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(54) A DRIVING DEVICE FOR AN ESCALATOR

(57) A driving device of an escalator, which comprises first, second, third and fourth driving motors, a driving spindle and a handrail belt spindle, wherein the first and second driving motors are connected with a first gear box and drive the driving spindle; the third and fourth driving motors are connected with a second gear box and drive the driving spindle. The driving device further comprises a fifth driving motor and a sixth driving motor. The fifth and sixth driving motors are connected with a third gear box and drive the driving spindle and the handrail belt spindle through the third gear box; the fifth driving motor is arranged between the driving spindle and the handrail belt spindle; the handrail belt spindle is arrange between the fifth and sixth driving motor; the third gearbox is disposed between the first and second gearboxes and is disposed closer to the first gearbox than the second gearbox.

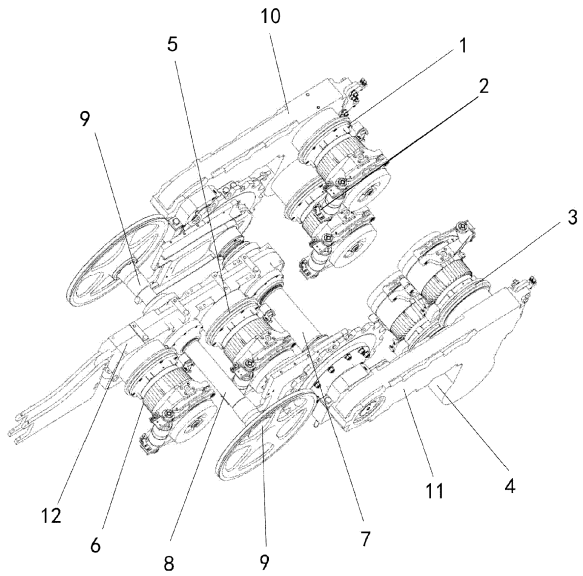

Fig. 1

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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.

SUMMARY OF THE INVENTION

[0005] In order to solve one or more defects in the prior art, according to one aspect of the present disclosure, 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.

[0006] The fifth driving motor and the sixth driving motor are connected with at least one third gear box.

[0007] 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.

[0008] According to the above aspects of the present disclosure, the fifth driving motor is arranged between the driving spindle and the handrail belt spindle.

[0009] The handrail belt spindle is arranged between the fifth driving motor and the sixth driving motor.

[0010] 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.

[0011] According to the above aspects of the present disclosure, 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.

[0012] According to the above aspects of the present disclosure, 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.

[0013] The fifth driving motor drives the first input gear.

[0014] The sixth driving motor drives the second input gear.

[0015] The first input gear is matched with the output gear and the handrail belt spindle gear at the same time.

[0016] The second input gear is matched with the handrail belt spindle gear.

[0017] 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.

[0018] The driving torque of the sixth driving motor is transmitted to the handrail belt spindle through the handrail belt spindle gear.

[0019] According to the above aspects of the present disclosure, a spline structure is arranged on the outer circumferential surface of a part of handrail belt spindle.

[0020] 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.

[0021] 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.

[0022] According to the above aspects of the present disclosure, the handrail belt assembly are arranged on two axial ends of the handrail belt spindle.

[0023] The rotation of the handrail belt spindle drives the handrail belt assembly to move.

[0024] According to the above aspects of the present disclosure, the handrail belt spindle is also provided with a third sealing piece and a fourth sealing piece.

[0025] 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.

[0026] According to the above aspects of the present disclosure, a spline structure is arranged on the outer circumferential surface of the first axial end of the driving spindle.

[0027] 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 pro-

vided with a spline structure.

[0028] 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.

[0029] According to the above aspects of the present disclosure, a first axial protrusion extending outward from the first axial end of the driving spindle.

[0030] 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.

[0031] 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.

[0032] A first cylindrical section is arranged on the driving spindle adjacent to the first annular recess of the driving spindle.

[0033] 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.

[0034] A first double-row roller bearing is arranged on the first cylindrical section.

[0035] 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.

[0036] 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.

[0037] According to the above aspects of the present disclosure, a second cylindrical section is arranged on the driving spindle adjacent to the first cylindrical section of the driving spindle.

[0038] A first step sprocket assembly is fitted on the second cylindrical section.

[0039] 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.

[0040] The step flange is provided with a step flange through hole.

[0041] 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.

[0042] According to the above aspects of the present disclosure, 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.

[0043] A second spacer is arranged between the inner ring of the first double-row roller bearing and the step flange.

[0044] The inner ring of the first double-row roller bearing abuts against the step flange through the second spacer.

[0045] According to the above aspects of the present disclosure, a third cylindrical section is arranged on the driving spindle adjacent to the second cylindrical section of the driving spindle.

[0046] A ring-shaped third spacer is arranged on the outer circumferential surface of the third cylindrical section.

[0047] Two single-row rolling bearings are respectively arranged on the outer circumferential surfaces of the two axial ends of the third spacer.

[0048] A first steering plate mounting part is arranged on the outer rings of the two single-row rolling bearings.

[0049] 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.

[0050] The stepped flange abuts against the inner ring of one of the single-row rolling bearings and abuts against the third spacer.

[0051] 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.

[0052] A first mounting part boss is arranged on the first steering plate mounting part.

[0053] A spacer boss facing the first mounting part boss is arranged on the third spacer.

[0054] The outer rings of the two single-row rolling bearings respectively abut against the two axial ends of the first mounting part boss.

[0055] The inner rings of the two single-row rolling bearings respectively abut against the two axial ends of the spacer boss.

[0056] According to the above aspects of the present disclosure, 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.

[0057] A fourth spacer in the shape of a ring is arranged on an outer circumferential surface of the fourth cylindrical section.

[0058] A first axial end of the fourth spacer is fitted on the third cylindrical section.

[0059] A second axial end of the fourth spacer is fitted on the fifth cylindrical section.

[0060] According to the above aspects of the present disclosure, the inner ring of the other single-row rolling bearing and the third spacer abut against the first axial end of the fourth spacer.

[0061] The output gear of the third gear box abuts against a step portion provided on the second axial end of the fourth spacer.

[0062] A first closing part is also arranged on the outer

surface of the fourth spacer.

[0063] The first closing member is fixedly connected to the first side of the housing of the third gear box by fastener.

[0064] According to the above aspects of the present disclosure, a sixth cylindrical section is arranged on the driving spindle adjacent to the fifth cylindrical section of the driving spindle.

[0065] A spline structure is arranged on the outer circumferential surface of the sixth cylindrical section.

[0066] 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.

[0067] The sixth cylindrical section of the driving spindle is splined in the output gear through hole of the output gear of the third gearbox.

[0068] According to the above aspects of the present disclosure, a second annular recess is arranged on the driving spindle adjacent to the sixth cylindrical section of the driving spindle.

[0069] 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.

[0070] 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.

[0071] A second closing part is also arranged on the outer surface of the eighth cylindrical section.

[0072] The second closing member is fixedly connected to the second side of the housing of the third gear box by fastener.

[0073] According to the above aspects of the present disclosure, a spline structure is arranged on the outer circumferential surface of the second axial end of the driving spindle.

[0074] 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.

[0075] 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.

[0076] According to the above aspects of the present disclosure, a second axial protrusion extending outward from the second axial end of the driving spindle.

[0077] 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.

[0078] According to the above aspects of the present disclosure, a third annular recess is arranged on the driving spindle adjacent to the second axial end of the driving spindle.

[0079] A ninth cylindrical section is arranged on the driving spindle adjacent to the third annular recess of the driving spindle.

[0080] 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.

[0081] A second double-row roller bearing is arranged on the ninth cylindrical section.

[0082] 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.

[0083] 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. According to the above aspects of the present disclosure, a tenth cylindrical section is arranged on the driving spindle adjacent to the ninth cylindrical section of the driving spindle.

[0084] A second step sprocket assembly is fitted on the tenth cylindrical section.

[0085] 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.

[0086] The step flange is provided with a step flange through hole.

[0087] 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.

[0088] According to the above aspects of the present disclosure, 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.

[0089] 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.

[0090] 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.

[0091] According to the above aspects of the present disclosure, an eleventh cylindrical section is arranged on the driving spindle adjacent to the tenth cylindrical section of the driving spindle.

[0092] An annular seventh spacer is arranged on the outer circumferential surface of the eleventh cylindrical section.

[0093] Two single-row rolling bearings are respectively arranged on the outer circumferential surfaces of the two axial ends of the seventh spacer.

[0094] A second steering plate mounting part is arranged on the outer rings of the two single-row rolling bearings.

[0095] 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.

[0096] The stepped flange abuts against the inner ring of one of the single-row rolling bearings and abuts against the seventh spacer.

[0097] 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.

[0098] A second mounting part boss is arranged on the second steering plate mounting part.

[0099] A spacer boss facing the second mounting part boss is arranged on the seventh spacer.

[0100] The outer rings of the two single-row rolling bearings respectively abut against the two axial ends of the second mounting part boss.

[0101] The inner rings of the two single-row rolling bearings respectively abut against the two axial ends of the spacer boss.

[0102] According to the above aspects of the present disclosure, 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.

[0103] According to the above aspects of the present disclosure, the first driving motor and the second driving motor are connected with the first gear box through a gear transmission mechanism.

[0104] The third driving motor and the fourth driving motor are connected with the second gear box through a gear transmission mechanism.

[0105] The fifth driving motor and the sixth driving motor are connected with said at least one third gear box through a gear transmission mechanism.

[0106] According to the technical scheme of the present disclosure, 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.

[0107] 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.

[0108] 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.

[0109] 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.

[0110] 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.

[0111] 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. Therefore, it is important that the appended claims should be regarded as including such equivalent structures as long as they do not exceed the spirit and scope of this disclosure.

BRIEF DESCRIPTION OF DRAWINGS

[0112] 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

[0113] The following is a detailed explanation of the specific implementation according to the disclosed content, combined with various drawings.

[0114] 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 respective planetary gear trains (not shown). The third driv-

ing motor and the fourth driving motor are connected to a second gearbox 11 through their respective planetary gear trains.

[0115] Technicians in this field can understand that each planetary gear train can also be set in corresponding gearboxes.

[0116] 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.

[0117] 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.

[0118] As shown in figs. 1 and 2, the driving device further includes a fifth driving motor 5 and a sixth driving motor 6.

[0119] The fifth driving motor 5 and the sixth driving motor 6 are connected with the third gear box 12 through respective planetary gear trains.

[0120] 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.

[0121] The fifth driving motor 5 is arranged between the driving spindle 7 and the handrail belt spindle 8.

[0122] The handrail belt spindle 8 is arranged between the fifth driving motor 5 and the sixth driving motor 6.

[0123] 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.

[0124] The driving spindle 7 and the handrail spindle 8 are arranged in parallel with each other.

[0125] 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.

[0126] Fig. 1 also shows six braking devices acting on the first to sixth driving motors respectively.

[0127] 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.

[0128] 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.

[0129] 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.

[0130] 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.

[0131] 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.

[0132] 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.

[0133] 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.

[0134] 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.

[0135] 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.

[0136] A first double-row roller bearing 13 is provided on the first cylindrical section 7-5.

[0137] 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.

[0138] 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.

[0139] 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.

[0140] A first step sprocket assembly 14 is fitted on the second cylindrical section 7-8.

[0141] 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.

[0142] The step flange 14-1 has a step flange through hole 14-3.

[0143] 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.

[0144] 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.

[0145] 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.

[0146] 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.

[0147] 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.

[0148] An annular third spacer 7-12 is provided on an outer circumferential surface of the third cylindrical section 7-11.

[0149] 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.

[0150] A first steering plate mounting portion 17 is provided on the outer ring 16-1 of the two single-row rolling bearings 16.

[0151] 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.

[0152] 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.

[0153] 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.

[0154] 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.

[0155] 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.

[0156] The third spacer 7-12 is provided with a spacer boss 7-12-1 facing the first mounting boss 17-1.

[0157] 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.

[0158] 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.

[0159] 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.

[0160] On the outer circumferential surface of the fourth cylindrical section 7-14, a ring-shaped fourth spacer 7-16 is provided.

[0161] As shown in fig. 5, the first axial end of the fourth spacer 7-16 is fitted on the third cylindrical section 7-11.

[0162] A second axial end of the fourth spacer 7-16 is fitted on the fifth cylindrical section 7-15.

[0163] 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.

[0164] 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.

[0165] A first closing member 19 is also provided on the outer surface of the fourth spacer 7-16.

[0166] 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.

[0167] 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.

[0168] A spline structure is provided on an outer circumferential surface of the sixth cylindrical section 7-17.

[0169] 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.

[0170] 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.

[0171] 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.

[0172] 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.

[0173] 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.

[0174] A second closing member 20 is also provided on the outer surface of the eighth cylindrical section 7-20.

[0175] 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.

[0176] 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.

[0177] 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.

[0178] 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.

[0179] 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.

[0180] 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.

[0181] 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.

[0182] 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.

[0183] 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.

[0184] 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.

[0185] A second double-row roller bearing 21 is arranged on the ninth cylindrical section 7-26.

[0186] 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.

[0187] 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.

[0188] 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.

[0189] 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.

[0190] A second step sprocket assembly 22 is fitted on the tenth cylindrical section 7-29.

[0191] 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.

[0192] The step flange 22-1 has a step flange through hole 22-3.

[0193] 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.

[0194] 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.

[0195] 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.

[0196] 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.

[0197] 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.

[0198] An annular seventh spacer 7-33 is provided on the outer circumferential surface of the eleventh cylindrical section 7-32.

[0199] 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.

[0200] A second steering plate mounting portion 23 is provided on the outer ring 16-1 of the two single-row rolling bearings 16.

[0201] 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.

[0202] 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.

[0203] 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.

[0204] 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.

[0205] The second steering plate mounting portion 23 is provided with a second mounting portion boss 23-1.

[0206] The seventh spacer 7-33 is provided with a spacer boss 7-33-1 facing the second mounting boss 23-1.

[0207] 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.

[0208] 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.

[0209] 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.

[0210] 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.

[0211] 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).

[0212] 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).

[0213] The first input gear 12-6 is simultaneously matched with the output gear 12-1 and the handrail belt spindle gear 12-7.

[0214] The second input gear 12-8 is engaged with the handrail belt spindle gear 12-7.

[0215] 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.

[0216] 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.

[0217] 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.

[0218] 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.

[0219] 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.

[0220] 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.

[0221] The rotation of the handrail belt spindle 8 drives the handrail assemblies 9 to move.

[0222] 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.

[0223] 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.

[0224] 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.

[0225] 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.

[0226] 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.

[0227] 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.

[0228] The foregoing disclosure provides illustration and description, but is not intended to be exhaustive or to limit the embodiments to the precise forms disclosed. Modifications and variations are possible in light of the above disclosure, or may be acquired from practice of the embodiments.

[0229] Even if specific combinations of features are recited in the claims and/or disclosed in the specification, these combinations are not intended to limit the disclosure of various embodiments. In fact, many of these features can be combined in ways not specifically recited in the claims and/or not specifically disclosed in the specification. Although each dependent claim listed below may directly depend on only one claim, the disclosure of various embodiments includes each dependent claim in combination with every other claim in the claim set.

Claims

1. A driving device for escalators, 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;
the fifth driving motor and the sixth driving motor are connected with at least one third gear box;
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 is arranged between the driving spindle and the handrail belt spindle;
the handrail belt spindle is arranged between the fifth driving motor and the sixth driving motor;
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; and wherein,
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; and wherein,
the first driving motor and the second driving motor are connected with the first gear box through a gear transmission mechanism;
the third driving motor and the fourth driving motor are connected with the second gear box through a gear transmission mechanism;
the fifth driving motor and the sixth driving motor are connected with said at least one third gear box through a gear transmission mechanism.

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

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;
the fifth driving motor drives the first input gear;
the sixth driving motor 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 through the input gear and to the handrail belt spindle 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 of handrail belt spindle;
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;
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 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 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 of the driving spindle;
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;
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 extending outward from the first axial end of the driving spindle;
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, and wherein,
a first annular recess is arranged on the driving spindle adjacent to the first axial end of the driving spindle;
a first cylindrical section is arranged on the driving spindle adjacent to the first annular recess of the driving spindle;
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;
a first double-row roller bearing is arranged on the first cylindrical section;
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;
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 is arranged on the driving spindle adjacent to the first cylindrical section of the driving spindle;
a first step sprocket assembly is fitted on the second cylindrical section;
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;
the step flange is provided with a step flange through hole;
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 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;
a second spacer is arranged between the inner ring of the first double-row roller bearing 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 is arranged on the driving spindle adjacent to the second cylindrical section of the driving spindle;
a ring-shaped third spacer is arranged on the outer circumferential surface of the third cylindrical section;
two single-row rolling bearings are respectively arranged on the outer circumferential surfaces of the two axial ends of the third spacer;
a first steering plate mounting part is arranged on the outer rings of the two single-row rolling bearings;
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;
the stepped flange abuts against the inner ring of one of the single-row rolling bearings and abuts against the third spacer;
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;
a first mounting part boss is arranged on the first steering plate mounting part; a spacer boss 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 and a fifth cylindrical section are sequentially arranged on the driving spindle adjacent to the third cylindrical section of the driving spindle;
a fourth spacer 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 of the other single-row rolling bearing and the third spacer abut against the first axial end of the fourth spacer;
the output gear of the third gear box abuts against a step portion provided on the second axial end of the fourth spacer;
a first closing part is also arranged on the outer surface of the fourth spacer; the first closing member is fixedly connected to the first side of the housing of the third gear box by fastener, and
wherein,
a sixth cylindrical section is arranged on the driving spindle 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, 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 is arranged on the driving spindle adjacent to the sixth cylindrical section of the driving spindle;
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;
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;
a second closing part is also arranged on the outer surface of the eighth cylindrical section;
the second closing member is fixedly connected to the second side of the housing 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 of the driving spindle;
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;
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 extending outward from the second axial end of the driving spindle;
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.

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

a third annular recess is arranged on the driving spindle adjacent to the second axial end of the driving spindle;
a ninth cylindrical section is arranged on the driving spindle adjacent to the third annular recess of the driving spindle;
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;
a second double-row roller bearing is arranged on the ninth cylindrical section; 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;
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 is arranged on the driving spindle adjacent to the ninth cylindrical section of the driving spindle;
a second step sprocket assembly is fitted on the tenth cylindrical section;
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;
the step flange is provided with a step flange through hole;
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 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 is arranged between the inner ring of the second double-row roller bearing 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 is arranged on the driving spindle adjacent to the tenth cylindrical section of the driving spindle;
an annular seventh spacer is arranged on the outer circumferential surface of the eleventh cylindrical section;
two single-row rolling bearings are respectively arranged on the outer circumferential surfaces of the two axial ends of the seventh spacer;
a second steering plate mounting part is arranged on the outer rings of the two single-row rolling bearings;
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;
the stepped flange abuts against the inner ring of one of the single-row rolling bearings and abuts against the seventh spacer;
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;
a second mounting part boss is arranged on the second steering plate mounting part;
a spacer boss 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 formed between the eleventh cylindrical section of the driving spindle and the eighth cylindrical section of the driving spindle.

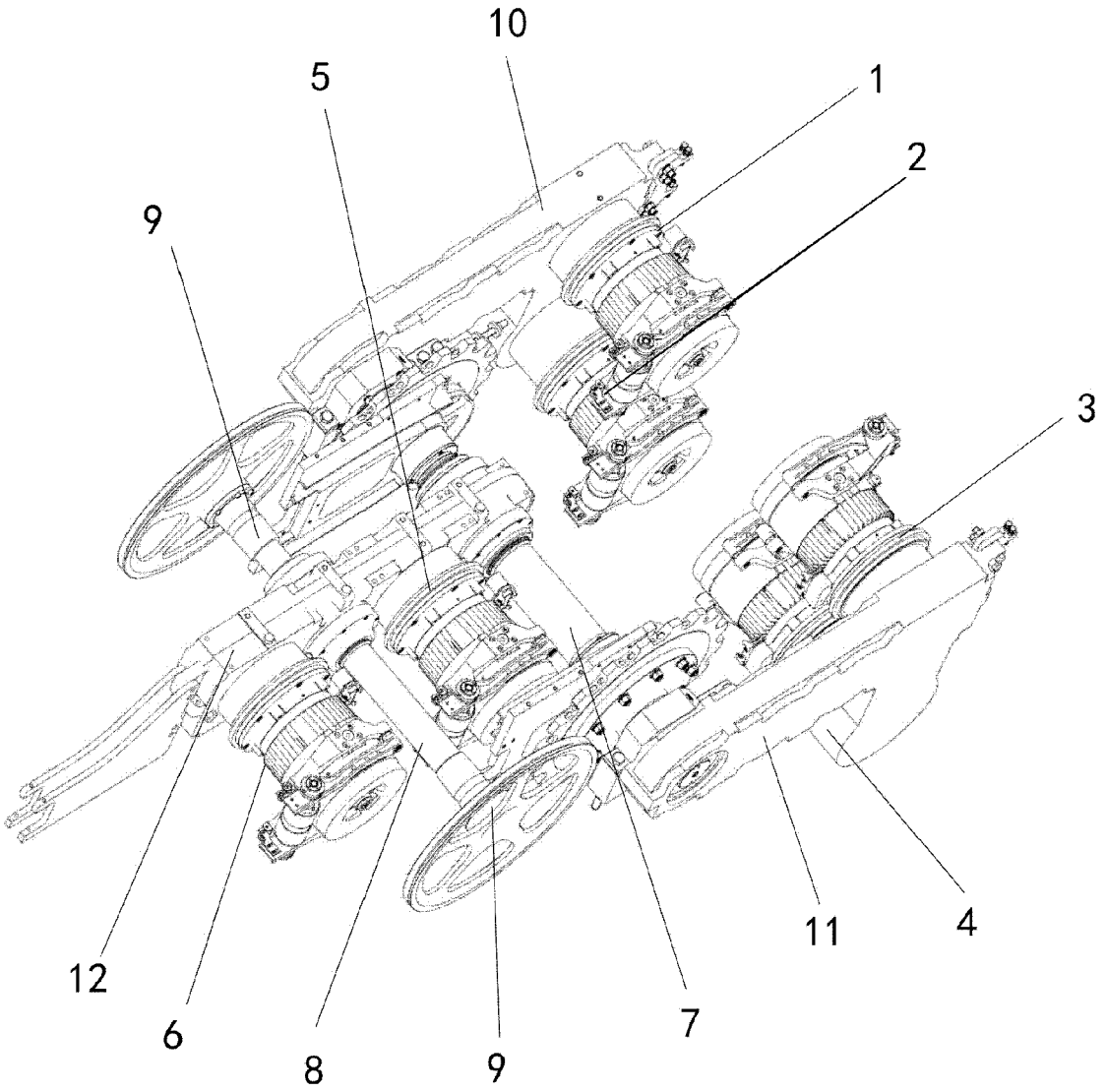

Fig. 1

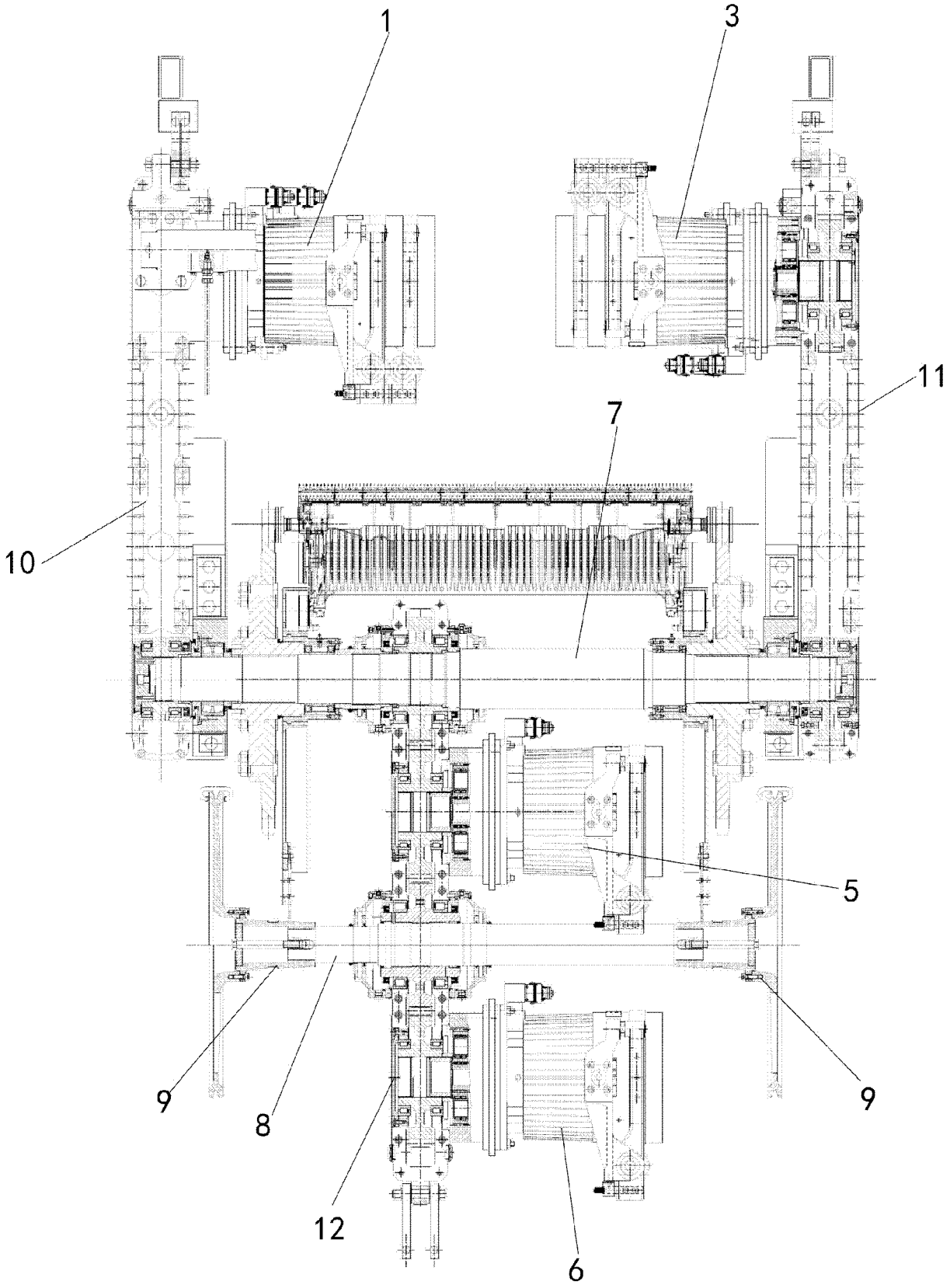

Fig. 2

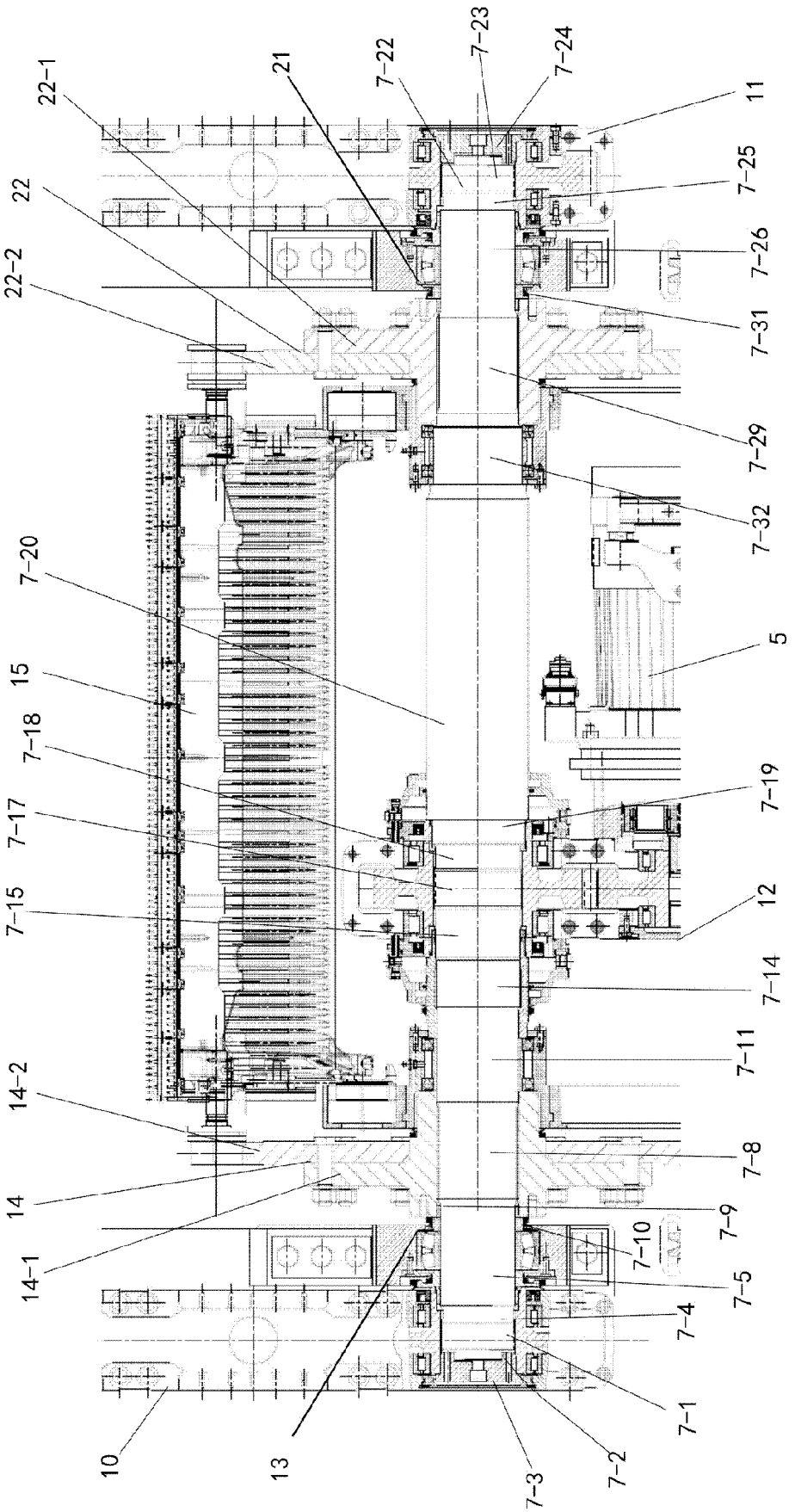
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Fig. 3

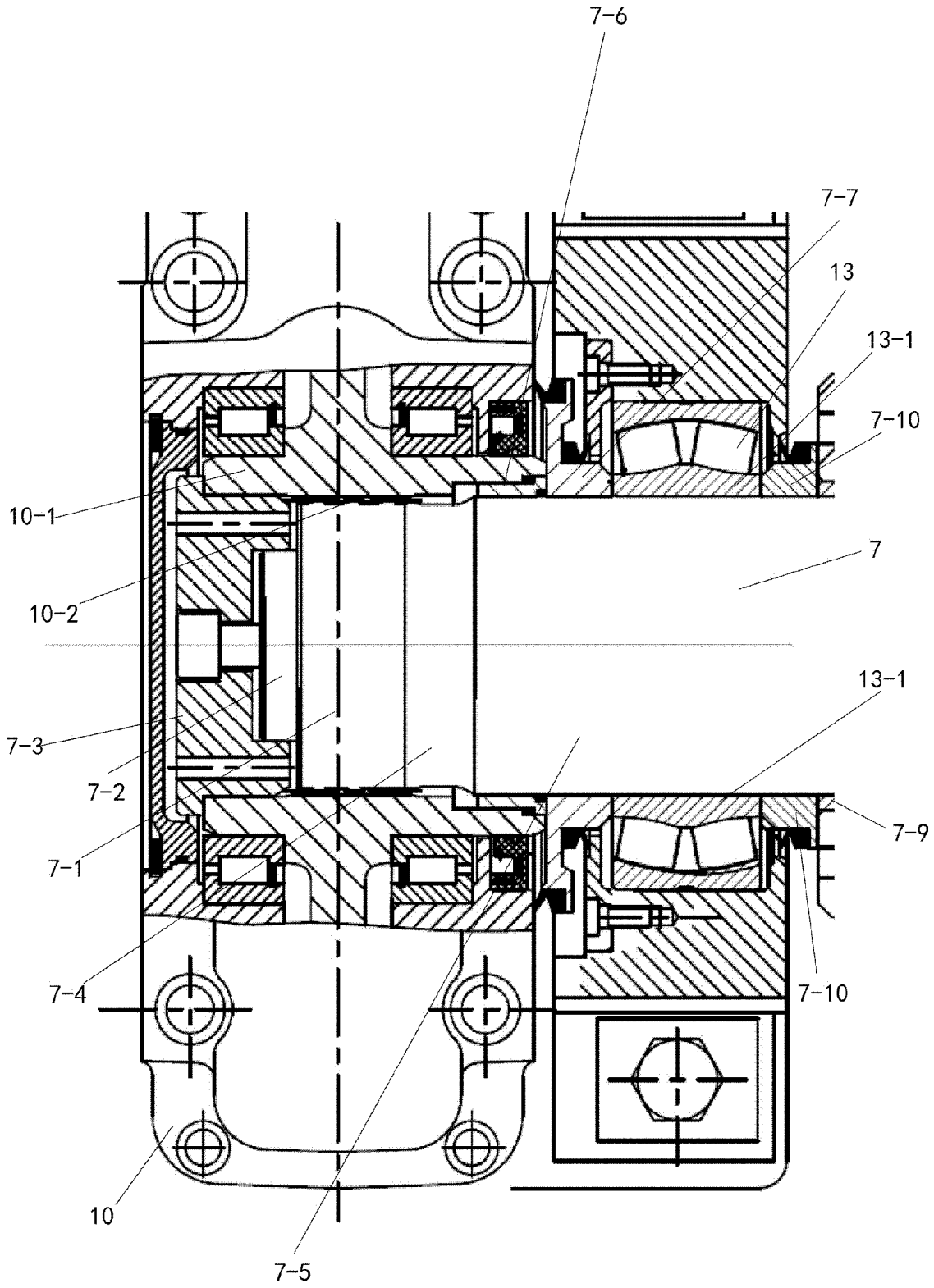

Fig. 4

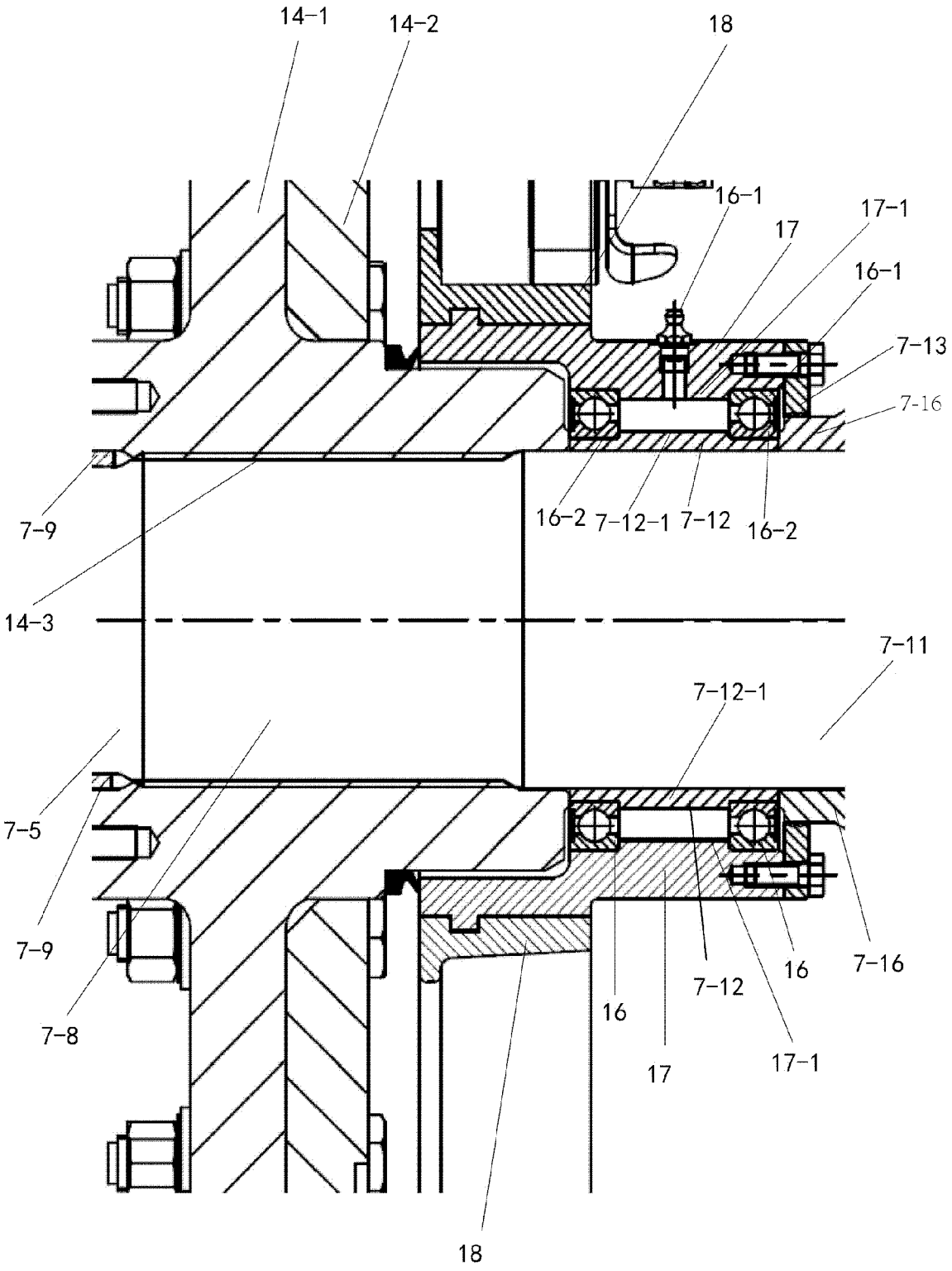
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Fig. 5

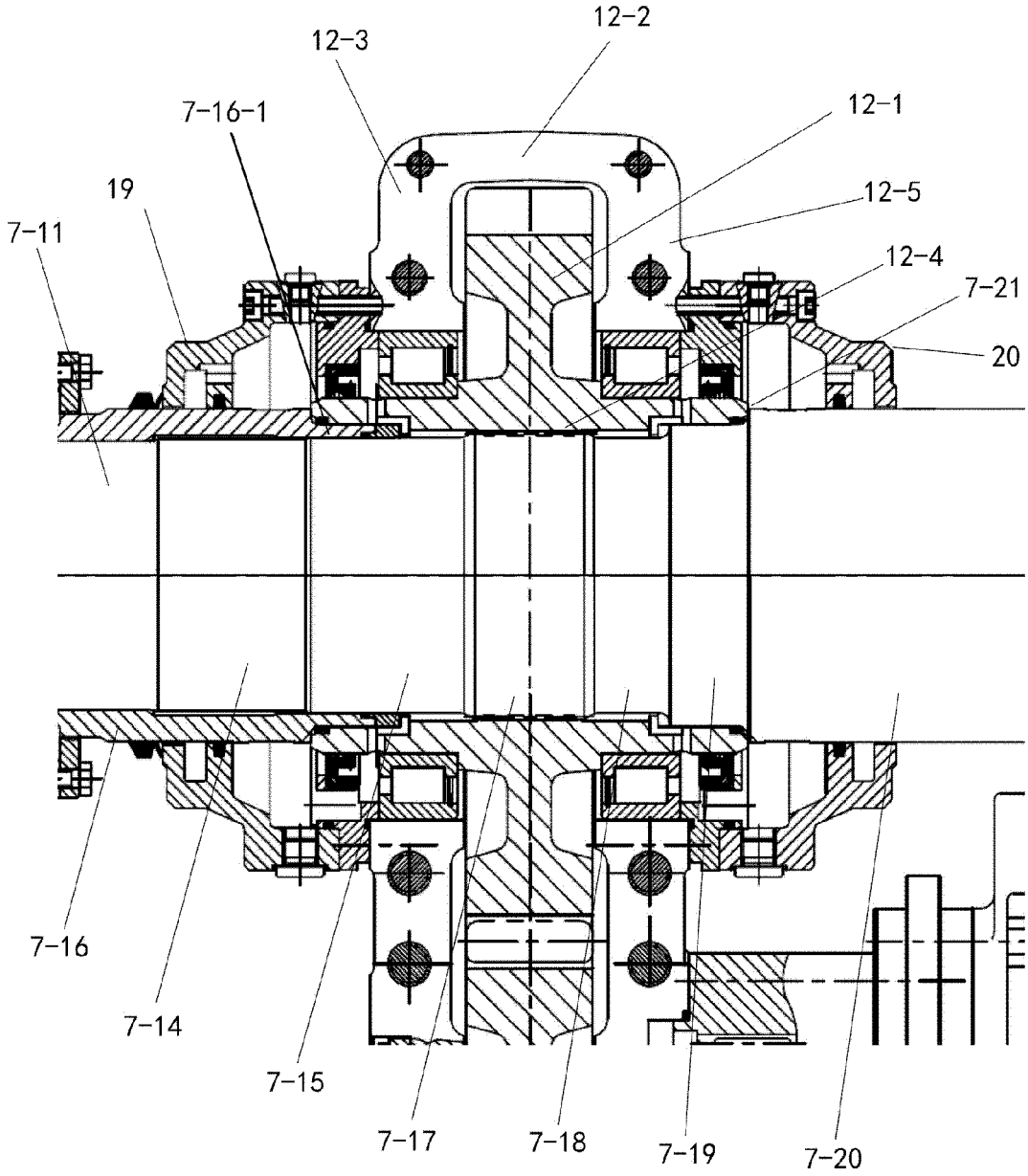
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Fig. 6

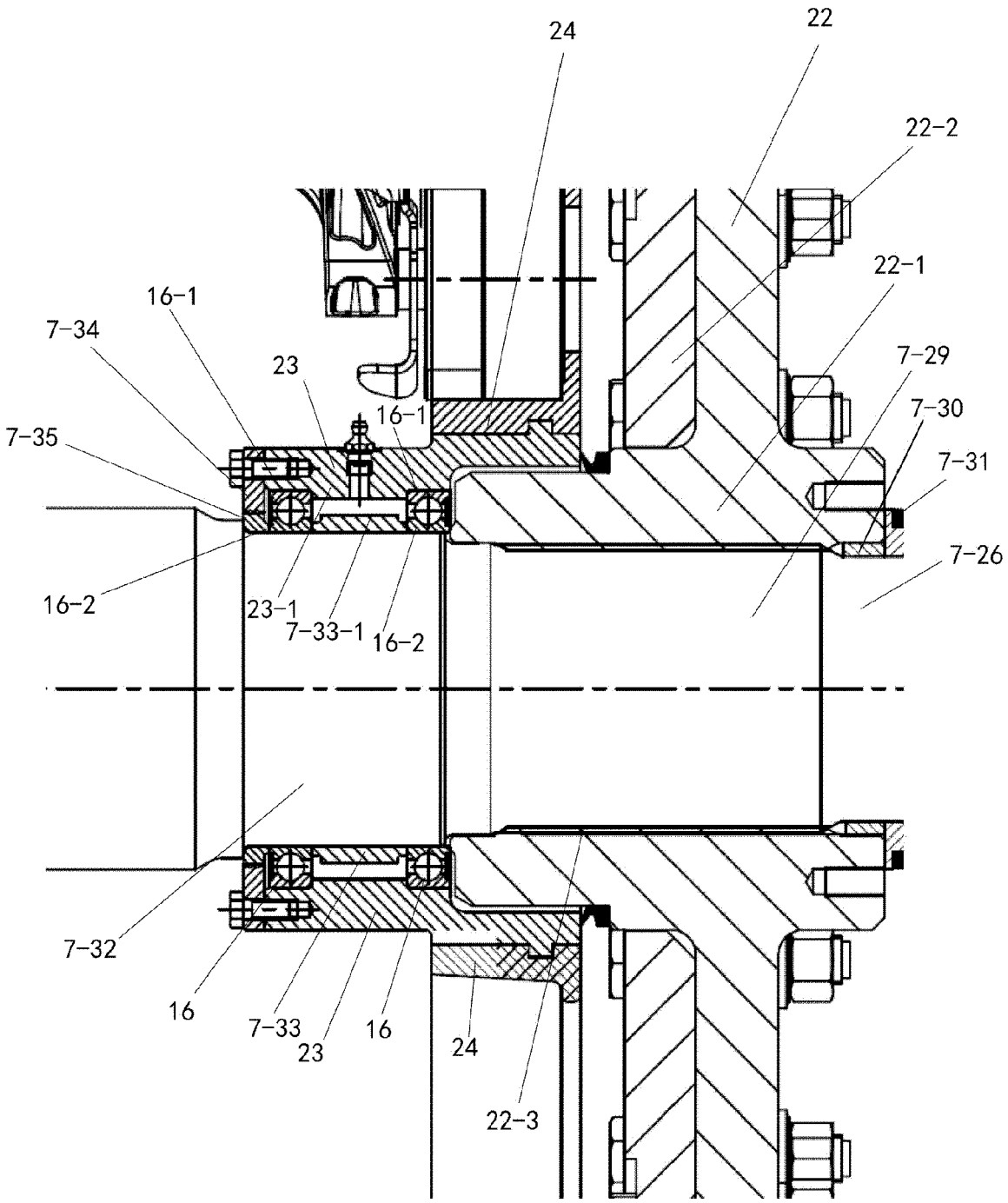
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Fig. 7

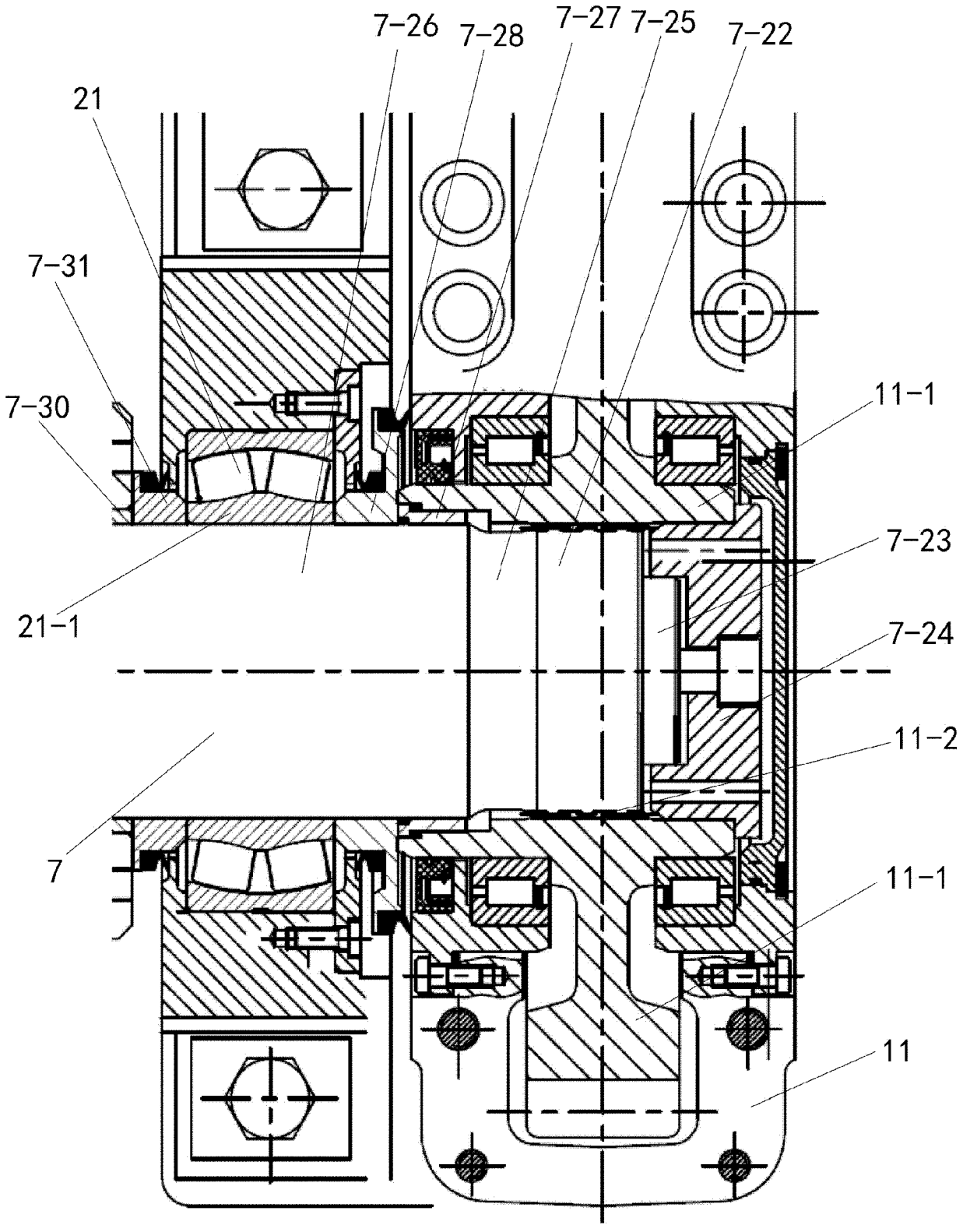

Fig. 8

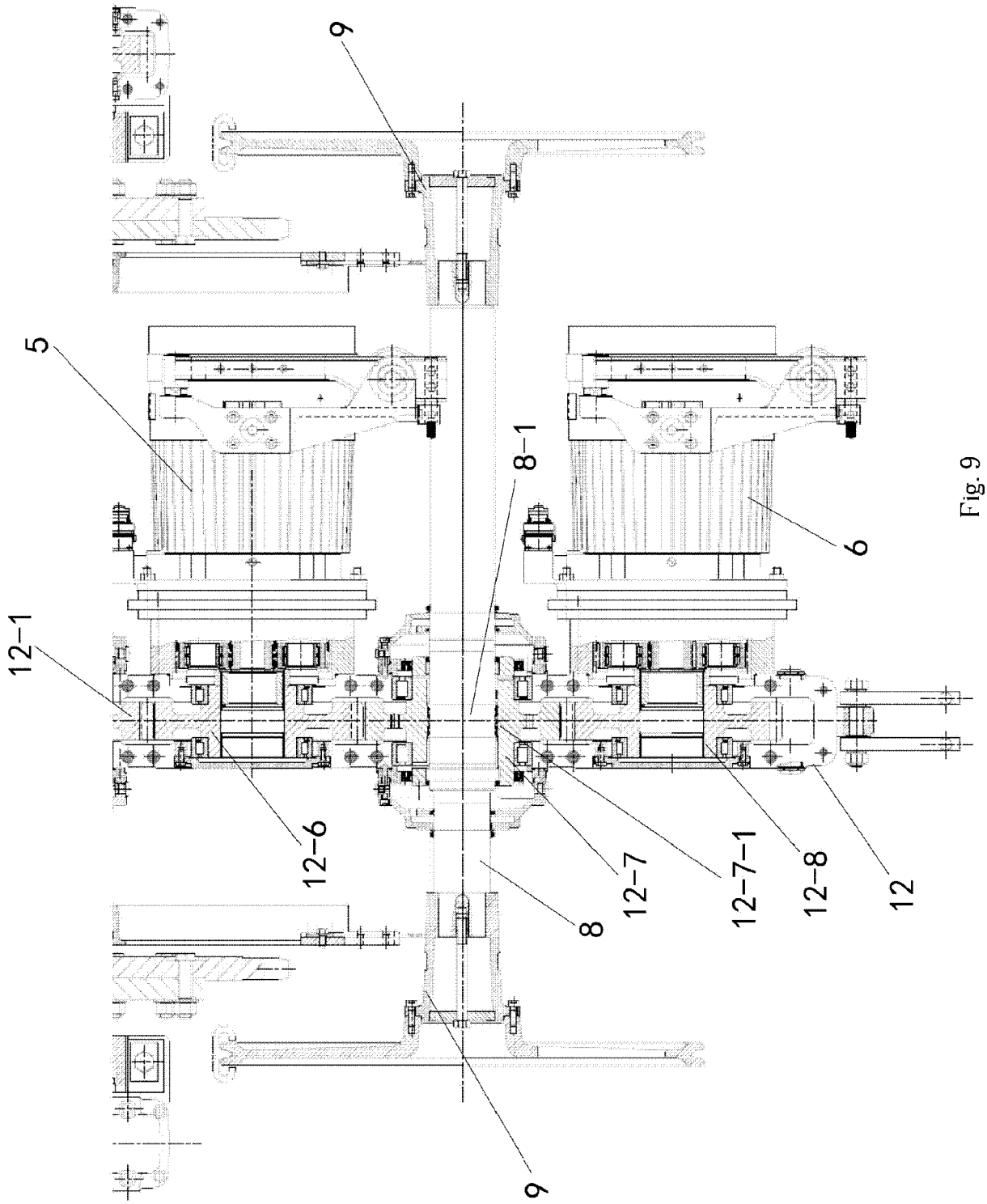

Fig. 9

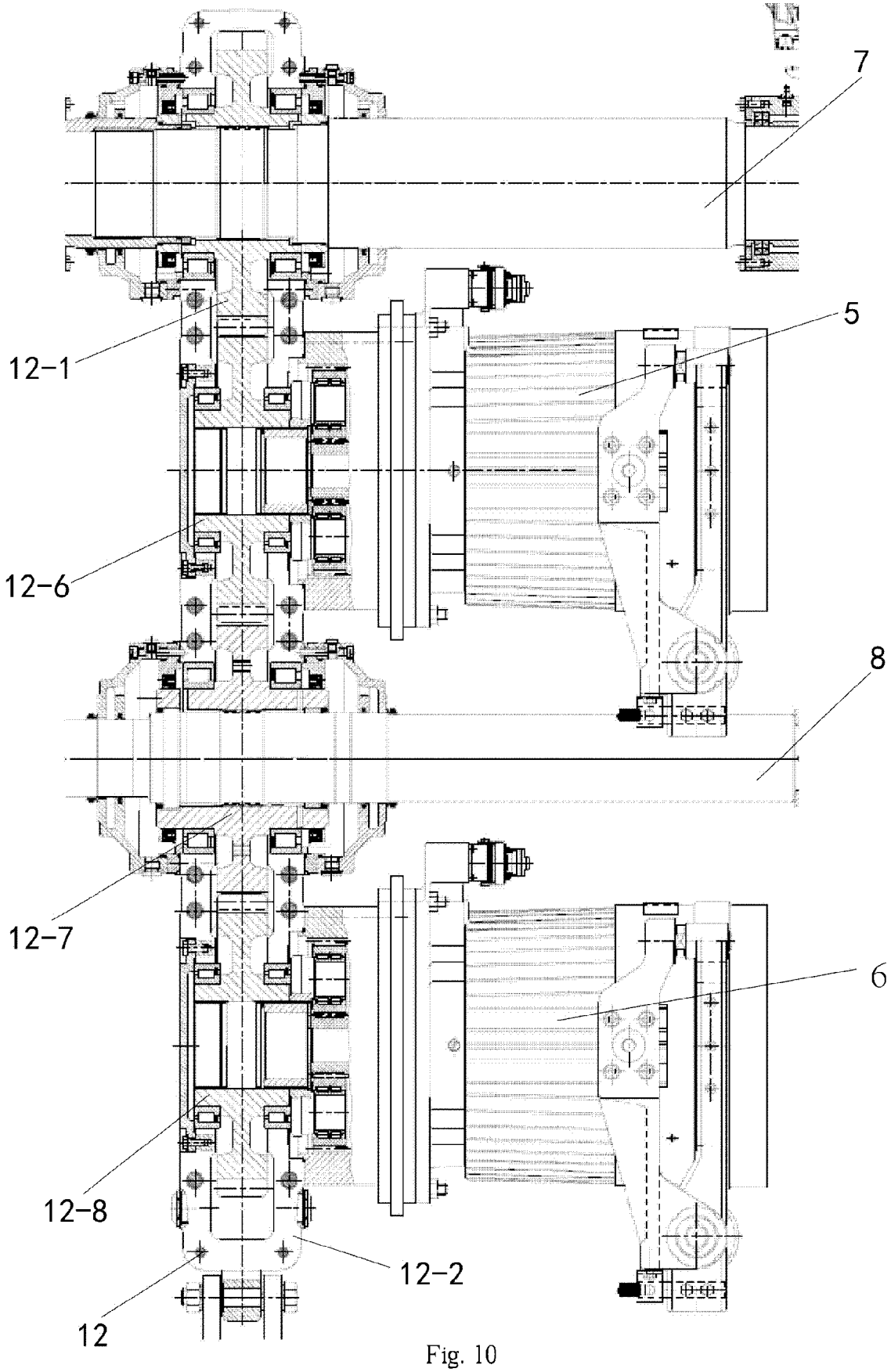

Fig. 10

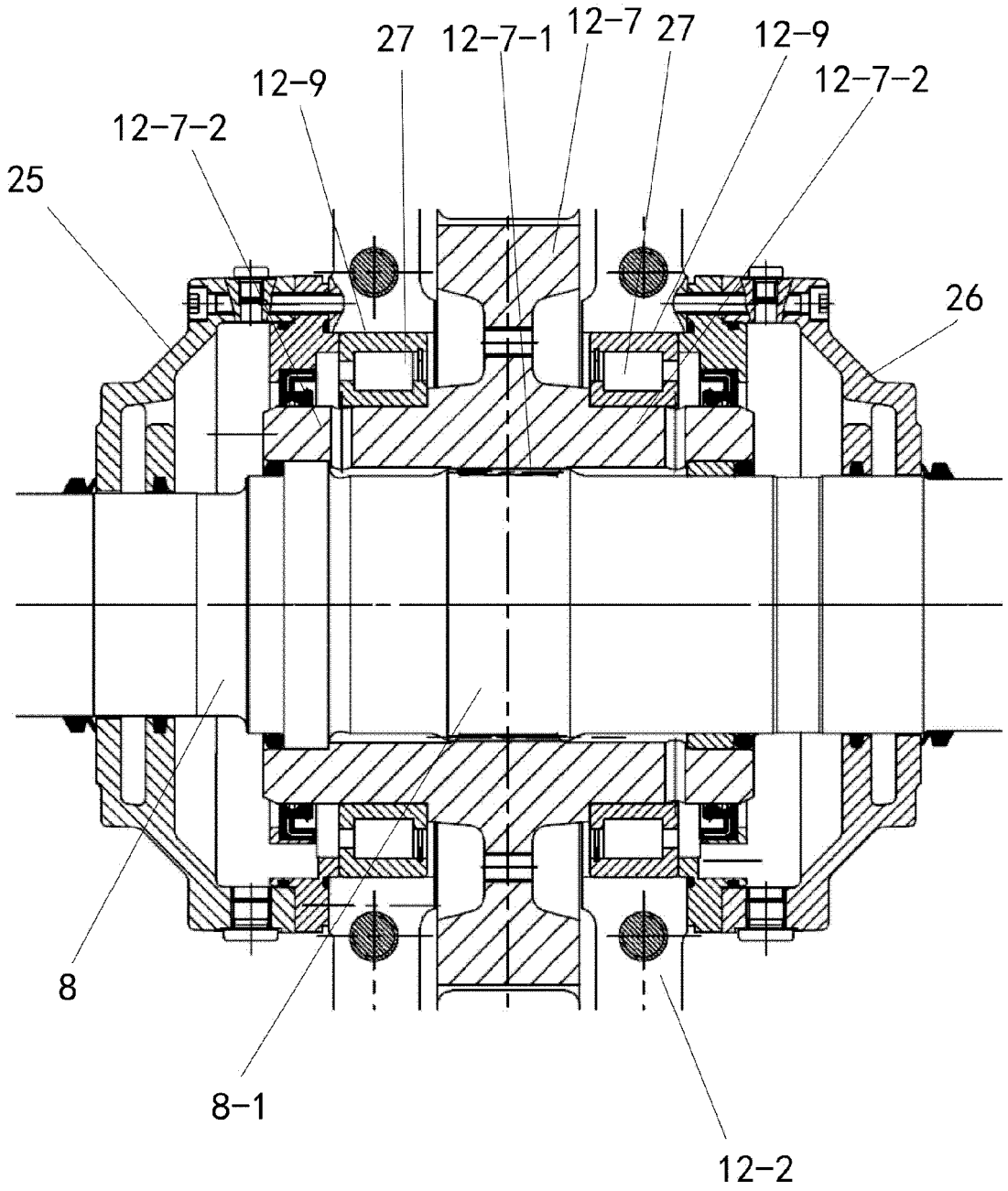

Fig. 11

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EUROPEAN SEARCH REPORT

Application Number
EP 23 19 5014

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	JP 2000 177964 A (HITACHI LTD; HITACHI BUILDING SYS CO LTD) 27 June 2000 (2000-06-27) * abstract * * paragraphs [0009] - [0018] * * figures 1, 3 *	1-16	INV. B66B23/02
A	JP 4 473359 B2 (INVENTIO AG) 2 June 2010 (2010-06-02) * abstract * * paragraphs [0017] - [0020], [0024] * * figures 1-5 *	1-16	
A	GB 1 445 555 A (ORENSTEIN & KOPPEL AG) 11 August 1976 (1976-08-11) * abstract * * page 3, line 79 - page 4, line 38 * * figures 1, 3, 4 *	1-16	
			TECHNICAL FIELDS SEARCHED (IPC) B66B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	10 January 2024	Oosterom, Marcel

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10-01-2024

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 2000177964 A	27-06-2000	JP 3599584 B2	08-12-2004
		JP 2000177964 A	27-06-2000
JP 4473359 B2	02-06-2010	AT E238961 T1	15-05-2003
		BR 9900441 A	22-02-2000
		CA 2261445 A1	13-08-1999
		CN 1225893 A	18-08-1999
		EP 0936175 A1	18-08-1999
		ES 2198797 T3	01-02-2004
		JP 4473359 B2	02-06-2010
		JP H11335050 A	07-12-1999
		JP 2009274879 A	26-11-2009
		MY 122422 A	29-04-2006
		US 6155401 A	05-12-2000
GB 1445555 A	11-08-1976	AT 340822 B	10-01-1978
		AU 474861 B2	05-08-1976
		CA 1010391 A	17-05-1977
		CH 597086 A5	31-03-1978
		DE 2421729 A1	20-11-1975
		FI 751180 A	05-11-1975
		FR 2269485 A1	28-11-1975
		GB 1445555 A	11-08-1976
		IT 1035606 B	20-10-1979
		JP S5418036 B2	04-07-1979
		JP S50152478 A	08-12-1975
		NL 7505176 A	06-11-1975
		SE 389087 B	25-10-1976
		SU 557749 A3	05-05-1977

EPO FORM P0459

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