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(54) **TRANSFER ROBOT**

(57) This application discloses a transfer robot. The transfer robot includes a robot body (100) and a telescopic arm assembly (200) telescopically provided in a first direction (X) with respect to the robot body (100). The telescopic arm assembly (200) includes a bottom plate (10) and a top plate (20), and a first motor (30) for lifting the top plate (20) is mounted on the bottom plate (10). The first motor (30) has a first driving shaft (32) disposed in the first direction (X), and a first brake (35) and a second brake (36) are sequentially provided inside the first motor (30) in the first direction (X), and are configured to simultaneously lock the first driving shaft (32).

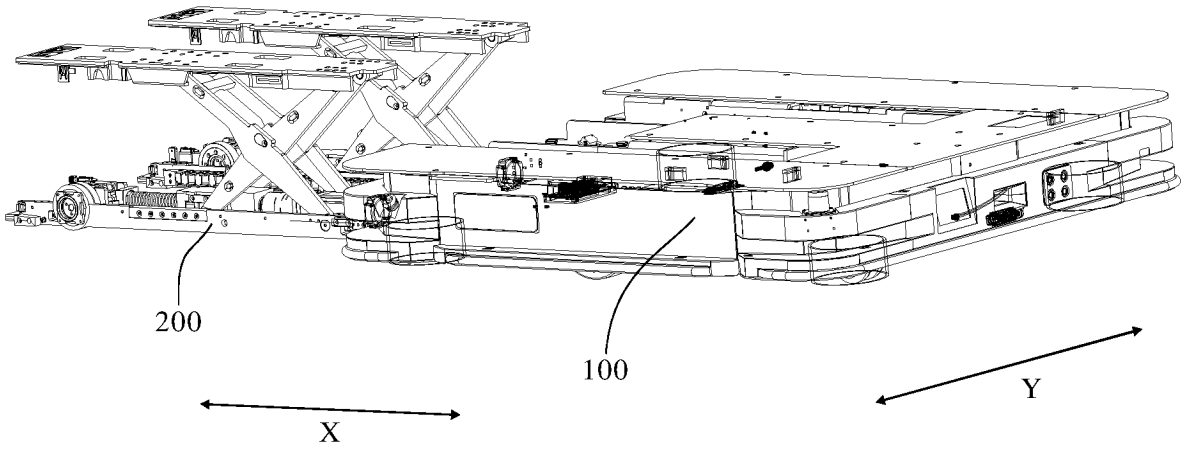

FIG. 1

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Description

TECHNICAL FIELD

[0001] The present application relates to, but is not limited to, the field of logistics equipment technology, and in particular to a transfer robot.

BACKGROUND

[0002] In the field of logistics, chassis-type transfer robots can usually be used to transfer bins.

[0003] A chassis-type transfer robot includes a chassis-type body and a telescopic arm assembly provided on the body, where the telescopic arm assembly is horizontally extendable and retractable with respect to the body, and the telescopic arm assembly is typically provided with a lifting mechanism, such that the chassis-type body is capable of transferring bins to or from it by means of the telescopic arm assembly.

[0004] In the related art, the telescopic arm assembly typically includes a top plate and a bottom plate arranged up and down. A lifting motor is provided on the bottom plate, and can drive the top plate to move up and down with respect to the bottom plate through a transmission device so as to lift bins. In addition, the telescopic arm assembly is typically equipped with a telescopic motor, which drives a driving wheel to rotate so as to enable the telescopic arm assembly to extend and retract with respect to the body.

SUMMARY

[0005] Embodiments of the present application provide a transfer robot. The transfer robot has a first brake and a second brake sequentially provided inside a first motor (i.e., lifting motor) in an extension direction of a first driving shaft of the first motor, and the first brake and the second brake can simultaneously lock the first driving shaft, thereby avoiding safety accidents, such as overturning of bins, that may occur due to the fact that a driving shaft of a lifting motor cannot be locked by a brake of the lifting motor.

[0006] In addition, the transfer robot has a telescopic arm assembly provided with a second motor (i.e., telescopic motor), and opposite ends of a second driving shaft of the second motor protrude from a second motor housing. That is to say, the second motor is provided with a dual-output shaft, such that a telescopic stroke of the telescopic arm assembly can be completed with only one telescopic motor, saving the space.

[0007] Embodiments of the present application provide a transfer robot, including a robot body and a telescopic arm assembly telescopically provided in a first direction with respect to the robot body, where the telescopic arm assembly includes a top plate and a bottom plate arranged up and down, a first motor is mounted on the bottom plate, and the first motor has a first driving shaft drivably connected with the top plate, so as to drive the top plate to move up and down with respect to the bottom plate, where the first driving shaft extends in the first direction, and a first brake and a second brake are sequentially provided inside the first motor in the first direction, and are configured to simultaneously lock the first driving shaft.

[0008] In an embodiment, preferably, the robot body includes a main control module, which is communicably connected with the first brake and the second brake, and is configure to simultaneously drive the first brake and the second brake to be closed in response to power-off of the first motor or reception of a fault signal, such that the first brake and the second brake simultaneously lock the first driving shaft.

[0009] In an embodiment, preferably, the first motor includes a first motor housing, and the first driving shaft is disposed inside the first motor housing, where a portion of the first driving shaft protrudes from an end of the first motor housing away from the robot body, and is drivably connected with the top plate.

[0010] In an embodiment, preferably, the first driving shaft is drivably connected with the top plate through a transmission mechanism, where the transmission mechanism includes a transmission shaft arranged in the first direction and a scissor arm arranged in a third direction, the third direction being perpendicular to the first direction, where the transmission shaft is fixedly mounted to the bottom plate, a transmission block is disposed around the transmission shaft, the first driving shaft is drivably connected with the transmission shaft, and the first driving shaft is configured to drive the transmission block to move along the transmission shaft; and the scissor arm includes a first scissor arm and a second scissor arm which cross each other and are rotatably connected with each other, an upper end of the first scissor arm and an upper end of the second scissor arm are fixedly mounted to the top plate, a lower end of the first scissor arm is fixedly mounted to the bottom plate, and a lower end of the second scissor arm is fixedly mounted to the transmission block.

[0011] In an embodiment, preferably, the transmission shaft includes a ball screw, and the transmission block includes a screw nut.

[0012] In an embodiment, preferably, one end of the transmission shaft is drivably connected with the first driving shaft through a first speed reducer, and the other end of the transmission shaft is fixedly mounted to the bottom plate through a fixing seat.

[0013] In an embodiment, preferably, a second motor is further mounted on the bottom plate, and includes a second motor housing and a second driving shaft running through the second motor housing in a second direction, the second direction being a horizontal direction perpendicular to the first direction, where opposite ends of the second driving shaft in the second direction protrude from the second motor housing and are each provided with a driving wheel, such that the second motor drives the

telescopic arm assembly to extend and retract in the first direction with respect to the robot body.

[0014] In an embodiment, preferably, a second speed reducer is provided between the second driving shaft and the driving wheel, where an end portion of the driving wheel, an end portion of the second speed reducer, and an end portion of the second driving shaft are coplanar in a plane perpendicular to the second direction.

[0015] In an embodiment, preferably, the second speed reducer includes a planetary speed reducer.

[0016] In an embodiment, preferably, a second encoder is disposed inside the second motor housing, the second encoder is disposed around the second driving shaft, and the second encoder is communicably connected with a main control module of the robot body.

[0017] In an embodiment, preferably, a third brake is disposed inside the second motor housing, the third brake is disposed around the second driving shaft, and the third brake is communicably connected with the main control module, and is configured to lock the second driving shaft, where the second encoder and the third brake are respectively disposed on opposite sides of the second driving shaft in the second direction.

[0018] In an embodiment, preferably, the first motor is provided at an end of the bottom plate close to the robot body, and the second motor is provided at an end of the bottom plate away from the robot body; and a driven wheel is further provided at the end of the bottom plate close to the robot body.

[0019] In an embodiment, preferably, motor mounting seats are respectively provided at opposite ends of the second motor housing in the second direction, and extend perpendicularly to the second direction, where each of the motor mounting seats is provided with a mounting through-hole, to allow a fastener to fasten the second motor housing to the bottom plate through the mounting through-hole.

[0020] Embodiments of the present application provide a transfer robot. The transfer robot includes a robot body and a telescopic arm assembly telescopically provided in a first direction (i.e., horizontal direction) with respect to the robot body. The telescopic arm assembly includes a bottom plate and a top plate, and a first motor for lifting the top plate is mounted on the bottom plate, where the first motor has a first driving shaft provided in a telescopic direction of the telescopic arm assembly, and a first brake and a second brake are sequentially provided inside the first motor in the telescopic direction, and are configured to simultaneously lock the first driving shaft.

[0021] In addition, a second motor is provided on the bottom plate of the telescopic arm assembly, and includes a second motor housing and a second driving shaft provided inside the second motor housing. The second driving shaft is provided in a second direction, with opposite ends of the second driving shaft in the second direction protruding from the second motor housing, and driving wheels are drivably connected to the opposite ends of the second driving shaft, respectively. In this way, the second motor can horizontally extend and retract the telescopic arm assembly with respect to the robot body by driving the driving wheels.

[0022] That is to say, with the transfer robot according to the embodiments of the present application, the telescopic arm assembly is equipped with the first motor (i.e., lifting motor), and two brakes are arranged in series in the extension direction of the first driving shaft of the first motor, and are closed simultaneously to lock the first driving shaft, such that a relatively large brake torque can be provided. In this way, for example, when the top plate needs to be positioned at a lower height position, the two brakes can ensure that the first driving shaft is locked after power-off, that is, inertial rotation of the first driving shaft is prevented, thereby avoiding the occurrence of safety accidents, such as overturning of bins, caused by failure to lock the first driving shaft.

[0023] In addition, the second motor (i.e., telescopic motor) can enable dual-side driving with the protruding opposite ends of a single second driving shaft, that is, the second motor is provided with a dual-output shaft. Therefore, only one second motor needs to be mounted on the bottom plate of the telescopic arm assembly. Compared with the case where two second motors need to be mounted on the bottom plate in the case of single-side driving, the embodiments of the present application can save the number of the second motor and reduce the space occupation. In addition, the second motor enables dual-side driving with a single second driving shaft, resulting in better output stability. Two driving wheels on opposite sides of the second driving shaft have a consistent rotational speed and are more synchronized. Moreover, the size of the second motor in the first direction is shortened, saving space and reserving space for arrangement of other parts.

BRIEF DESCRIPTION OF DRAWINGS

[0024] In order to more clearly illustrate technical solutions in embodiments of the present application, the drawings to be used in the description of the embodiments of the present application will be briefly described below. The drawings in the following description merely illustrate some of the embodiments of the present application, and those skilled in the art can obtain other drawings from these drawings without any creative efforts.

FIG. 1 is a schematic structural diagram illustrating a transfer robot according to an embodiment of the present application.

FIG. 2 is a schematic structural diagram illustrating a telescopic arm assembly according to an embodiment of the present application.

FIG. 3 is a schematic diagram illustrating a mounting structure of a first motor and a transmission shaft according to an embodiment of the present application.

FIG. 4 is a schematic diagram illustrating a mounting structure of a first motor and a first speed reducer according to an embodiment of the present application.

FIG. 5 is a schematic structural diagram illustrating a first motor according to an embodiment of the present application, in which two brakes are arranged in series in an extension direction of a first driving shaft.

FIG. 6 is a cross-sectional view illustrating a second motor according to an embodiment of the present application.

FIG. 7 is a cross-sectional view illustrating a second motor according to another embodiment of the present application.

FIG. 8 is a cross-sectional view illustrating a second motor according to yet another embodiment of the present application.

FIG. 9 is a schematic structural diagram illustrating a second motor according to an embodiment of the present application.

FIG. 10 is a schematic structural diagram illustrating a second motor according to another embodiment of the present application.

Description of reference numerals

[0025]

100-robot body, 200-telescopic arm assembly,
10-bottom plate,
20-top plate,
30-first motor, 31-first motor housing, 32-first driving shaft, 33-first speed reducer, 34-first encoder, 35-first brake, 36-second brake, 37-brake harness,
40-second motor, 41-second motor housing, 42-second driving shaft, 43-second speed reducer, 44-second encoder, 45-outlet terminal, 46-motor mounting seat, 47-horizontal bend, 48-third brake, 49-mounting through-hole,
51-transmission shaft, 52- transmission block, 53-scissor arm,
531-first scissor arm, 532-second scissor arm,
60-coupling,
70-driving wheel,
80-driven wheel,
90-fixing seat,
X-first direction, Y-second direction.

DETAILED DESCRIPTION

[0026] For a better understanding of the above technical solutions, exemplary embodiments of the present application will be described in detail below with reference to the accompanying drawings. The described embodiments are merely a part of the embodiments of the present application, but not all of the embodiments of the present application. It is to be understood that the present application is not limited by the exemplary embodiments described herein.

[0027] A chassis-type transfer robot is generally provided with a telescopic arm assembly, which is horizontally extendable and retractable with respect to a chassis-type body. The telescopic arm assembly generally includes a top plate and a bottom plate arranged up and down. A lifting motor is provided on the bottom plate, and can drive the top plate to move up and down with respect to the bottom plate through a transmission device. In this way, with the cooperation of horizontal telescopic movement and vertical lifting movement, a telescopic arm can transfer bins to or from the body.

[0028] However, considering width or structure of the telescopic arm assembly and other limitations, the model or size of the lifting motor mounted on the bottom plate of the telescopic arm assembly is usually too small, and a brake torque of a brake inside the lifting motor is too small, which results in that a driving shaft after power-off usually cannot be completely locked by the brake of the lifting motor, and safety accidents such as overturning of bins often occur. In addition, the conventional telescopic arm assembly usually needs to be provided with two single-side output telescopic motors, resulting in a large space occupation.

[0029] In view of this, embodiments of the present application provide a transfer robot, in which a first brake and a second brake are sequentially provided inside a first motor (i.e., lifting motor) in an extension direction of a first driving shaft of the first motor, and can simultaneously lock the first driving shaft, i.e., prevent inertial rotation of the first driving shaft after power-off, thereby avoiding safety accidents, such as overturning of bins, that may occur due to the fact that a driving shaft of a lifting motor cannot be locked by a brake of the lifting motor. In addition, a telescopic arm assembly of the transfer robot is provided with a second motor (i.e., telescopic motor), and opposite ends of a second driving shaft of the second motor protrude from a second motor housing. That is to say, the second motor is provided with a dual-output shaft, such that a telescopic stroke of the telescopic arm assembly can be completed with only one telescopic motor, saving the space.

[0030] FIG. 1 is a schematic structural diagram of a transfer robot, FIG. 2 is a schematic structural diagram of a telescopic arm assembly, and FIG. 5 is a schematic structural diagram of an interior of a first motor. Referring to FIG. 1, FIG. 2 and FIG. 5, the transfer robot includes a robot body 100 and a telescopic arm assembly 200 telescopically provided in a first direction X with respect to the robot body 100. The telescopic arm assembly 200 includes a top plate 20 and a bottom plate 10 arranged up and down. A first motor 30 is mounted on the bottom plate 10, and has a first driving shaft 32 drivably connected with the top plate 20 so as to drive the top plate 20 to move up and down with respect to the bottom plate 10. The first driving shaft 32 extends in the first direction X, and a first brake 35 and a second brake 36 are sequentially provided inside the first motor 30 in the first direction X, and

are configured to simultaneously lock the first driving shaft 32.

[0031] In particular, the first motor 30 is disposed at an end of the bottom plate 10 close to the robot body 100, and the first motor 30 includes a first motor housing 31 and the first driving shaft 32 disposed inside the first motor housing 31. The first driving shaft 32 extends in the first direction X, a portion of the first driving shaft 32 protrudes from an end of the first motor housing 31 away from the robot body 100, and the protruding portion of the first driving shaft 32 is drivably connected with the top plate 20 to drive the top plate 20 to move up and down with respect to the bottom plate 10.

[0032] Referring first to FIG. 1, the robot body 100 is generally of a chassis type, and has the telescopic arm assembly 200 mounted thereon, where the telescopic arm assembly 200 is horizontally telescopically mounted to the robot body 100. In FIG. 1, the first direction X is a horizontal direction, and a second direction Y is another horizontal direction perpendicular to the first direction X. The telescopic arm assembly 200 is telescopically mounted to the robot body 100 in the first direction X.

[0033] Referring then to FIG. 2, the telescopic arm assembly 200 includes the top plate 20 and the bottom plate 10 arranged vertically in a height direction, the top plate 20 and the bottom plate 10 extending generally in the first direction X. The first motor 30 is mounted on the bottom plate 10, and the first driving shaft 32 of the first motor 30 is disposed in the first direction X. Moreover, the first driving shaft 32 is drivably connected with the top plate 20, such that the first motor 30 can drive the top plate 20 to move up and down with respect to the bottom plate 10 through the first driving shaft 32.

[0034] Referring to FIG. 5, the first brake 35 and the second brake 36 are sequentially disposed inside the first motor 30 in an axial direction of the first driving shaft 32, i.e., the first direction X, and the first brake 35 and the second brake 36 are configured to simultaneously lock the first driving shaft 32.

[0035] It is to be understood that for the first driving shaft, two brakes are arranged in series inside the first motor. By arranging two brakes, a brake torque can be greatly increased. Closing the two brakes simultaneously can prevent inertial rotation of the first driving shaft after power-off.

[0036] The embodiments of the present application provide a transfer robot. The transfer robot includes a robot body and a telescopic arm assembly telescopically provided in a first direction (i.e., horizontal direction) with respect to the robot body. The telescopic arm assembly includes a bottom plate and a top plate, and a first motor for lifting the top plate is mounted on the bottom plate, where the first motor has a first driving shaft provided in a telescopic direction of the telescopic arm assembly, and a first brake and a second brake are sequentially provided inside the first motor in the telescopic direction, and are configured to simultaneously lock the first driving shaft.

[0037] That is to say, with the transfer robot according to the embodiments of the present application, the telescopic arm assembly is equipped with the first motor (i.e., lifting motor), and two brakes are arranged in series in the extension direction of the first driving shaft of the first motor, and are closed simultaneously to lock the first driving shaft, such that a relatively large brake torque can be provided. In this way, for example, when the top plate needs to be positioned at a lower height position, the two brakes can ensure that the first driving shaft is locked after power-off, that is, inertial rotation of the first driving shaft is prevented, thereby avoiding the occurrence of safety accidents, such as overturning of bins, caused by failure to lock the first driving shaft.

[0038] In particular, the first motor 30 can be disposed at an end of the bottom plate 10 close to the robot body 100. The first driving shaft 32 protrudes from an end of the first motor housing 31 toward the robot body 100 so as to be drivably connected with the top plate 20.

[0039] In this embodiment, it is to be understood that the robot body 100 includes a main control module, such as a main control circuit board, which is communicably connected to the first brake 35 and the second brake 36 through a brake harness 37. The main control module is configured to simultaneously drive the first brake 35 and the second brake 36 to be closed, such that the first brake 35 and the second brake 36 lock the first driving shaft 32 at the same time.

[0040] The main control module is further configured to simultaneously drive the first brake 35 and the second brake 36 to be closed, in the case that power supply to the first motor 30 is cut off, or in the case that a fault signal is received. For example, when the top plate 20 needs to be lowered to a lower height, the main control module first cuts off the power supply to the first motor 30, at which time the first driving shaft 32 of the first motor 30 still has a certain rotational speed due to inertia, and the main control module simultaneously drives the two brakes to be closed, so as to prevent the inertial rotation of the first driving shaft 32 to avoid the occurrence of safety accidents.

[0041] As for the first driving shaft 32 drivably connected with the top plate 20 as described above, referring again to FIG. 2 and FIG. 3, in an embodiment, the first driving shaft 32 is drivably connected to the top plate 20 via a transmission mechanism. The transmission mechanism includes a transmission shaft 51 provided in the first direction X and a scissor arm 53 provided in a third direction, where the third direction is perpendicular to the first direction X and the second direction Y, for example, the third direction can be a vertical direction.

[0042] The transmission shaft 51 is fixedly mounted to the bottom plate 10, and a transmission block 52 is disposed around the transmission shaft 51. The first driving shaft 32 is drivably connected with the transmission shaft 51, and is configured to drive the transmission block 52 to move along the transmission shaft 51. The scissor arm 53 includes a first scissor arm 531 and a second scissor arm 532 which cross each other and are

rotatably connected with each other, where an upper end of the first scissor arm 531 and an upper end of the second scissor arm 532 are fixedly mounted to the top plate 20, a lower end of the first scissor arm 531 is fixedly mounted to the bottom plate 10, and a lower end of the second scissor arm 532 is fixedly mounted to the transmission block 52. In this way, the first driving shaft 32 drives the transmission block 52 to move along the transmission shaft 51, and drives the second scissor arm 532 to rotate with respect to the first scissor arm 531, thereby driving the top plate 20 to move up and down with respect to the bottom plate 10.

[0043] This embodiment illustrates a possible structure in which the first driving shaft 32 is drivably connected with the top plate 20.

[0044] In particular, the transmission mechanism between the first driving shaft 32 and the top plate 20 includes the transmission shaft 51 and the scissor arm 53. The transmission shaft 51 extends in the first direction X and is fixedly mounted to the bottom plate 10, and the transmission block 52 is disposed around the transmission shaft 51. The first driving shaft 32 is drivably connected with the transmission shaft 51 to drive the transmission block 52 to move along the transmission shaft 51, that is, to move in the first direction X. The scissor arm 53 is disposed in the vertical direction, and includes the first scissor arm 531 and the second scissor arm 532 which cross each other and are rotatably connected with each other, where the upper ends of the first scissor arm 531 and the second scissor arm 532 are fixedly mounted to the top plate 20, the lower end of the first scissor arm 531 is fixedly mounted to the bottom plate 10, and the lower end of the second scissor arm 532 is fixedly mounted to the transmission block 52. In this way, the first driving shaft 32 can move the top plate 20 up and down with respect to the bottom plate 10 by driving the transmission block 52 to move in the first direction X.

[0045] The transmission shaft 51 mentioned above includes, for example, a ball screw, and the transmission block 52 includes, for example, a screw nut. One end of the ball screw is drivably connected with the first driving shaft 32 through a first speed reducer 33 and a coupling 60, and the other end of the ball screw is fixedly mounted to the bottom plate 10 through a fixing seat 90. It is to be understood that the first driving shaft 32 can move the screw nut along the ball screw (i.e., in the first direction X) by driving the ball screw to rotate.

[0046] Referring to FIG. 4 and FIG. 5, the first motor 30 includes the first motor housing 31, in which a stator winding is mounted. The first driving shaft 32 is disposed in an inner cavity of the first motor housing 31. A first encoder 34 may be disposed at one end of the first driving shaft 32, and the first speed reducer 33 may be disposed at the other end of the first driving shaft 32.

[0047] The first encoder 34 can provide real-time feedback on the rotational speed and torque of the first driving shaft 32. The first speed reducer 33 is connected to the transmission shaft 51 through the coupling 60.

[0048] As for the horizontal extension and retraction of the telescopic arm assembly 200 with respect to the robot body 100 as described above, referring to FIG. 2 and FIGS. 6 to 10, in an embodiment, a second motor 40 is further mounted on the bottom plate 10, and includes a second motor housing 41 and a second driving shaft 42 disposed inside the second motor housing 41. The second driving shaft 42 runs through the second motor housing 41 in the second direction Y, which is a horizontal direction perpendicular to the first direction X. The second driving shaft 42 is disposed in the second direction Y, with opposite ends of the second driving shaft 42 in the second direction Y protruding from the second motor housing 41, and driving wheels 70 are respectively mounted at the opposite ends of the second driving shaft 42 protruding from the second motor housing 41, such that the second motor 40 drives the telescopic arm assembly 200 to extend and retract horizontally with respect to the robot body 100.

[0049] That is, the second motor 40 can drive the telescopic arm assembly 200 to horizontally extend and retract with respect to the robot body 100. The second motor housing 41 of the second motor 40 is provided with the second driving shaft 42 running therethrough, the second driving shaft 42 extending in the second direction Y perpendicular to the first direction X, that is, the second driving shaft 42 being disposed perpendicular to the first driving shaft 32. The driving wheels 70 are respectively mounted at the opposite ends of the second driving shaft 42 protruding from the second motor housing 41, such that the second motor 40 can drive the telescopic arm assembly 200 to complete the telescopic movement by driving the driving wheels 70 to rotate.

[0050] Referring to FIG. 2, the bottom plate 10 has, for example, an elongated shape extending in the first direction X. The driving wheels 70 drivably connected at the opposite ends of the second motor 40 span across the bottom plate 10 in the second direction Y, such that the telescopic arm assembly 200 can extend and retract smoothly in the horizontal direction.

[0051] With the above arrangement, the telescopic arm assembly 200 in this embodiment can complete the horizontal extension and retraction by providing only one second motor 40 with a dual-output shaft, thereby reducing space occupation.

[0052] That is to say, in this embodiment, a single second driving shaft can drive two driving wheels on opposite sides thereof, such that the telescopic arm assembly can complete the telescopic movement in the horizontal direction, which is stable and reliable.

[0053] The embodiments of the present application provide a transfer robot. The transfer robot includes a robot body and a telescopic arm assembly telescopically provided in a first direction with respect to the robot body. A second motor is provided on a bottom plate of the telescopic arm assembly, and includes a second motor housing and a second driving shaft provided inside the

second motor housing. The second driving shaft is provided in a second direction, with opposite ends of the second driving shaft in the second direction protruding from the second motor housing, and driving wheels are drivably connected to the opposite ends of the second driving shaft, respectively. In this way, the second motor can horizontally extend and retract the telescopic arm assembly with respect to the robot body by driving the driving wheels.

[0054] That is to say, in this embodiment, the second motor can enable dual-side driving with the protruding opposite ends of a single second driving shaft, that is, the second motor is provided with a dual-output shaft. Therefore, only one second motor needs to be mounted on the bottom plate of the telescopic arm assembly. Compared with the case where two second motors need to be mounted on the bottom plate in the case of single-side driving, this embodiment can save the number of the second motor and reduce the space occupation.

[0055] Further, a second speed reducer 43 is disposed between the second driving shaft 42 and the driving wheel 70, where an end portion of the driving wheel 70, an end portion of the second speed reducer 43, and an end portion of the second driving shaft 42 are coplanar in a plane perpendicular to the second direction Y. By arranging the driving wheel 70 and the second speed reducer 43 in the same plane, the width of the second motor 40 can be greatly reduced, saving space occupation. The second speed reducer 43 may be a planetary speed reducer, for example.

[0056] Further, a hollow second encoder 44 is disposed inside the second motor housing 41. The second encoder 44 is disposed around the second driving shaft 42, and is communicably connected to the main control module of the robot body 100. Referring to FIG. 6, the second encoder 44 may be located in the middle of the second driving shaft 42, or referring to FIG. 7 or FIG. 8, the second encoder 44 may be located on a side of the second driving shaft 42 and close to the second motor housing 41.

[0057] The second encoder 44 can provide real-time feedback on the rotational speed and torque of the second driving shaft 42.

[0058] In a particular embodiment, a third brake 48 is disposed inside the second motor housing 41. The third brake 48 is disposed around the second driving shaft 42, is communicably connected to the main control module, and is configured to lock the second driving shaft 42. The second encoder 44 and the third brake 48 are respectively disposed on both sides of the second driving shaft 42 in the second direction Y.

[0059] That is, referring to FIG. 8, the second encoder 44 and the third brake 48 may be disposed inside the second motor housing 41 at the same time, and the second encoder 44 and the third brake 48 are respectively disposed on both sides of the second driving shaft 42. In this way, the robot body 100 can lock the second driving shaft 42 through the main control module.

[0060] In addition, referring to FIG. 9 or FIG. 10, an outlet terminal 45 may be provided at an end of the second motor housing 41 toward the robot body 100, and is used for cables of the third brake 48 and the second encoder 44 to pass through and connect to the main control module of the robot body 100.

[0061] In a possible embodiment, the second motor 40 is disposed at an end of the bottom plate 10 away from the robot body 100, and a driven wheel 80 is disposed at an end of the bottom plate 10 close to the robot body 100. The driving wheel (i.e., the driving wheel 70 mounted to the second motor 40) is disposed away from the robot body 100, and the driven wheel 80 is disposed close to the robot body 100, which can avoid jamming of the telescopic arm assembly 200 during the telescopic movement.

[0062] In a possible embodiment, motor mounting seats 46 are respectively disposed at opposite ends of the second motor housing 41 in the second direction Y, and extend perpendicularly to the second direction Y. The motor mounting seat 46 is provided with a mounting through-hole 49, so as to allow a fastener (e.g., a mounting screw) to fasten the second motor housing 41 to the bottom plate 10 through the mounting through-hole 49.

[0063] In addition, referring to FIG. 9 and FIG. 10, the motor mounting seats 46 can be directly disposed on the second motor housing 41, and the second motor 40 is fixedly mounted to the bottom plate 10 through the motor mounting seats 46.

[0064] Referring to FIG. 9, the motor mounting seat 46 may, for example, be of an L-shape and be disposed at both ends of the second motor housing 41 in the second direction Y, with the mounting through-hole 49 provided in a horizontal bend 47 of the L-shape, such that the motor mounting seat 46 can be fixed to the bottom plate 10 in the vertical direction with a mounting screw. Alternatively, referring to FIG. 10, the motor mounting seat 46 may be provided with a mounting through-hole extending horizontally therethrough, such that the motor mounting seat 46 may be fixed to the bottom plate 10 in the horizontal direction with a mounting screw.

[0065] In addition, the outlet terminal 45 may be provided at an end of the second motor housing 41 facing the robot body 100, for the cable of the second encoder 44 to pass through and connect to the main control module of the robot body 100.

[0066] Further, the first motor 30 may be disposed at an end of the bottom plate 10 close to the robot body 100, and the second motor 40 may be disposed at an end of the bottom plate 10 away from the robot body 100. Moreover, the driven wheel 80 may be disposed at the end of the bottom plate 10 close to the robot body 100. In this way, the driving wheel (i.e., the driving wheel 70 mounted to the second motor 40) is disposed away from the robot body 100, and the driven wheel 80 is disposed close to the robot body 100, which can avoid jamming of the telescopic arm assembly 200 during the telescopic movement.

[0067] The basic principles of the present application have been described above with reference to specific embodiments. However, it should be noted that the features, advantages, effects, etc. mentioned in the present application are only examples and not limitations, and cannot be considered to be essential to various embodiments of the present application. In addition, the specific details disclosed above are only for the purpose of illustration and ease of understanding, and not for the purpose of limitation, and do not limit the present application to what must be implemented with the specific details disclosed above.

[0068] The block diagrams of components, apparatuses, devices, and systems involved in the present application are merely illustrative examples and are not intended to require or imply that they must be connected, arranged, or configured in the manner shown in the block diagrams. These components, apparatuses, devices, and systems may be connected, arranged, and configured in any manner, as will be appreciated by those skilled in the art. Words such as "including," "comprising," "having," and the like are open-ended words that mean "including, but not limited to," and are used interchangeably therewith. As used herein, words "or" and "and" refer to and are used interchangeably with the word "and/or", unless the context clearly indicates otherwise. As used herein, the word "such as" refers to, and is used interchangeably with, the phrase "such as, but not limited to".

[0069] It should also be noted that the parts or steps in the apparatuses, devices and methods of the present application may be decomposed and/or recombined. These decompositions and/or re-combinations are to be regarded as equivalents of the present application.

[0070] The above description of the disclosed aspects is provided to enable any person skilled in the art to make or use the present application. Various modifications to these aspects will be readily apparent to those skilled in the art, and the generic principles defined herein may be applied to other aspects without departing from the scope of the present application. Thus, the present application is not intended to be limited to the aspects illustrated herein, but rather to follow the broadest scope consistent with the principles and novel features disclosed herein.

[0071] The foregoing description has been provided for purposes of illustration and description. Furthermore, this description is not intended to limit the embodiments of the application to the form disclosed herein. While various exemplary aspects and embodiments have been discussed above, those skilled in the art will recognize that certain variations, modifications, alterations, additions, and sub-combinations thereof should be included within the scope of protection of the present application.

Claims

1. A transfer robot, the transfer robot comprising a robot body (100) and a telescopic arm assembly (200) telescopically provided in a first direction (X) with respect to the robot body (100),

   wherein the telescopic arm assembly (200) comprises a top plate (20) and a bottom plate (10) arranged up and down, a first motor (30) is mounted on the bottom plate (10), and the first motor (30) has a first driving shaft (32) drivably connected with the top plate (20), so as to drive the top plate (20) to move up and down with respect to the bottom plate (10),
   characterized in that
   the first driving shaft (32) extends in the first direction (X); and
   a first brake (35) and a second brake (36) are sequentially provided inside the first motor (30) in the first direction (X), and the first brake (35) and the second brake (36) are configured to simultaneously lock the first driving shaft (32).

2. The transfer robot according to claim 1, wherein the robot body (100) comprises a main control module communicably connected with the first brake (35) and the second brake (36),
   wherein the main control module is configured to simultaneously drive the first brake (35) and the second brake (36) to be closed in response to power-off of the first motor (30) or reception of a fault signal, such that the first brake (35) and the second brake (36) simultaneously lock the first driving shaft (32).

3. The transfer robot according to claim 1 or 2, wherein the first motor (30) comprises a first motor housing (31), and the first driving shaft (32) is disposed inside the first motor housing (31),
   wherein a portion of the first driving shaft (32) protrudes from an end of the first motor housing (31) away from the robot body (100), and is drivably connected with the top plate (20).

4. The transfer robot according to any one of claims 1 to 3, wherein the first driving shaft (32) is drivably connected with the top plate (20) through a transmission mechanism, the transmission mechanism comprising:

   a transmission shaft (51) arranged in the first direction (X) and a scissor arm (53) arranged in a third direction, the third direction being perpendicular to the first direction (X),
   wherein the transmission shaft (51) is fixedly mounted to the bottom plate (10), a transmission block (52) is disposed around the transmission shaft (51), the first driving shaft (32) is drivably connected with the transmission shaft (51), and the first driving shaft (32) is configured to drive the transmission block (52) to move along the

transmission shaft (51); and
the scissor arm (53) comprises a first scissor arm (531) and a second scissor arm (532) which cross each other and are rotatably connected with each other, an upper end of the first scissor arm (531) and an upper end of the second scissor arm (532) are fixedly mounted to the top plate (20), a lower end of the first scissor arm (531) is fixedly mounted to the bottom plate (10), and a lower end of the second scissor arm (532) is fixedly mounted to the transmission block (52).

5. The transfer robot according to claim 4, wherein the transmission shaft (51) comprises a ball screw, and the transmission block (52) comprises a screw nut.

6. The transfer robot according to claim 4 or 5, wherein one end of the transmission shaft (51) is drivably connected with the first driving shaft (32) through a first speed reducer (33), and the other end of the transmission shaft (51) is fixedly mounted to the bottom plate (10) through a fixing seat (90).

7. The transfer robot according to any one of claims 1 to 6, wherein a second motor (40) is further mounted on the bottom plate (10), and comprises a second motor housing (41) and a second driving shaft (42) running through the second motor housing (41) in a second direction (Y), the second direction (Y) being a horizontal direction perpendicular to the first direction (X),
wherein opposite ends of the second driving shaft (42) in the second direction (Y) protrude from the second motor housing (41) and are each provided with a driving wheel (70), such that the second motor (40) drives the telescopic arm assembly (200) to extend and retract in the first direction (X) with respect to the robot body (100).

8. The transfer robot according to claim 7, wherein a second speed reducer (43) is provided between the second driving shaft (42) and the driving wheel (70), wherein an end portion of the driving wheel (70), an end portion of the second speed reducer (43), and an end portion of the second driving shaft (42) are coplanar in a plane perpendicular to the second direction (Y).

9. The transfer robot according to claim 8, wherein the second speed reducer (43) comprises a planetary speed reducer.

10. The transfer robot according to any one of claims 7 to 9, wherein a second encoder (44) is disposed inside the second motor housing (41), the second encoder (44) is disposed around the second driving shaft (42), and the second encoder (44) is communicably connected with a main control module of the robot body (100).

11. The transfer robot according to claim 10, wherein a third brake (48) is disposed inside the second motor housing (41), the third brake (48) is disposed around the second driving shaft (42), and the third brake (48) is communicably connected with the main control module and is configured to lock the second driving shaft (42),
wherein the second encoder (44) and the third brake (48) are respectively disposed on opposite sides of the second driving shaft (42) in the second direction (Y).

12. The transfer robot according to any one of claims 7 to 11, wherein the first motor (30) is provided at an end of the bottom plate (10) close to the robot body (100), and the second motor (40) is provided at an end of the bottom plate (10) away from the robot body (100); and
a driven wheel (80) is further provided at the end of the bottom plate (10) close to the robot body (100).

13. The transfer robot according to any one of claims 7 to 12, wherein motor mounting seats (46) are respectively provided at opposite ends of the second motor housing (41) in the second direction (Y), and extend perpendicularly to the second direction (Y),
wherein each of the motor mounting seats (46) is provided with a mounting through-hole (49), to allow a fastener to fasten the second motor housing (41) to the bottom plate (10) through the mounting through-hole (49).

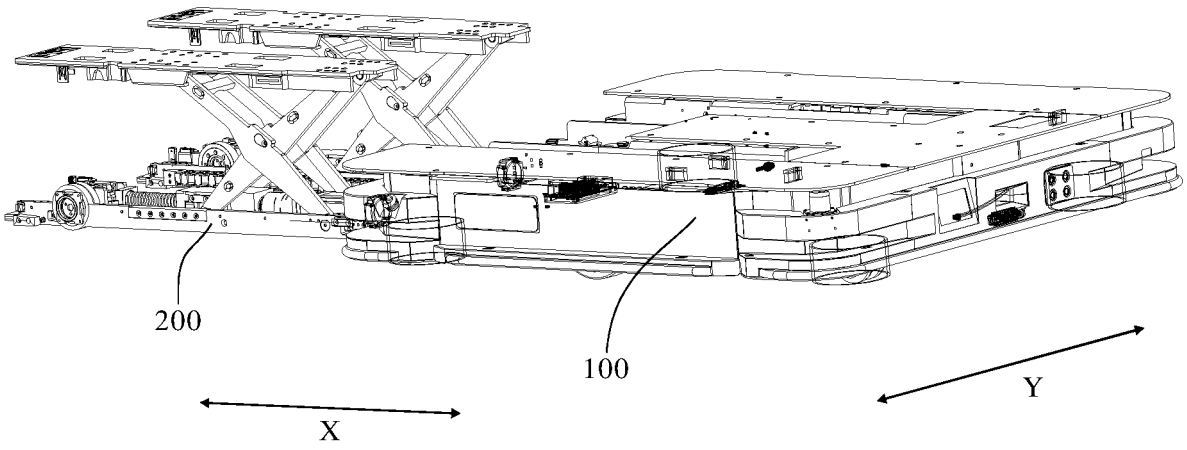

FIG. 1

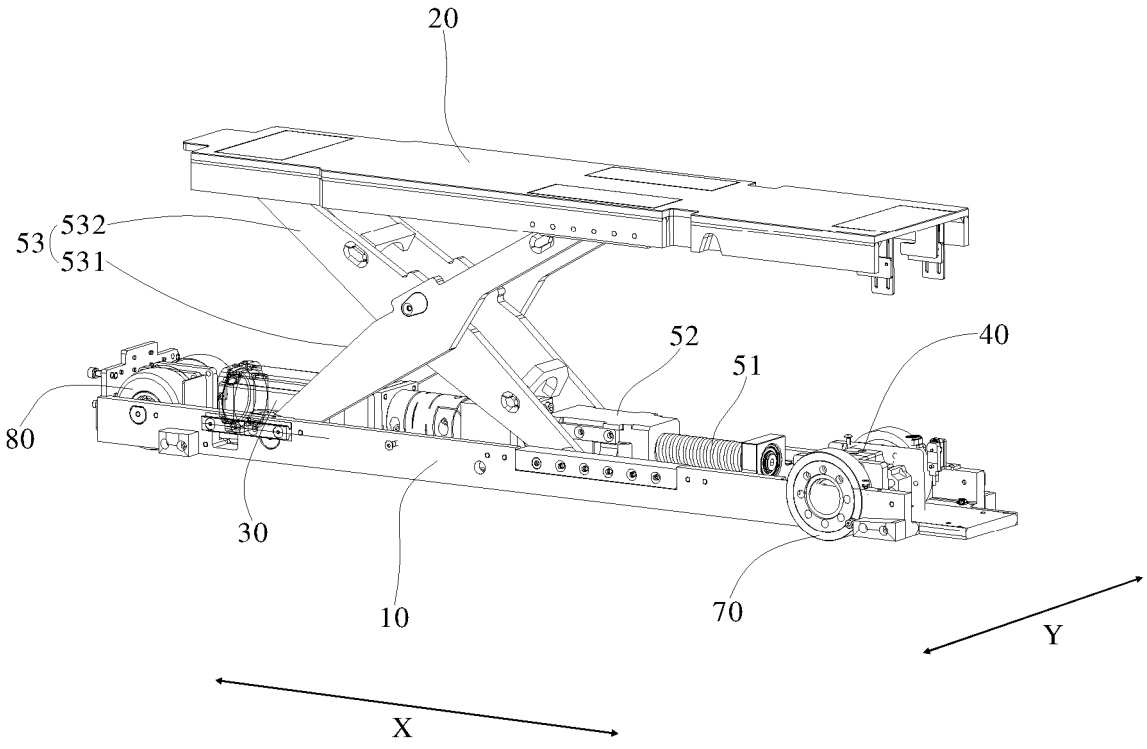

FIG. 2

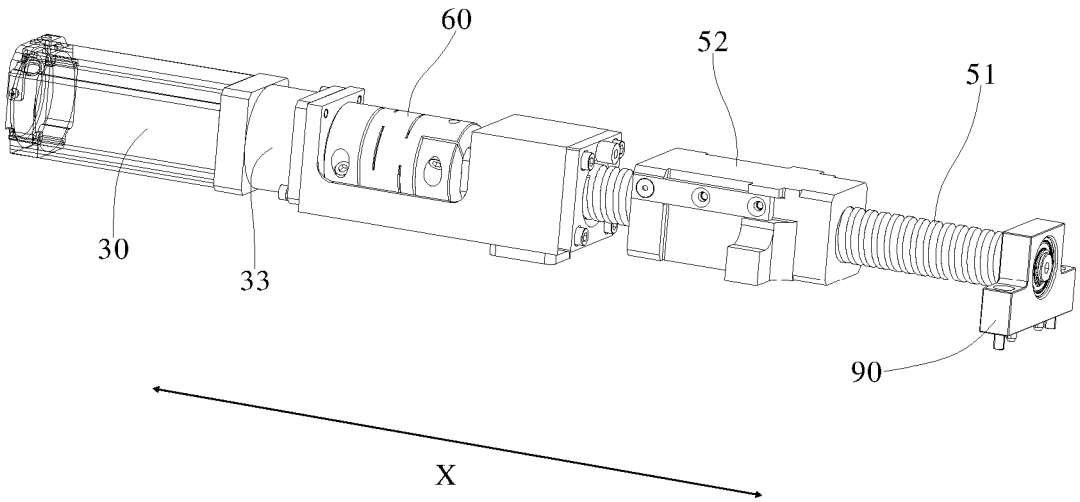

FIG. 3

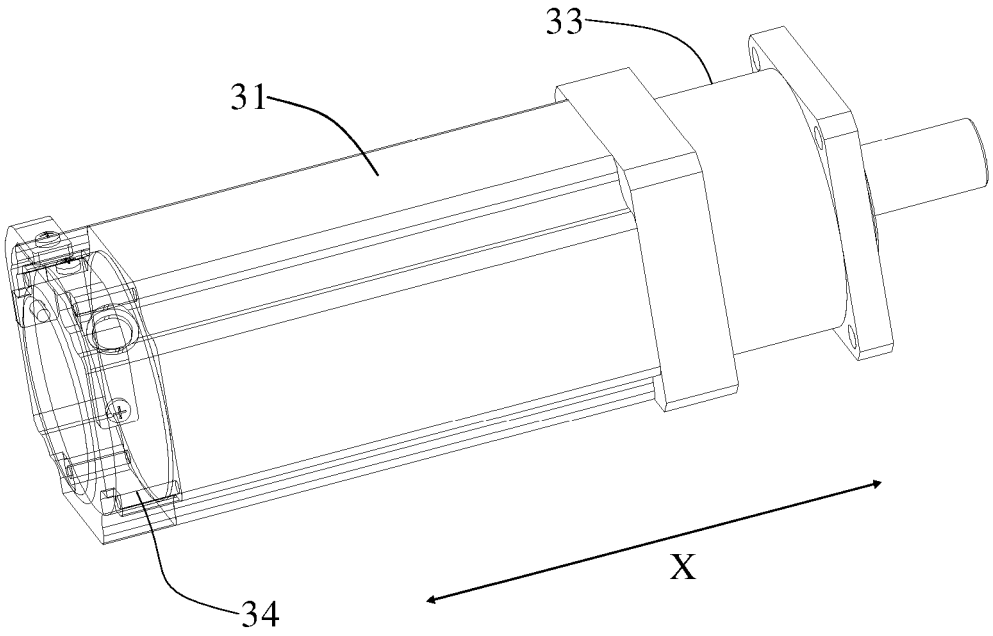

FIG. 4

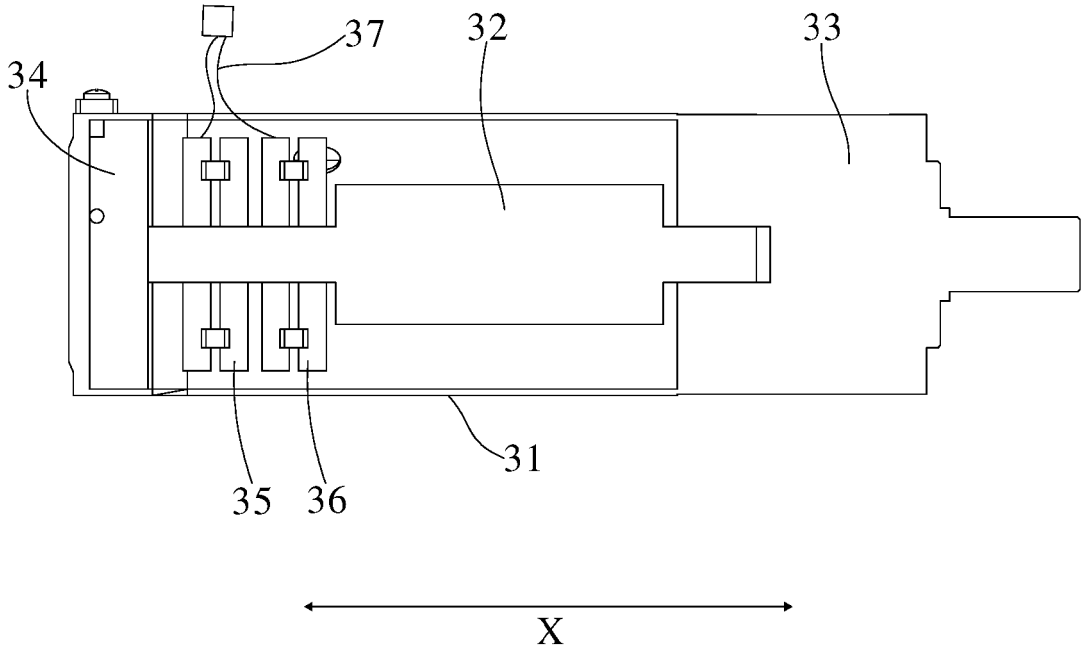

FIG. 5

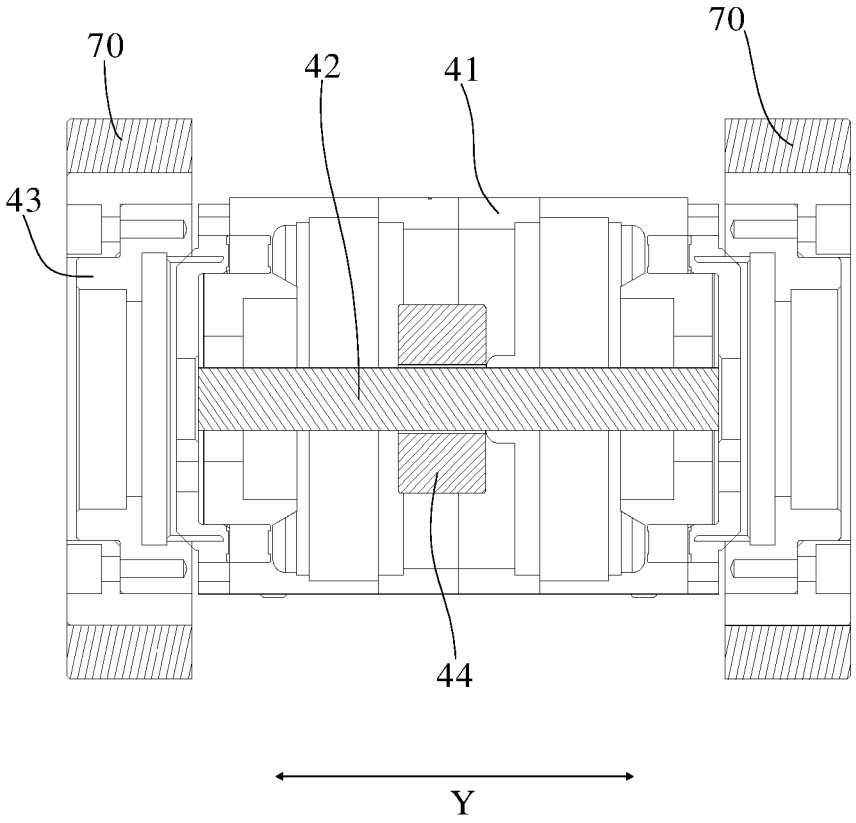

FIG. 6

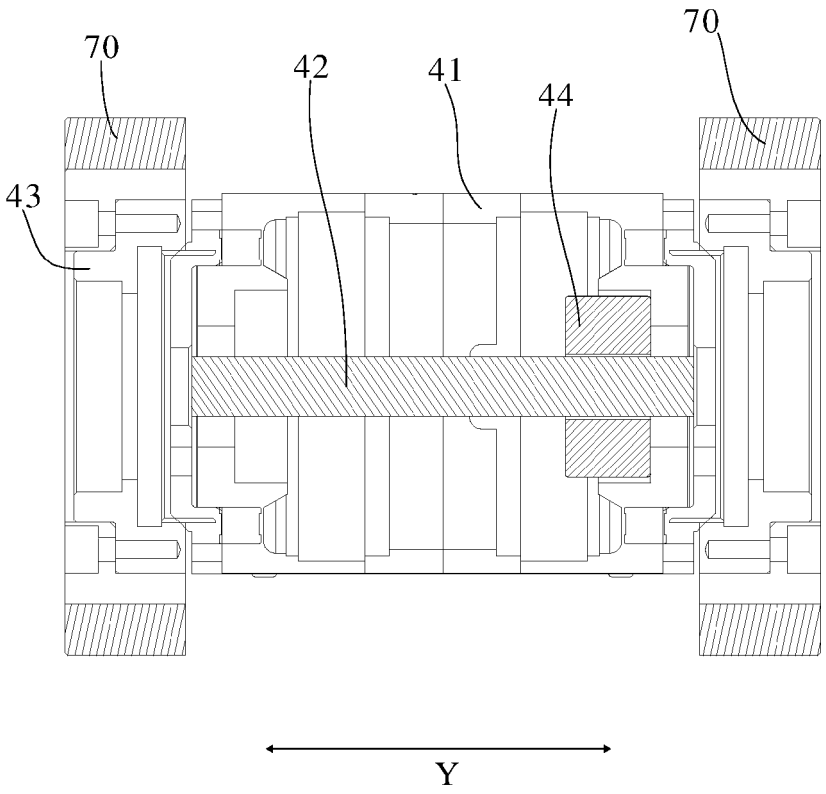

FIG. 7

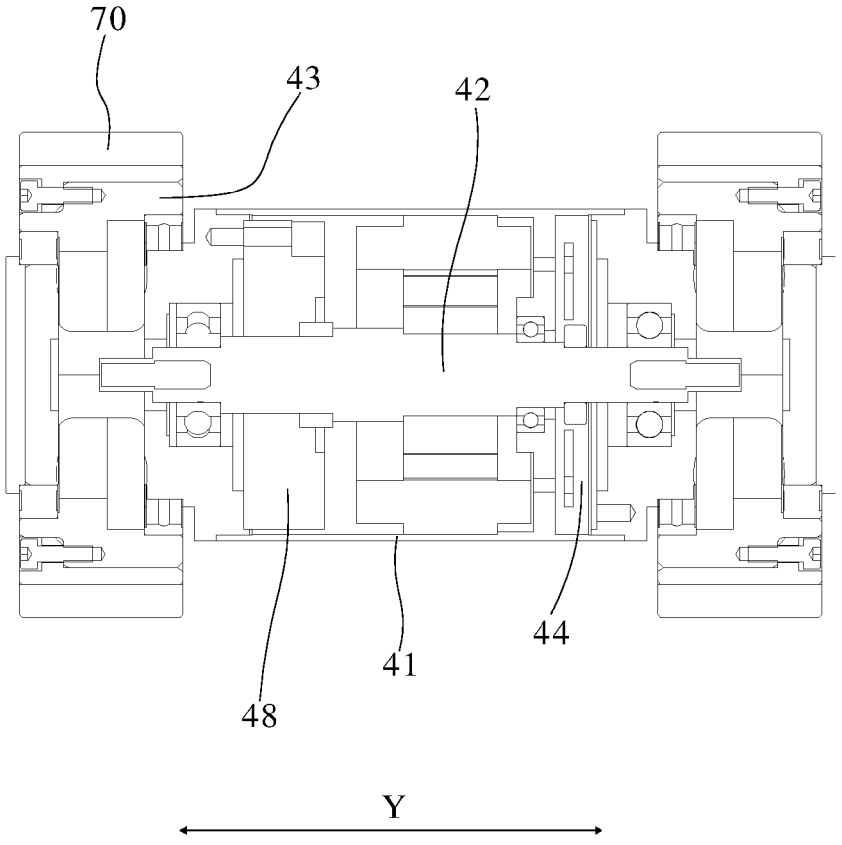

FIG. 8

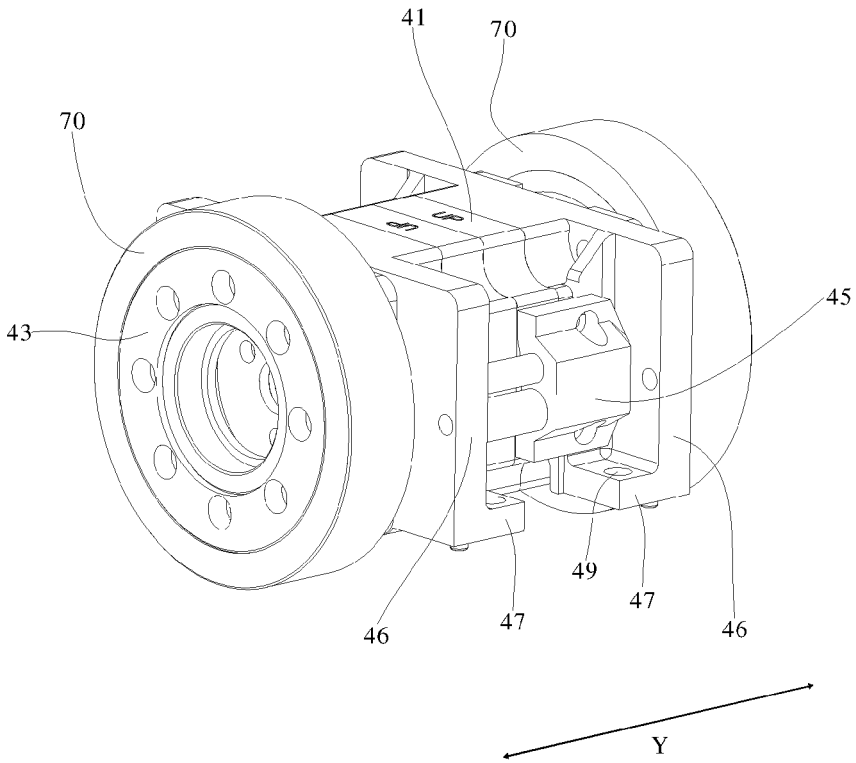

FIG. 9

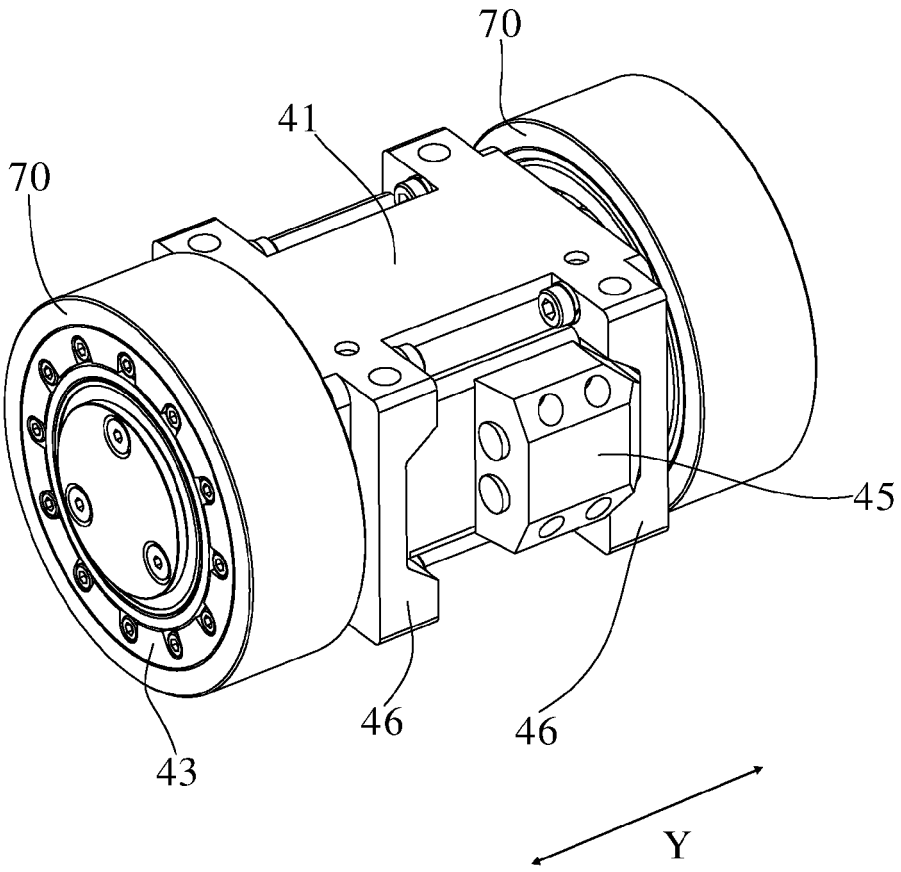

FIG. 10

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EUROPEAN SEARCH REPORT

Application Number
EP 24 19 4550

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	9 January 2025	Verheul, Omiros

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