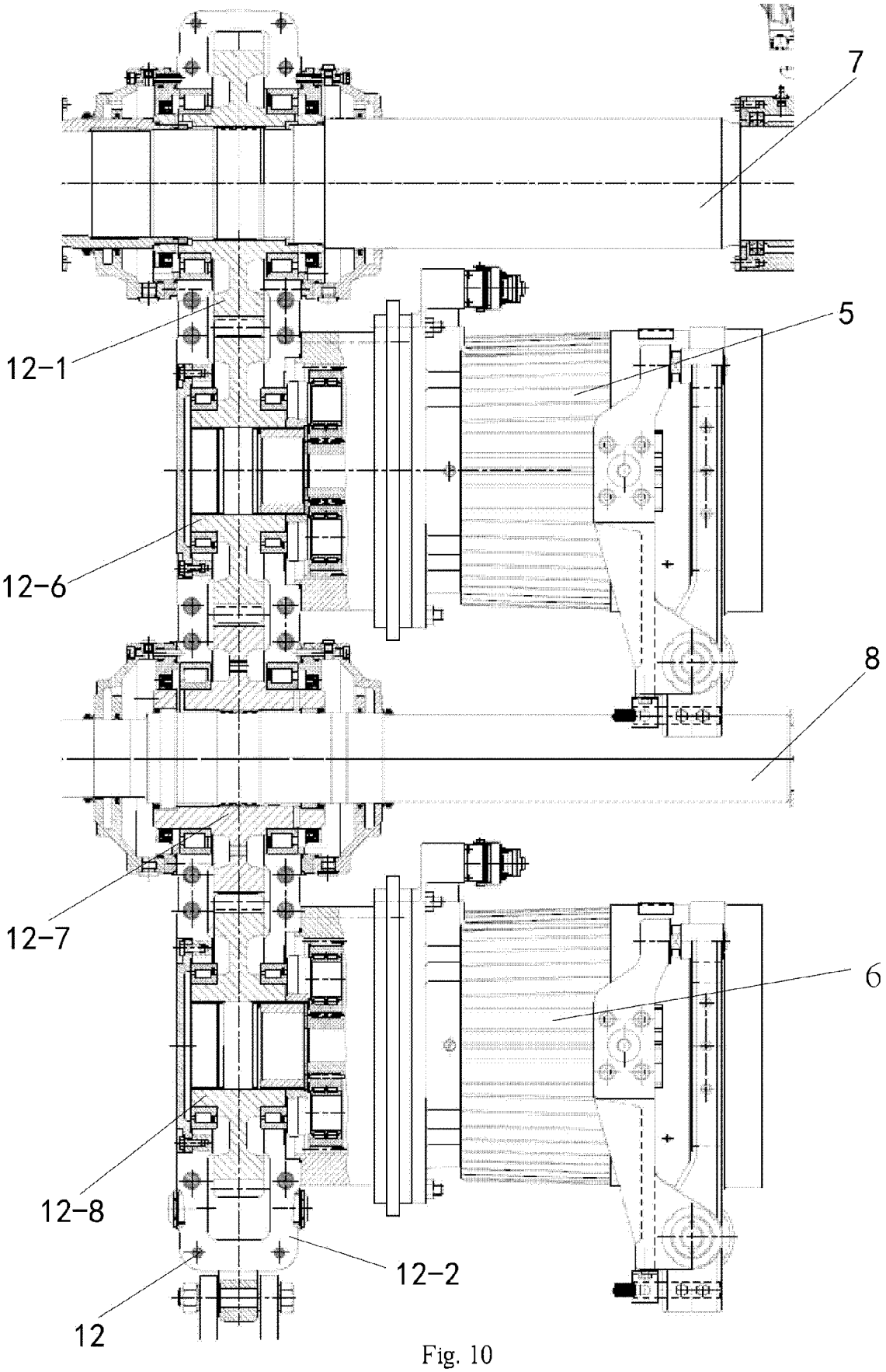

Fig. 10

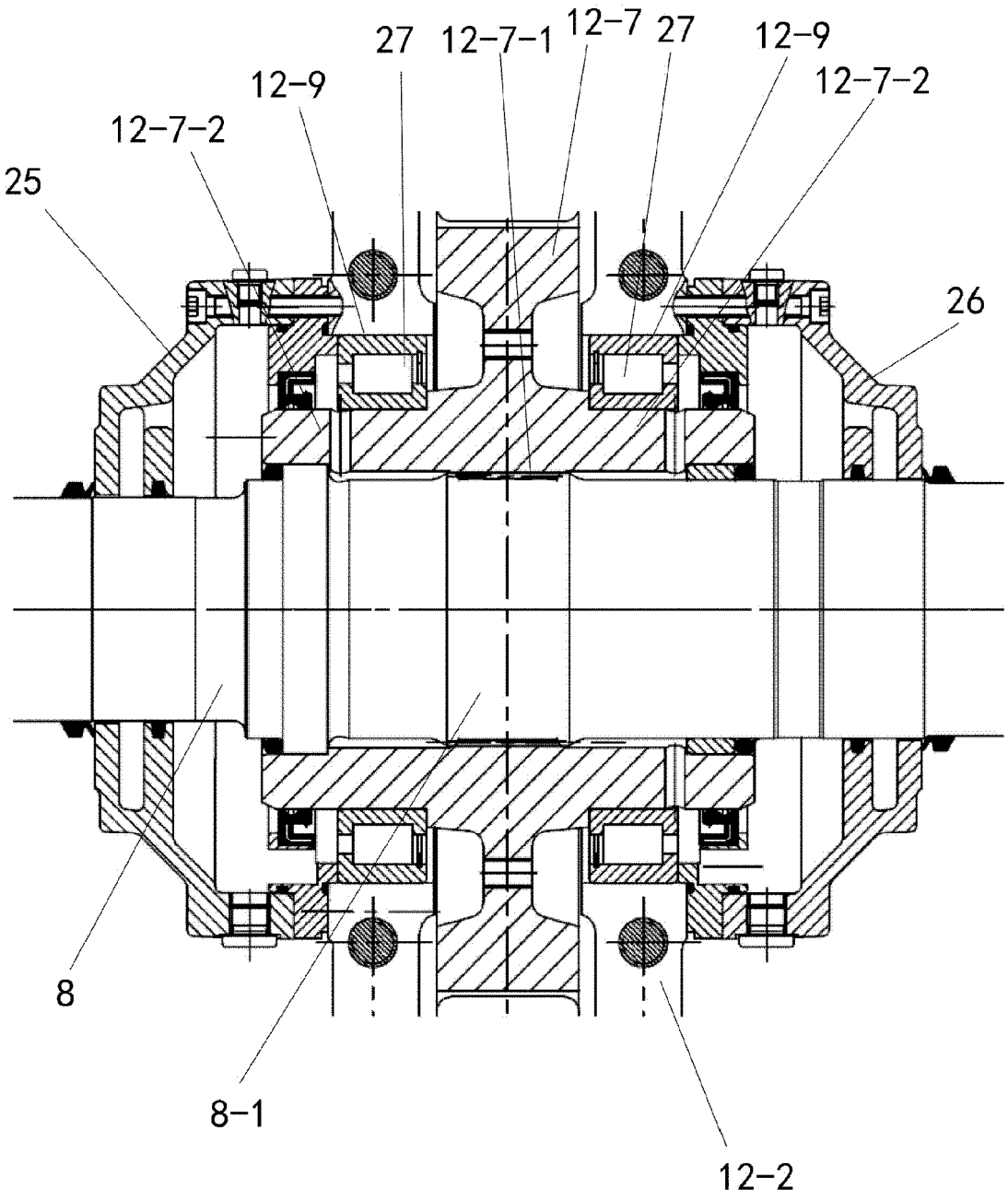

Fig. 11

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

- JP 2000177964 A **[0005]**
- JP 4473359 B **[0005]**
- GB 1445555 A **[0006]**