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(54) **SIDE DOOR DRIVING MECHANISM**

(57) A side door driving mechanism, comprising a motor, a screw rod pair, transmission gears, and a push rod. The motor and the screw rod pair are arranged on a vehicle door in parallel, and are drivably connected at an end through the transmission gears; the push rod has

one end connected to an output end of the screw rod pair and the other end hinged to a vehicle body bracket to be fixed on a vehicle body, and the axis of the bracket is parallel to the hinge shaft.

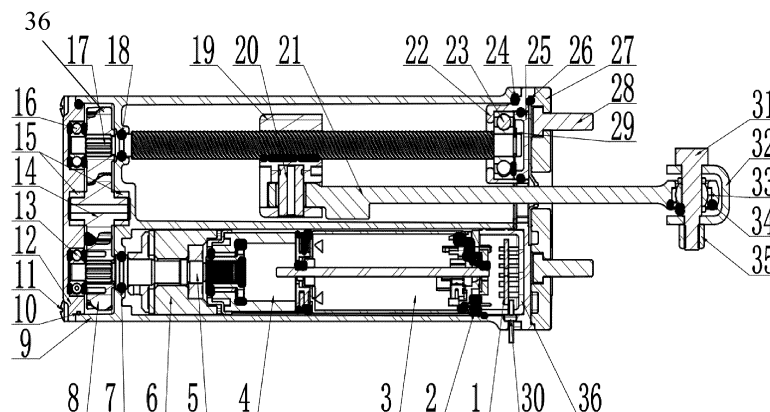


FIG.2

Description

TECHNICAL FIELD

[0001] The invention relates to the technical field of vehicle doors, and in particular to a side door driving mechanism.

BACKGROUND

[0002] With the development of vehicles towards automation and intelligence, the demand for automatic door opening and closing mechanisms for vehicles is increasing, which greatly improves the user experience of vehicles and enhances use convenience for users. The mechanisms have high practicality and allow vehicle doors to open and close automatically, bringing convenience for people to travel. Moreover, they also avoid unexpected events happening when a vehicle door is opened/closed, such as collision with other obstacles, damaging the vehicle door, or pinching people's hands/feet and causing personal injury; or the unexpected event that the vehicle door is not closed in place.

[0003] Nowadays, there are also electric vehicle door mechanisms, most of which are of zipper/rack/hinge shaft/orthogonal worm gear types. These mechanisms have many parts, complex structures, and take up a large space, cannot provide enough force (too large/too small) for opening and closing a vehicle door manually, or they cannot achieve uphill/downhill/side slope hovering and the like, fail to effectively detect obstacles or they do not have an anti-pinch function or intelligent manual mode, that is, when not in manual mode, open/close the vehicle door manually in a slow manner with a small force; open/close the vehicle door quickly, and the tailgate follows to open or close automatically like an intelligent vehicle door driving mechanism.

[0004] In addition, due to the limited space of a vehicle door, it is desired to design a vehicle door driving mechanism that is smaller in size and easy to install.

SUMMARY OF THE INVENTION

[0005] In view of this, it is desired to provide a side door driving mechanism to solve the problems in the prior art.

[0006] In order to solve the problems in the prior art, the technical solutions adopted by the invention are as follows:

[0007] A side door driving mechanism, comprising a motor, a screw rod pair, transmission gears, and a push rod, wherein the motor and the screw rod pair are arranged on a vehicle door in parallel, and are drivably connected at an end through the transmission gears; the push rod has one end connected to an output end of the screw rod pair and the other end hinged to a vehicle body bracket to be fixed on a vehicle body, and the axis of the bracket is parallel to the hinge shaft.

[0008] Preferably, the hinged connection is realized by

means of a hinge assembly, and the hinge assembly comprises a mounting hole formed at an end portion of the push rod, a pin screw that passes through the mounting hole and is rotationally connected to the vehicle body bracket at two ends, and a locking nut provided on the other side of the push rod to lock the pin screw.

[0009] Preferably, a joint bearing is also provided at the position where the vehicle body bracket and the push rod are hinged, and is limited by a second retaining ring.

[0010] Preferably, the screw rod pair comprises a screw rod to be mounted on the vehicle door and a screw nut threadedly connected to the screw rod; the screw nut is provided with a guide device for limiting the screw nut to move along the axis of the screw rod.

[0011] Preferably, a housing is provided outside and fixed to the motor, the screw rod pair, the transmission gears, and the push rod; the housing is provided with a through hole for the end portion of the push rod to extend out, and the housing is to be fixed to the vehicle door.

[0012] Preferably, one end of the motor is provided with a circuit assembly, a motor gasket and a motor spacer sleeve; one end of the motor is connected to the circuit assembly, motor gasket and the motor spacer sleeve, and the other end of the motor is provided with a reducer which has an internal spline output and the internal spline is connected to a motor shaft; the rotational motion of the motor is transmitted to the motor shaft via the reducer, causing the motor shaft to rotate.

[0013] Preferably, the motor shaft is provided with a sealing ring groove in which a first sealing ring is fitted, a spline at a middle portion thereof to connect a first transmission gear, and a bearing limit step at an end portion thereof to connect a first bearing; the motor shaft is connected to a brake, and the brake is provided with a catching groove to connect the housing; an end portion of the housing is connected to a housing cover by means of a positioning stop and a connecting screw to fasten the housing and the housing cover; the housing cover is provided with a sealing ring groove in which a second sealing ring is fitted.

[0014] Preferably, the transmission gears include a first transmission gear, a second transmission gear and a third transmission gear; after the first transmission gear rotates, the rotational motion of the first transmission gear is transmitted, via the second transmission gear, to the third transmission gear and to the screw rod, causing the screw rod to do a rotational motion; the screw rod is provided, in turn, with a bearing step to connect a second bearing, a spline to connect the third transmission gear, and a sealing ring groove to connect a third sealing ring; a thread is provided on a middle portion of the screw rod to connect the screw nut; the screw nut has a threaded portion inside and is provided with a pin to connect the push rod, and the pin is provided with a back-stop mechanism.

[0015] Preferably, the other end of the screw rod is provided with a bearing step to connect a third bearing; the first retaining ring is connected in sequence so as to

fix the third bearing; the third bearing is fixed to the housing by means of a bearing carrier and a bearing gasket; sealing gaskets are arranged between the housing and the bearing carrier and between the bearing carrier and the mounting base in sequence; the sealing gasket is provided with a sealing lip for sealed connection with the push rod, and the lower part of the sealing gasket is provided with a harness sealing structure.

[0016] Preferably, the side door driving mechanism further comprises a brake, the brake is electrically connected to an ECU, and the ECU is electrically connected to a vehicle door sensor.

[0017] Preferably, the motor shaft is provided with a sealing ring groove in which a first sealing ring is fitted, a spline at a middle portion thereof to connect a first transmission gear, and a bearing limit step at an end portion thereof to connect a first bearing; the motor shaft is connected to a damper.

[0018] Preferably, the motor shaft is directly connected to the first transmission gear.

[0019] Preferably, the housing is composed of a first housing and a second housing that are combined; the motor, the reducer, the motor shaft, the brake and a transmission gear set are mounted in the first housing; the screw rod and the screw nut are mounted in the second housing.

[0020] Preferably, the first housing is L-shaped and comprises a motor mounting portion and a gear receiving portion; the motor, the reducer, the motor shaft, and the brake are mounted in the motor mounting portion, and the transmission gear set is mounted in the gear receiving portion.

[0021] Preferably, the second housing comprises a housing portion, the housing portion has a hollow portion inside, the screw rod and the screw nut are located in the hollow portion, and the push rod has one end extending into the hollow portion and connected to the screw nut and the other end extending out of the housing portion and connected to the vehicle body bracket.

[0022] Preferably, in the side door driving mechanism, a combination platform portion is provided on the first housing, the second housing is located above the combination platform portion, the first housing has a fixed length, and the second housing has a variable length.

[0023] Preferably, hinge holes are provided at two ends of the push rod, and at least one joint bearing is contained in the hinge holes at the two ends.

[0024] Preferably, the push rod is provided with a limiting portion which is a straight-surface limiting portion or an arc-surface limiting portion, the limiting portion is provided on one side or both upper and lower sides of the push rod, and the push rod is straight or curved.

[0025] As one of embodiments, preferably, a second hinge hole is formed at the position where the push rod and the screw nut are assembled, a first hinge hole is formed at the position where the push rod and the vehicle body bracket are assembled, the second hinge hole is provided with a joint bearing, and the first hinge hole is

provided with two bushings.

[0026] As another embodiment, preferably, a second hinge hole is formed at the position where the push rod and the screw nut are assembled, a first hinge hole is formed at the position where the push rod and the vehicle body bracket are assembled, the second hinge hole is provided with a joint bearing, and the first hinge hole is provided with a joint bearing.

[0027] Compared with the prior art, the present application has the following beneficial effects:

1. Capable of opening and closing the vehicle door automatically.
2. Simple structure, reliable function; small size, easy installation; low operating noise.
3. Since a bracket is provided at the position connected to the vehicle body and the bracket and the side door driving mechanism push rod are provided with joint bearings, it is ensured that during the opening and closing process of the vehicle door, the rotation axis of the bracket of the side door driving mechanism is always parallel to the hinge shaft, and it also reduces the installation accuracy of the side door driving mechanism.
4. Since the side door driving mechanism is provided with a damper, when the reducer of the motor is disengaged (the clutch is disengaged) or during the manufacturing process of the side door driving mechanism, the consistent internal resistance of the side door driving mechanism can be ensured, that is, the consistency in terms of the force for opening or closing the vehicle door manually, the product functions, and the like is ensured.
5. In extreme working conditions such as flat, uphill, downhill, and side slopes, the requirement for door hovering in all working conditions can be met.
6. Intelligent obstacle detection or anti-pinch function are provided to avoid collision with other obstacles, damage to the door, or pinching of hands/feet, causing personal injury when the vehicle door is opened or closed.
7. Capable of electrically opening/closing the vehicle door in an automatic manner; manual state: open/close the door manually in a slow manner with a small force; open/close the vehicle door quickly, and the tailgate follows to open or close automatically like an intelligent vehicle door driving mechanism.

BRIEF DESCRIPTION OF THE DRAWINGS

[0028]

FIG. 1 shows the installation position of a side door driving mechanism;

FIG. 2 shows the internal structure of the side door driving mechanism;

FIG. 3 shows the side door driving mechanism having a brake replaced with a damper;

FIG. 4 is a structural diagram of the side door driving mechanism without a brake or a damper;

FIG. 5 is a schematic structural diagram of a combined housing of the side door driving mechanism;

FIG. 6 is a schematic structural diagram of a push rod of the side door driving mechanism according to an embodiment; and

FIG. 7 is a schematic structural diagram of the push rod of the side door driving mechanism according to another embodiment.

Reference numerals in the figures:

[0029] 1. circuit assembly, 2. motor gasket, 3. motor, 4. reducer, 5. motor shaft, 6. brake, 7. first sealing ring, 8. first transmission gear, 9. housing, 10. second sealing ring, 11. connecting screw, 12. housing cover, 13. first bearing, 14. second transmission gear, 15. shaft sleeve, 16. second bearing, 17. screw rod, 18. third sealing ring, 19. screw nut, 20. pin, 21. push rod, 22. bearing carrier, 23. third bearing, 24. first sealing gasket, 25. bearing gasket, 26. second sealing gasket, 27. mounting base, 28. fixing screw, 29. first retaining ring, 30. harness plug, 31. pin screw, 32. vehicle body bracket, 33. joint bearing, 34. second retaining ring, 35. locking nut, 36. third transmission gear, 37. damper, 38. first housing, 381. motor mounting portion, 382. gear receiving portion, 39. second housing, 391. hollow portion; 4. combination platform portion; 41. limiting portion; 42. first hinge hole, 43. second hinge hole; 44. bushing.
101. Vehicle door, 102. driving mechanism, 103. vehicle body bracket, 104. vehicle body, 105. ECU, 106. vehicle door sensor, 107. hinge.

DETAILED DESCRIPTION OF EMBODIMENTS

[0030] In order to further understand the features, technical means, and specific objectives and functions of the invention, the invention will be described in further detail below in conjunction with the accompanying drawings and specific embodiments.

[0031] As shown in FIG. 1, the driving mechanism 102 is mounted and fixed on a side of a middle portion of the vehicle door 101 close to a hinge 107, that is, the driving mechanism is mounted at the position of an original stopper on the vehicle door. In an electric working condition, when the driving mechanism 102 receives an open/close signal from an ECU 105, a motor 3 inside starts to run, the rotational motion of the motor 3 is transmitted internally through the driving mechanism 102 to rotate the screw rod 17 and push the screw nut 19 to move linearly, causing the push rod 21 to generate a push/pull force. Since the driving mechanism 102 is fixed to the vehicle door and a vehicle body bracket 103 is fixed to a vehicle body, the vehicle door 101 is driven electrically to open/close when as the push rod 21 extends out or contracts back.

[0032] As shown in FIG. 2, one end of the motor 3 is

connected to a circuit assembly 1, and one end of the motor 3 is connected to the motor rubber pad 2 and the motor spacer sleeve 36. The other end of the motor is provided with a reducer 4, which has an internal spline inside and is connected to a motor shaft 5. The rotational motion of the motor 3 is transmitted to the motor shaft 5 via the reducer 4, causing the motor shaft 5 to rotate. The motor shaft 5 is connected to a brake 6, and the ECU 105 outputs a voltage to the brake 6, so that the brake 6 generates a braking torque, thus changing the internal resistance of the side door driving mechanism. The motor shaft 5 is provided with a sealing ring groove in which a first sealing ring 7 is fitted, a spline at a middle portion thereof to connect a first transmission gear 8, and a bearing limit step at an end portion thereof to connect a first bearing 13. The brake 6 is provided with a catching groove to connect the housing 9. An end portion of the housing 9 is connected to a housing cover 12 by means of a positioning stop and a connecting screw 11 to fasten the housing 9 and the housing cover 12. The housing cover 12 is provided with a sealing ring groove in which a second sealing ring 10 is fitted. The transmission gears include a first transmission gear 8, a second transmission gear 14 and a third transmission gear 36. After the first transmission gear 8 rotates, the rotational motion of the first transmission gear 8 is transmitted, via the second transmission gear 14, to the third transmission gear 36 and to the screw rod 17, causing the screw rod 17 to do a rotational motion. The screw rod 17 is provided, in turn, with a bearing step to connect a second bearing 16, a spline to connect the third transmission gear 36, and a sealing ring groove to connect a third sealing ring 18. A thread is provided on a middle portion of the screw rod to connect the screw nut 19. The screw nut 19 has a threaded portion inside and is provided with a pin 20 to connect the push rod 21, and the pin 20 is provided with a back-stop mechanism to prevent the pin from moving back. The rotational motion of the screw rod 17 is transmitted to the screw nut 19, and a guide block on the screw nut 19 allows the screw nut 19 to move along the axis of the screw rod 17, thus causing the push rod 21 to do a push/pull action. The push rod 21 connected to the pin 20 can also make a rotational motion to adjust an angle between the push rod and the vehicle door. The other end of the screw rod 17 is provided with a bearing step to connect a third bearing 23, the third bearing 23 is connected to the first retaining ring 29 to fix the third bearing 23. The third bearing 23 is fixed to the housing 9 by means of a bearing carrier 22 and a bearing gasket 25. Sealing gaskets 24 and 26 are provided between the housing 9, the bearing carrier 22 and the mounting base 27 in turn. The sealing gasket 26 is provided with a sealing lip for sealed connection with the push rod 21, and the lower part of the sealing gasket 26 is provided with a harness sealing structure. In this way, the sealing effect can be ensured. The push rod 21 is provided with a limiting mechanism, which limits the push rod 21 at the maximum stroke on the edge of the mounting base 27 when the

push rod 21 reaches its maximum extension. The other end of the push rod 21 is connected to a joint bearing 33, which is limited by means of a second retaining ring 34, the vehicle body bracket 32 is connected to the middle portion of the joint bearing 33, and the vehicle body bracket 32 is connected to the vehicle body, and the end of the push rod 21 is fixed. The mounting base 27 is connected to a fixing screw 28 to fix the driving mechanism 102 to the vehicle door. The push rod 21 moves in a manner of extending out and contracting back, and the vehicle body bracket 32 is connected to the vehicle body, thereby electrically driving the vehicle door 101 to rotate and open/close.

[0033] As shown in FIG. 3, preferably, the motor shaft 5 is provided with a sealing ring groove in which a first sealing ring 7 is fitted, a spline at a middle portion thereof to connect a first transmission gear 8, and a bearing limit step at an end portion thereof to connect a first bearing 13. The motor shaft 5 is connected to a damper 37. The brake 6 may also be replaced with a damper 37. In this way, the damper 37 can still ensure hovering at all angles when the reducer of the motor is disengaged; and during the manufacturing process of the driving mechanism 102, the consistent internal resistance can be ensured, that is, the consistency in terms of the force for opening or closing the vehicle door manually, product functions, and the like is ensured.

[0034] As shown in FIG. 4, the brake 6 and the damper 37 may be omitted here, and the motor shaft 5 is directly connected to the first transmission gear 8. The absence of the brake 6 or the damper 37 here greatly reduces the overall length of the driving mechanism. As a result, the driving mechanism is applicable to a wider range of vehicle models.

[0035] As shown in FIG. 5, the housing 9 is composed of a first housing 38 and a second housing 39 that are combined; the motor 3, the reducer 4, the motor shaft 5, the brake 6 and a transmission gear set are mounted in the first housing 38; the screw rod 17 and the screw nut 19 are mounted in the second housing 39; a combination platform portion 40 is provided on the first housing 38, the second housing 39 is located on the combination platform portion 40, the first housing 38 has a fixed length, and the second housing 39 has a variable length. The first housing 38 with a fixed length and the second housing 39 with a frequently changing length can be separated, by only changing the length of the housing portion at the screw rod, the length of the mechanism can be adapted to different models of vehicle, which is more convenient, rapid and cost-effective and shortens the development cycle. In this way, the total length of the mechanism can be changed conveniently and rapidly with low cost. The first housing 38 is L-shaped and comprises a motor mounting portion 381 and a gear receiving portion 382. The motor 3, the reducer 4, the motor shaft 5, and the brake 6 are mounted in the motor mounting portion 381. The transmission gear set is mounted in the gear receiving portion 382. The second housing 39 comprises a

housing portion, the housing portion has a hollow portion 391 inside, the screw rod 17 and the screw nut 19 are located in the hollow portion 391, and the push rod 21 has one end extending into the hollow portion 391 and connected to the screw nut 19 and the other end extending out of the housing portion and connected to the vehicle body bracket 103.

[0036] In order to ensure that the push rod can be automatically aligned and axially limited, hinge holes are provided at two ends of the push rod 21, and at least one joint bearing 33 is included in the hinge holes at the two ends. The push rod 21 is provided with a limiting portion 41 which is a straight-surface limiting portion or an arc-surface limiting portion, the limiting portion 41 is provided on one side or both upper and lower sides of the push rod 21, and the push rod 21 is straight or curved. As shown in FIG. 6, a second hinge hole 43 is formed at the position where the push rod 21 and the screw nut 19 are assembled, a first hinge hole 42 is formed at the position where the push rod 21 and the vehicle body bracket, the second hinge hole 43 is provided with a joint bearing 33, and the first hinge hole 42 is provided with two bushings 44. Here, change the spherical bearing 33 to the screw nut 19 to achieve alignment. Alternatively, as shown in FIG. 7, joint bearings 33 are provided on both sides of the push rod 21, a second hinge hole 43 is formed at the position where the push rod 21 and the screw nut 19 are assembled, a first hinge hole 43 is formed at the position where the push rod 21 and the vehicle body bracket 32, the second hinge hole 43 is provided with a joint bearing 33, and the first hinge hole 42 is provided with a joint bearing 33.

[0037] Electric working condition: When the driving mechanism 102 receives a control signal to open/close the vehicle door electrically, the motor 3 is energized and starts to run, the first transmission gear 8 is then driven to rotate by means of the motor shaft 5 connected to the reducer 4; the rotational motion of the first transmission gear 8 is then transmitted to the screw rod 17 and the screw rod 17 is driven to rotate. Since the screw rod 17 is provided with a screw nut, the screw motion of the screw rod 17 is converted into the linear motion of the screw nut 19 to push/pull the push rod 21, thus causing a vehicle door assembly to do the open/close action.

[0038] Manual working condition: The power signal of the motor 3 remains off from the vehicle power supply, and a vehicle door sensor 106 can detect whether the door is manually opened/closed, and whether an open/close signal is sent. Specifically:

1. The vehicle door sensor 106 detects that a vehicle door is opened/closed manually when the vehicle door is not opened/closed manually. If the vehicle door 101 automatically falls/opens under extreme working conditions (uphill/downhill), the ECU 105 conducts computing based on an algorithm and outputs a suitable voltage to control the braking torque of the brake 6. The brake 6 is then connected to the

motor shaft 5 to increase the internal resistance of the driving mechanism, thereby stopping the vehicle door from automatically falling/opening/closing. On the contrary, in a normal state, when the vehicle door sensor 106 does not detect the opening/closing of the vehicle door, the internal friction component of the brake 6 is disengaged, thereby reducing the internal resistance of the driving mechanism 102. In this way, the internal resistance of the driving mechanism 102 is controlled and adjusted electrically.

2. The vehicle door sensor 106 detects that a vehicle door is opened/closed manually when the vehicle door is opened/closed manually. Specifically:

① Follow-up: When the vehicle door sensor 106 detects that the vehicle door is quickly opened/closed manually, the ECU 105 sends an automatic open/close signal in the same direction as when a person operates the vehicle door 101, and then the driving mechanism 102 opens/closes the vehicle door electrically.

(2) Gentle and manual operation: When the vehicle door sensor 106 detects that the vehicle door is opened/closed manually in a slow manner, the ECU 105 sends a disconnect signal to clutch 3, thereby maintaining a gentle and slow manual operation.

[0039] In addition, there are obstacle detection sensors inside/outside the vehicle door to detect obstacles in advance during the opening/closing process of the vehicle door 101. The arrangement of the obstacle detection sensors can prevent hitting/pinching the operator or other obstacles and avoid personal injury or damage to vehicle doors. The ECU 105 detects the current flowing through the motor 3 in the driving mechanism 102, thereby inferring the hitting/pinching event of the vehicle door.

[0040] The above embodiments only describe several implementations of the invention, and their description is specific and detailed, but cannot therefore be understood as a limitation on the patent scope of the invention. It should be noted that those of ordinary skill in the art may further make variations and improvements without departing from the conception of the invention, and these all fall within the scope of the invention. Therefore, the scope of the patent for the invention shall be subject to the appended claims.

Claims

1. A side door driving mechanism, comprising a motor, a screw rod pair, transmission gears and a push rod; the motor and the screw rod pair are arranged on a vehicle door in parallel, and are drivably connected at an end through the transmission gears; the push rod has one end connected to an output end of the screw rod pair and the other end hinged to a vehicle

body bracket to be fixed on a vehicle body, and the axis of the bracket is parallel to the hinge shaft.

2. The side door driving mechanism according to Claim 1, wherein the hinged connection is realized by means of a hinge assembly, and the hinge assembly comprises a mounting hole formed at an end portion of the push rod, a pin screw that passes through the mounting hole and is rotationally connected to the vehicle body bracket at two ends, and a locking nut provided on the other side of the push rod to lock the pin screw.

3. The side door driving mechanism according to Claim 2, wherein a joint bearing is also provided at the position where the vehicle body bracket and the push rod are hinged, and is limited by a second retaining ring.

4. The side door driving mechanism according to Claim 1, wherein the screw rod pair comprises a screw rod to be mounted on the vehicle door and a screw nut threadedly connected to the screw rod; the screw nut is provided with a guide device for limiting the screw nut to move along the axis of the screw rod.

5. The side door driving mechanism according to Claim 1, wherein a housing is provided outside and fixed to the motor, the screw rod pair, the transmission gears, and the push rod; the housing is provided with a through hole for the end portion of the push rod to extend out, and the housing is to be fixed to the vehicle door.

6. The side door driving mechanism according to any one of Claims 1-5, further comprising a brake, wherein the brake is electrically connected to an ECU, and the ECU is electrically connected to a vehicle door sensor.

7. The side door driving mechanism according to Claim 1, wherein one end of the motor is provided with a circuit assembly, a motor gasket and a motor spacer sleeve; one end of the motor is connected to the circuit assembly, motor gasket and the motor spacer sleeve, and the other end of the motor is provided with a reducer, which has an internal spline output, and the internal spline is connected to a motor shaft; the rotational motion of the motor is transmitted to the motor shaft via the reducer, causing the motor shaft to rotate.

8. The side door driving mechanism according to Claim 6, wherein the motor shaft is provided with a sealing ring groove in which a first sealing ring is fitted, a spline at a middle portion thereof to connect a first transmission gear, and a bearing limit step at an end portion thereof to connect a first bearing; the motor

shaft is connected to a brake, and the brake is provided with a catching groove to connect the housing; an end portion of the housing is connected to a housing cover by means of a positioning stop and a connecting screw to fasten the housing and the housing cover; the housing cover is provided with a sealing ring groove in which a second sealing ring is fitted.

9. The side door driving mechanism according to Claim 8, wherein the transmission gears include the first transmission gear, a second transmission gear and a third transmission gear; after the first transmission gear rotates, the rotational motion of the first transmission gear is transmitted, via the second transmission gear, to the third transmission gear and to the screw rod, causing the screw rod to do a rotational motion; the screw rod is provided, in turn, with a bearing step to connect a second bearing, a spline to connect the third transmission gear, and a sealing ring groove to connect a third sealing ring; a thread is provided on a middle portion of the screw rod to connect the screw nut; the screw nut has a threaded portion inside and is provided with a pin to connect the push rod, and the pin is provided with a back-stop mechanism.
10. The side door driving mechanism according to Claim 1, wherein the other end of the screw rod is provided with a bearing step to connect a third bearing; the first retaining ring is connected in sequence so as to fix the third bearing; the third bearing is fixed to the housing by means of a bearing carrier and a bearing gasket; sealing gaskets are arranged between the housing and the bearing carrier and between the bearing carrier and the mounting base in sequence; the sealing gasket is provided with a sealing lip for sealed connection with the push rod, and the lower part of the sealing gasket is provided with a harness sealing structure.
11. The side door driving mechanism according to any one of Claims 1-5, wherein the motor shaft is provided with a sealing ring groove in which a first sealing ring is fitted, a spline at a middle portion thereof to connect a first transmission gear, and a bearing limit step at an end portion thereof to connect a first bearing; the motor shaft is connected to a damper.
12. The side door driving mechanism according to any one of Claims 1-5, wherein the motor shaft is directly connected to the transmission gear.
13. The side door driving mechanism according to Claim 5, wherein the housing is composed of a first housing and a second housing that are combined; the motor, the reducer, the motor shaft, the brake and a transmission gear set are mounted in the first housing; the screw rod and the screw nut are mounted in the

second housing.

14. The side door driving mechanism according to Claim 13, wherein the first housing is L-shaped and comprises a motor mounting portion and a gear receiving portion; the motor, the reducer, the motor shaft, and the brake are mounted in the motor mounting portion, and the transmission gear set is mounted in the gear receiving portion.
15. The side door driving mechanism according to Claim 14, wherein the second housing comprises a housing portion, the housing portion has a hollow portion inside, the screw rod and the screw nut are located in the hollow portion, and the push rod has one end extending into the hollow portion and connected to the screw nut and the other end extending out of the housing portion and connected to the vehicle body bracket.
16. The side door driving mechanism according to Claim 15, wherein a combination platform portion is provided on the first housing, the second housing is located above the combination platform portion, the first housing has a fixed length, and the second housing has a variable length.
17. The side door driving mechanism according to Claim 3, wherein hinge holes are provided at two ends of the push rod, and at least one joint bearing is contained in the hinge holes at the two ends.
18. The side door driving mechanism according to Claim 17, wherein the push rod is provided with a limiting portion which is a straight-surface limiting portion or an arc-surface limiting portion, the limiting portion is provided on one side or both upper and lower sides of the push rod, and the push rod is straight or curved.
19. The side door driving mechanism according to Claim 17, wherein a second hinge hole is formed at the position where the push rod and the screw nut are assembled, a first hinge hole is formed at the position where the push rod and the vehicle body bracket are assembled, the second hinge hole is provided with a joint bearing, and the first hinge hole is provided with two bushings.
20. The side door driving mechanism according to Claim 17, wherein a second hinge hole is formed at the position where the push rod and the screw nut are assembled, a first hinge hole is formed at the position where the push rod and the vehicle body bracket are assembled, the second hinge hole is provided with a joint bearing, and the first hinge hole is provided with a joint bearing.

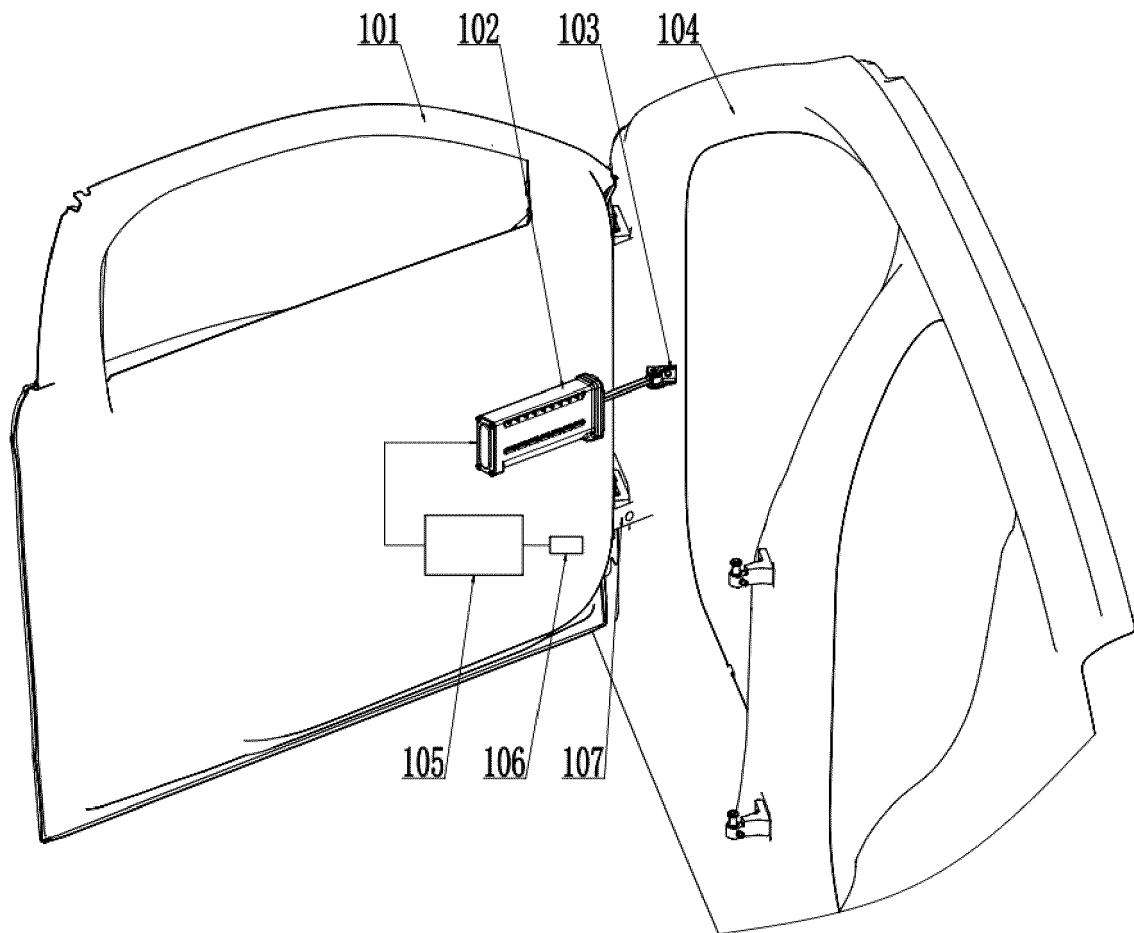


FIG.1

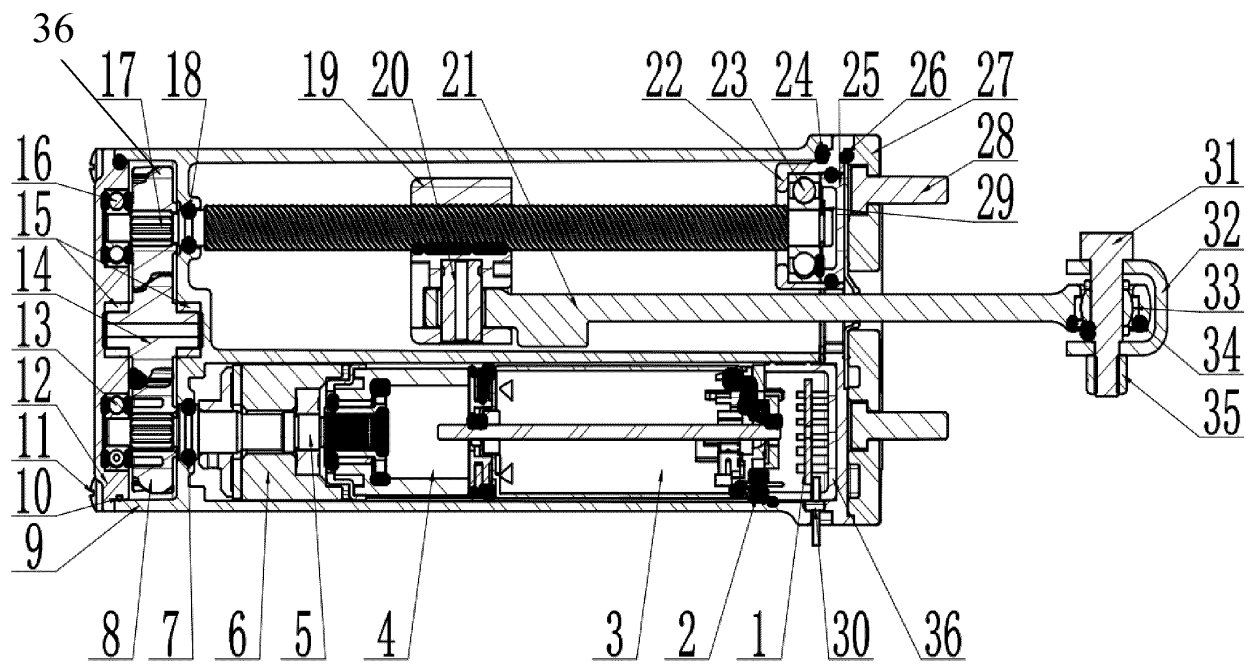


FIG.2

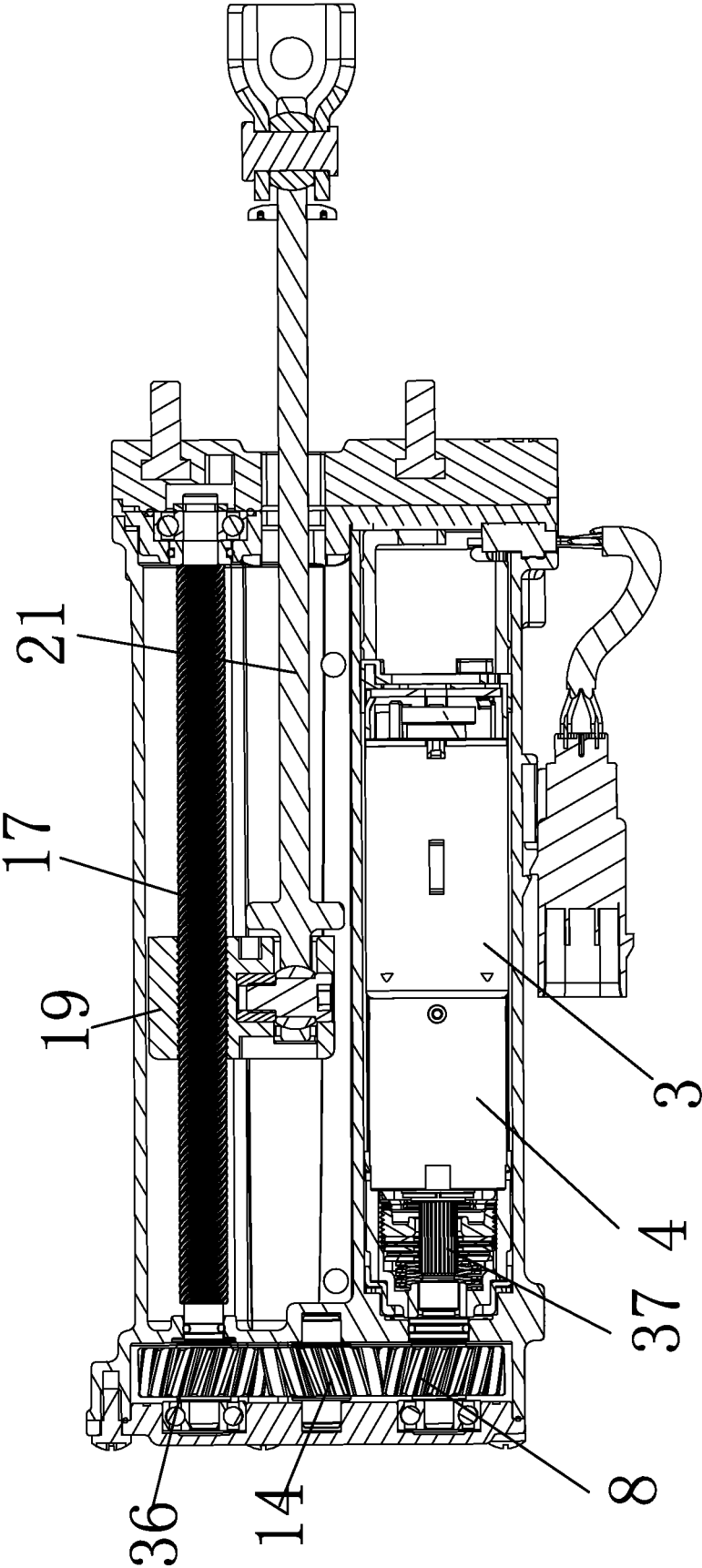


FIG.3

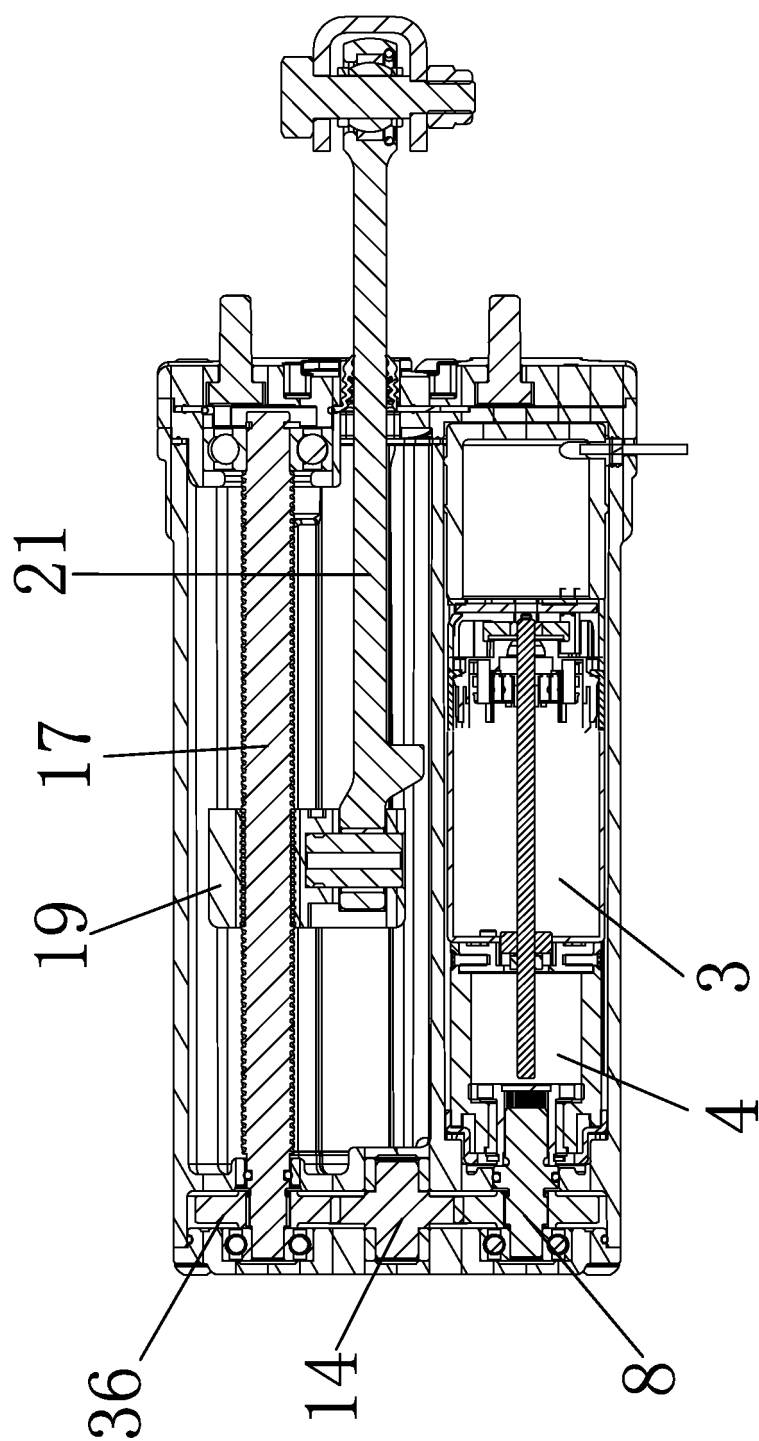


FIG. 4

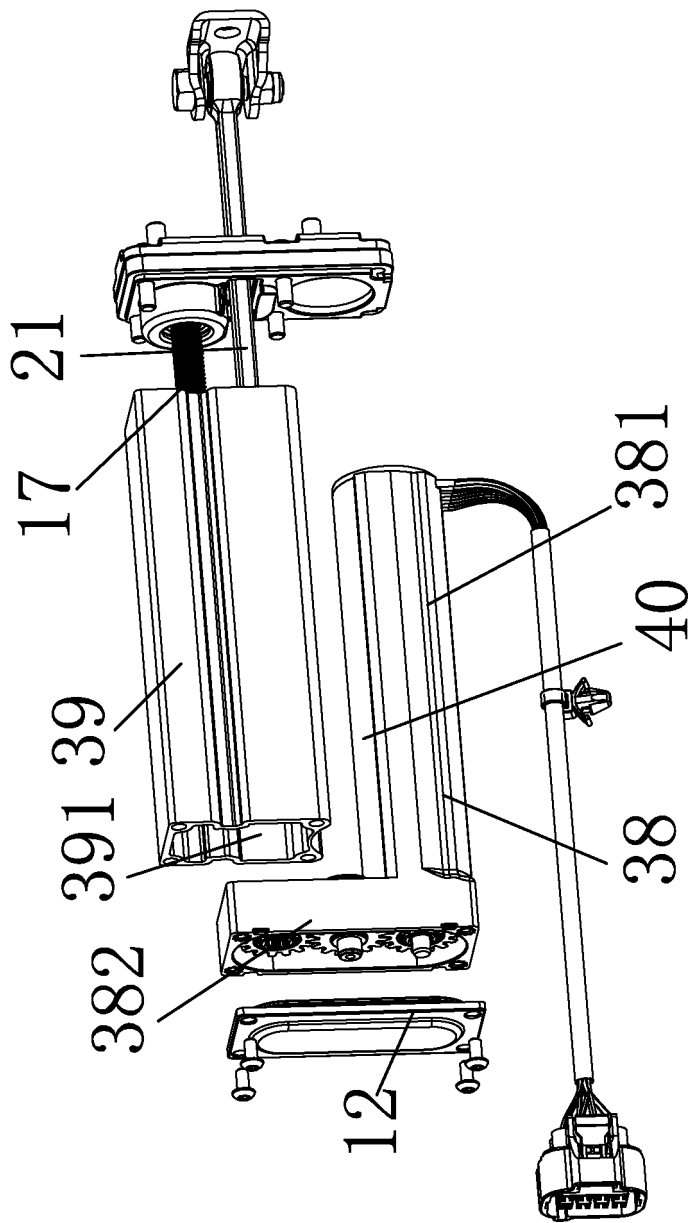


FIG.5

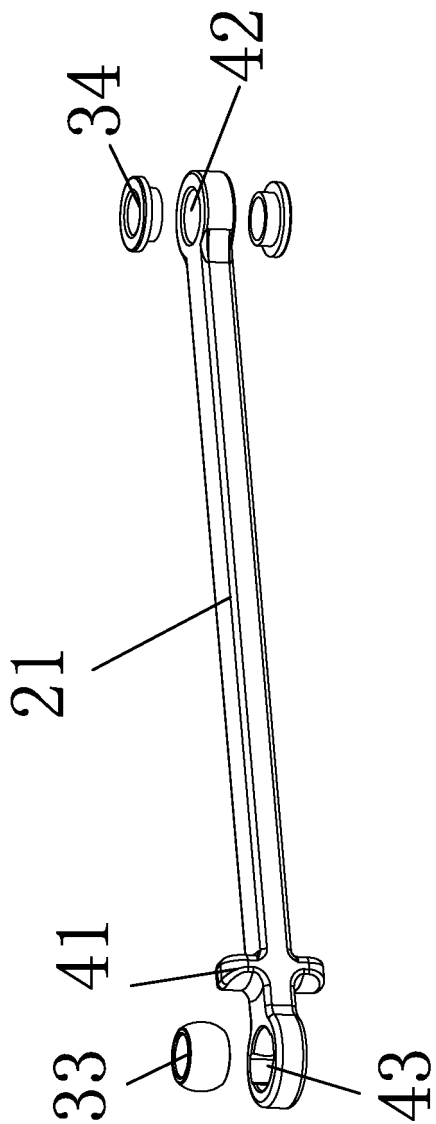


FIG.6

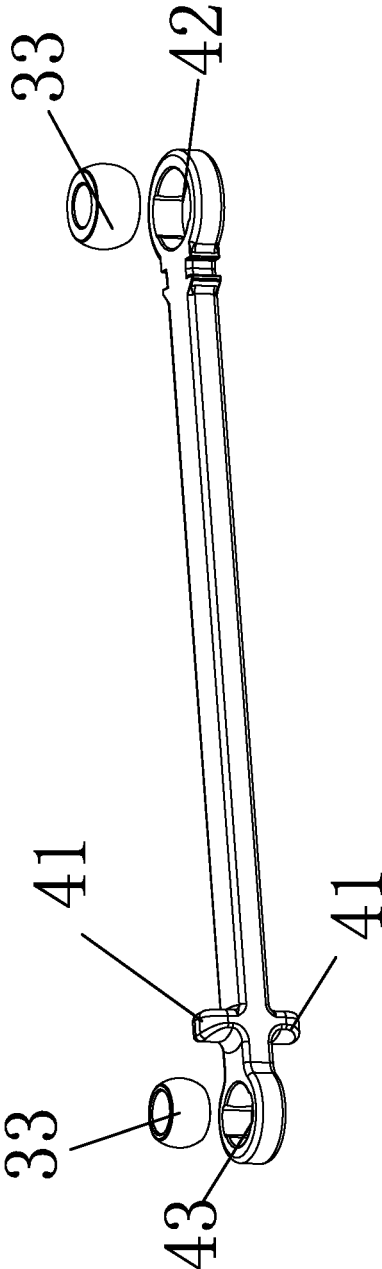


FIG.7

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2022/131937

A. CLASSIFICATION OF SUBJECT MATTER E05F15/622(2015.01);B60J5/04(2006.01)i According to International Patent Classification (IPC) or to both national classification and IPC																					
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) IPC:E05F15,B60J5 Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) CNABS, CNTXT, VEN, CNKI: 车, 螺纹, 丝杠, 丝杆, 电机, 电动机, car?, vehicle?, screw?, motor?																					
C. DOCUMENTS CONSIDERED TO BE RELEVANT <table border="1"> <thead> <tr> <th>Category*</th> <th>Citation of document, with indication, where appropriate, of the relevant passages</th> <th>Relevant to claim No.</th> </tr> </thead> <tbody> <tr> <td>X</td> <td>CN 113006630 A (NINGBO SHINTAI MACHINES CO., LTD.) 22 June 2021 (2021-06-22) description, paragraphs 25-49, and figures 1-4</td> <td>1-20</td> </tr> <tr> <td>X</td> <td>CN 113389460 A (FOSHAN SUSHIDAI TECHNOLOGY CO., LTD.) 14 September 2021 (2021-09-14) description, specific embodiments, and figures 1-2</td> <td>1-20</td> </tr> <tr> <td>PX</td> <td>CN 113958223 A (NINGBO SHINTAI MACHINES CO., LTD.) 21 January 2022 (2022-01-21) claims 1-10, description, specific embodiments, and figures 1-2</td> <td>1-20</td> </tr> <tr> <td>PX</td> <td>CN 216588233 U (NINGBO SHINTAI MACHINES CO., LTD.) 24 May 2022 (2022-05-24) claims 1-10, description, specific embodiments, and figures 1-2</td> <td>1-20</td> </tr> <tr> <td>A</td> <td>CN 201679375 U (CHERY AUTOMOBILE CO., LTD.) 22 December 2010 (2010-12-22) entire document</td> <td>1-20</td> </tr> <tr> <td>A</td> <td>WO 2018066500 A1 (MITSUBA CORP.) 12 April 2018 (2018-04-12) entire document</td> <td>1-20</td> </tr> </tbody> </table>	Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.	X	CN 113006630 A (NINGBO SHINTAI MACHINES CO., LTD.) 22 June 2021 (2021-06-22) description, paragraphs 25-49, and figures 1-4	1-20	X	CN 113389460 A (FOSHAN SUSHIDAI TECHNOLOGY CO., LTD.) 14 September 2021 (2021-09-14) description, specific embodiments, and figures 1-2	1-20	PX	CN 113958223 A (NINGBO SHINTAI MACHINES CO., LTD.) 21 January 2022 (2022-01-21) claims 1-10, description, specific embodiments, and figures 1-2	1-20	PX	CN 216588233 U (NINGBO SHINTAI MACHINES CO., LTD.) 24 May 2022 (2022-05-24) claims 1-10, description, specific embodiments, and figures 1-2	1-20	A	CN 201679375 U (CHERY AUTOMOBILE CO., LTD.) 22 December 2010 (2010-12-22) entire document	1-20	A	WO 2018066500 A1 (MITSUBA CORP.) 12 April 2018 (2018-04-12) entire document	1-20
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Date of the actual completion of the international search 07 February 2023	Date of mailing of the international search report 24 February 2023																				
Name and mailing address of the ISA/CN China National Intellectual Property Administration (ISA/ CN) China No. 6, Xitucheng Road, Jimenqiao, Haidian District, Beijing 100088 Facsimile No. (86-10)62019451	Authorized officer Telephone No.																				

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PCT/CN2022/131937

C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2020120055 A1 (BROSE FAHRZEUGTEILE SE & CO. KOMMANDITGESELLSCHAFT, BAMBERG) 18 June 2020 (2020-06-18) entire document	1-20

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/CN2022/131937

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
CN 113006630 A	22 June 2021	None	
CN 113389460 A	14 September 2021	None	
CN 113958223 A	21 January 2022	None	
CN 216588233 U	24 May 2022	None	
CN 201679375 U	22 December 2010	None	
WO 2018066500 A1	12 April 2018	JP 2018058417 A	12 April 2018
		JP 6676512 B2	08 April 2020
WO 2020120055 A1	18 June 2020	DE 102018131933 A1	18 June 2020

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