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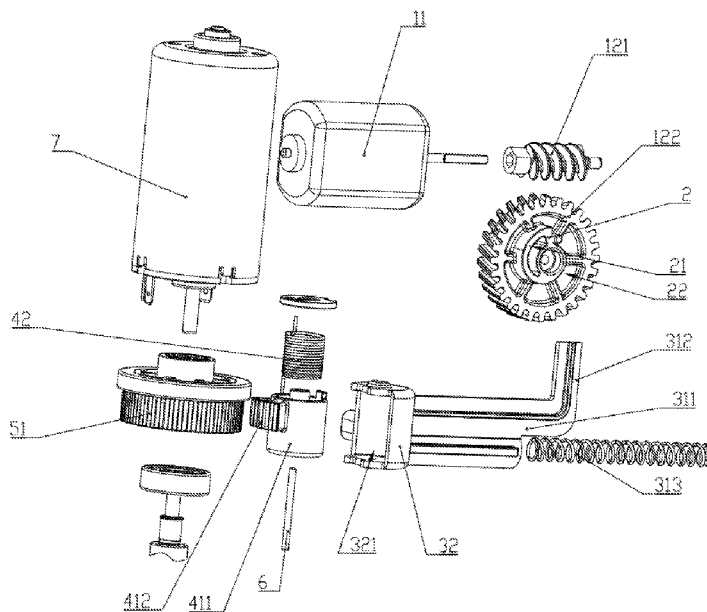


FIG. 2

(57) Abstract: The present utility model provides a door holding mechanism, comprising: a driving part with a cam provided at the output end; a connecting part with one end thereof abutting against the cam; a first stopper connected to the other end of the connecting part and provided with a first feature; and a second stopper connected to a power transmission mechanism of a door drive assembly and provided with a second feature that can be engaged with the first feature; wherein the rotation of the cam can drive the first stopper into a first position and a second position; when the first stopper is in the first position, the second feature and the first feature are engaged to prevent the power transmission mechanism of the door drive assembly from moving; and when the first stopper is in the second position, the second feature and the first feature are disengaged.



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DOOR HOLDING MECHANISM

Technical Field

The present utility model relates to the technical field of vehicles, and in particular to a door holding mechanism, which is particularly suitable for keeping an opening angle of a door at any opening angle unchanged.

Background Art

A vehicle has multiple doors, such as a side door for a driver or a passenger to get on the vehicle and a tailgate for closing a trunk. Electric tailgates are first developed and have been widely used in vehicles because it is not convenient for users to open the tailgates by hand when holding things. With the further development of the vehicle's intelligence, electric methods are also gradually being used to open or close the side doors of vehicles. A known solution is that a motor is used to drive a worm, which drives a worm engaging part to rotate, and by means of a lead screw and nut mechanism, the worm engaging part then converts rotational movement of the motor into reciprocating movement of the lead screw and nut mechanism. When receiving a signal, the motor rotates, so as to open or close the door.

An electric side door faces such a problem that when the door is opened, if there is an external force, the door swings under the action of the external force, which in turn drives the motor to rotate in the reverse direction by means of a transmission mechanism. This movement of the door is obviously undesirable, which not only affects the user experience, but also poses potential risks. For example, the door will move in the door closing direction due to the external force, posing a risk of trapping the user.

To this end, a solution has been proposed in the prior art to provide a brake unit for holding the electric side door. For example, Chinese patent application CN 111386379 A discloses a power drive module for a vehicle door, the power drive module comprising an actuating assembly. A brake assembly cooperates with a part of the power drive module to prevent any rotational movement of the power drive module. This effectively holds the door in an open position or in a partially open position. A controller communicates with a motor and the brake assembly to coordinate operation during manual and/or automatic movement of the door. In this

way, the door can be held in any open position on a certain slope or under a certain wind force. The brake assembly has a brake band which can be cooperated with a brake ring to prevent undesired rotation of a gearbox.

5 In addition, Chinese patent application CN 115961852 A also discloses a brake unit for an electric side door, the brake unit comprising a friction member, a spring and an adjusting member. The friction member is in frictional contact with a transmission shaft, the spring applies an elastic force to push the friction member toward the transmission shaft, and the adjusting member is used to adjust tension of the spring.

10 With the vigorous development and broad application prospects of electric door drive devices, it is necessary to develop other forms of door holding mechanisms. In addition, the above-mentioned friction braking method also suffers from some drawbacks, for example, its holding function may decay over time, resulting in a decrease in the performance of the holding function; and friction braking will
15 produce noise, which is uncomfortable and may cause the user to think that there is a problem with the vehicle.

Summary

An objective of the present utility model is to solve at least one of the above
20 problems and/or other problems in the prior art.

To achieve the above objective, the present utility model provides a door holding mechanism, comprising:

a driving part with a cam provided at the output end;
a connecting part with one end thereof abutting against the cam;
25 a first stopper connected to the other end of the connecting part and provided with a first feature; and

a second stopper connected to a power transmission mechanism of a door drive assembly and provided with a second feature that can be engaged with the first feature;

30 wherein the rotation of the cam can drive the first stopper into a first position and a second position; when the first stopper is in the first position, the second feature and the first feature are engaged to prevent the power transmission mechanism of the door drive assembly from moving; and when the first stopper is in the second position, the second feature and the first feature are disengaged.

According to a refinement of the present utility model, the driving part comprises a motor and a transmission assembly connected to the output end of the motor.

5 According to a refinement of the present utility model, the transmission assembly comprises a worm connected to the output end of the motor and a worm engaging part engaged with the worm, and the cam is coaxially arranged with the worm engaging part and is configured to synchronously rotate with the worm engaging part.

10 According to a refinement of the present utility model, the axial direction of the worm is perpendicular to the axial direction of the worm engaging part and parallel to the movement direction of the connecting part.

According to a refinement of the present utility model, the cam and the worm engaging part are integrally formed.

15 According to a refinement of the present utility model, an outer peripheral surface of the cam comprises a first curved face and a second curved face, the contour of the first curved face being configured as an involute developed along one side of a base circle, the second curved face being configured to be located along the other side of the first curved face and coincide with the base circle, the first stopper is in the second position when the connecting part abuts against the maximum radius end of the first curved face, and the first stopper is in the first position when the
20 connecting part abuts against the second curved face.

According to a refinement of the present utility model, the second stopper comprises a brake wheel, and the first stopper comprises a sector gear that can mesh with the brake wheel.

25 According to a refinement of the present utility model, the sector gear comprises a connecting cylinder and a sector gear body connected to the connecting cylinder, and the connecting part comprises a connecting part body and a mounting part at one end of the connecting part body.

30 According to a refinement of the present utility model, the mounting part is in the shape of a cylinder with an opening on the circumferential surface, the connecting cylinder is connected in the mounting part via a pin, a reset piece is arranged between the mounting part and the connecting cylinder, and the first stopper can rotate relative to the mounting part and can be reset to an initial position under the action of the reset piece.

According to a refinement of the present utility model, the connecting part body comprises a main body part, a cam engaging part at one end of the main body part away from the mounting part and an elastic piece arranged along the moving direction of the connecting part body, wherein the elastic piece is configured to keep
5 the cam engaging part abutting against the cam.

As can be seen from the above, the present utility model proposes a holding mechanism of a door drive device different from the existing friction brake. By using a cam mechanism and an elastic piece, the power transmission mechanism of the door drive device can be held stationary by using cooperating stop pieces, thereby
10 allowing the door to be held at a desired angle. The present utility model uses a worm transmission mechanism with low noise and does not require continuous power supply when implementing the holding function.

Brief Description of the Drawings

15 Features and advantages of the present utility model will be clearly understood from the detailed description provided below with reference to the accompanying drawings. It should be understood that the following accompanying drawings are only schematic and not necessarily drawn to scale, and therefore cannot be regarded as limiting the present utility model. In the figures:

20 FIG. 1 shows a schematic view of a first stopper of a door holding mechanism in a first position according to an exemplary embodiment of the present utility model.

FIG. 2 shows an exploded view of the door holding mechanism shown in FIG. 1.

FIG. 3 shows a schematic view of a reset piece.

25 FIG. 4 shows a schematic view of a sector gear and a cover plate thereof.

FIG. 5 shows a schematic view of a stop part.

Detailed Description of Embodiments

Embodiments of the present utility model are described below with reference
30 to the drawings. In the following description, many specific details are set forth so that those skilled in the art can more fully understand and implement the present utility model. However, it will be obvious to those skilled in the art that the present utility model may be implemented without some of these specific details. In addition, it should be understood that the present utility model is not limited to the particular

embodiments described. Instead, it is contemplated that the present utility model can be implemented by any combination of the features and elements described below, regardless of whether they relate to different embodiments. Thus, the following aspects, features, embodiments and advantages are merely illustrative and should not be considered as elements or limitations of the claims, unless otherwise explicitly recited in the claims.

The terms such as "first" and "second" are used below to describe elements in the present application, and these terms are only used to distinguish the individual elements and are not intended to limit the nature, order or number of these elements.

10 The terms "including" and "having" are used to denote an open-ended inclusion and mean that there may be additional elements/components in addition to the listed elements/components.

The door holding mechanism of the present utility model is particularly suitable for an electric side door. The electric side door is a door provided with a door drive assembly. The door is typically rotationally connected, via a hinge, to a vehicle body, for example, at a door frame, and the door is driven by the door drive assembly to change an opening angle to open or close. As one exemplary implementation, the door drive assembly comprises a drive motor, a worm connected to the output end of the drive motor, a worm engaging part meshed with the worm, a lead screw which passes through the worm engaging part and can rotate synchronously with the worm engaging part, a slider which is in threaded connection with the lead screw, and a rotating arm which has one end rotationally connected to the slider and the other end connected to the door. The axial directions of the worm engaging part and the worm shaft are arranged perpendicular to each other to change the power output direction of the drive motor. The axial direction of the rotating arm is parallel to the direction of the lead screw when the door is closed. The worm drives the worm engaging part and therefore the lead screw to rotate, such that the slider can move in the axial direction of the lead screw, so as to drive the rotating arm to extend or retract, thus enabling the door to be opened or closed.

30 The present utility model does not limit the specific structure of the door drive assembly. For example, in addition to the structure of the exemplary drive assembly described above, a transmission mechanism such as a planetary gear transmission mechanism or a multi-stage fixed-shaft gear transmission mechanism may be used to output the power of the motor.

FIG. 1 shows a schematic view of a door holding mechanism in a first state according to an embodiment of the present utility model, and FIG. 2 shows an exploded view of the door holding mechanism. The door holding mechanism is used to enable the door to be held in a state at any angle. As shown in FIGS. 1 and 2, the door holding mechanism according to this embodiment may comprise a driving part 1, a cam 2, a connecting part 3, a first stopper 4 and a second stopper 5. An output end of the driving part 1 is provided with the cam 2. One end of the connecting part 3 abuts against a peripheral surface of the cam 2, and the other end of the connecting part 3 is connected to the first stopper 4. The first stopper 4 is provided with a first feature, and correspondingly the second stopper 5 is provided with a second feature that can be engaged with the first feature. By the rotation of the cam 2, one end of the connecting part 3 can be brought into abutment against any position on the peripheral surface of the cam 2, when the connecting part 3 abuts against a different position on the peripheral surface, the first stopper 4, which is connected to the other end of the connecting part 3, can be arranged in different positions due to a change in the diameter of the cam 2. In this way, by the rotation of the cam 2, the first stopper 4 is brought into the first position and the second position. When the first stopper 4 is in the first position as shown in FIG. 1, the first stopper 4 can be engaged with the second stopper 5, thereby stopping the output end of the door drive assembly, and preventing the door from swinging due to the wind force, gravity, etc. When the first stopper 4 is in the second position, the first stopper 4 is at a distance from the second stopper 5 so that the first feature and the second feature are also disengaged.

According to an exemplary embodiment of the driving part 1, the driving part 1 may comprise a motor 11 and a transmission assembly 12 connected to the output end of the motor 11. As shown in FIGS. 1 and 2, the motor 11 is arranged in a transverse direction (in left-right direction shown in FIG. 1), and the axial direction of the cam 2 is arranged in a direction perpendicular to the transverse direction (in a direction perpendicular to the paper shown in FIG. 1), so that the driving direction of the motor 11 can be converted into the rotation direction along the cam 2 by means of the transmission assembly 12, and the space occupied by the door holding mechanism at the door frame of the vehicle body can be reduced. It can be understood that the driving direction of the motor 11 refers to the forward or reverse rotation direction of an output shaft of the motor 11.

According to an exemplary embodiment of the transmission assembly 12, the transmission assembly 12 may comprise a worm 121 connected to the output end of the motor 11 and a worm engaging part 122 engaged with the worm 121. The cam 2 is coaxially arranged with the worm engaging part 122 and is configured to synchronously rotate with the worm engaging part 122. For example, in some embodiments, it is possible to provide a connecting feature on a side surface of the cam 2 that faces the worm engaging part 122, and a cooperating feature on a side surface of the worm engaging part 122 that faces the cam 2. The cooperating feature and the connecting feature cooperate with each other, so that the worm engaging part 122 and the cam 2 can be limited to only rotate synchronously. The connecting part 3 can be arranged in the same plane as the cam 2, and one end of the connecting part 3 can abut against the peripheral surface of the cam 2. The worm engaging part 122 may be in the form of a helical gear or a worm gear.

In the above embodiments, the axial direction of the worm 121 is in the left-right direction shown in FIG. 1, the axial direction of the worm engaging part 122 is a direction perpendicular to the paper, and the movement direction of the connecting part 3 is in the left-right direction. In this way, the axis of the worm 121 is perpendicular to the axis of the worm engaging part 122 and parallel to the movement direction of the connecting part 3.

According to a further exemplary embodiment of the cam 2 and the worm engaging part 122, the cam 2 and the worm engaging part 122 are integrally formed.

According to an exemplary embodiment of the cam 2, the outer peripheral surface of the cam 2 comprises an actuating part and a non-actuating part. When the actuating part is in contact with the connecting part 3, as the cam 2 rotates, the actuating part can act on the connecting part 3 continuously, so that the connecting part 3 moves to the left or to the right depending on the rotation direction of the cam 2. As an example, the cam 2 comprises a first curved face 21 and a second curved face 22 as an actuating part and a non-actuating part, respectively. Taking FIG. 1 as an example, the cam 2 is cut in a plane parallel to the paper to form a cross section of the cam 2. The figure of the first curved face 21 in this cross section is an involute developed along one side of a base circle. When extending along the involute from the base circle, the radius of the cam 2 gradually increases. When the connecting part 3 is disengaged from the second curved face 22 and then begins to abut against the first curved face 21 of the cam 2, the first stopper 4 is gradually disengaged from

the second stopper 5. When the connecting part 3 abuts against a radially large position of the first curved face 21 of the cam 2, the first stopper 4 is in the second position and has the maximized distance from the second stopper 5. The second curved face 22 coincides with the base circle, forming a protruding face which protrudes outwardly and facilitates abutment of the connecting part 3. One end of the second curved face 22 is connected to the minimum radius section of the first curved face 21 to form a smooth transition. When the connecting part 3 abuts against a part of the second curved face 22 that corresponds to the base circle (i.e. the middle section of the second curved face 22), the first stopper 4 is in the first position and cooperates with the second stopper 5. It can be understood that the base circle refers to a circle in the cam 2 that takes the minimum radius of the contour of the cam 2 as its radius.

According to an exemplary embodiment, as shown in FIG. 1, the connecting part 3 comprises a connecting part body 31 and a mounting part 32 at one end of the connecting part body 31 (at the left end of the connecting part body 31 shown in FIG. 1). The connecting part body 31 comprises a main body part 311, and a cam engaging part 312 at one end of the main body part 311. The mounting part 32 has the first stopper 4 mounted thereon, and the first stopper 4 is rotatably mounted on the mounting part 32. Therefore, when the cam engaging part 312 moves under the action of the cam 2, the main body part 311, the mounting part 32 and the first stopper 4 all move linearly as the cam 2 rotates.

In order to enable the connecting part 3 to be reset, an elastic piece 313 is further provided. The elastic piece 313 may be a coil spring, which is arranged in the moving direction of the connecting part 3. The elastic piece 313 is connected at one end to the main body part 311 or the cam engaging part 312, and at the other end to a stationary part, to ensure that the cam engaging part 312 has a certain elastic potential energy when abutting against the cam 2, and that the cam engaging part 312 and the cam 2 can abut against each other at all times. For example, the elastic piece 313 is a tension spring, and the cam engaging part 312 is elongated and has a certain elastic potential energy when abutting against the right side of the cam 2. Of course, in some other particular embodiments, the elastic piece may be a compression spring, and the cam engaging part 312 correspondingly abuts against the left side, not the right side, of the cam 2.

For the second stopper 5 and the first stopper 4, the second stopper 5 comprises a brake wheel 51, and the first stopper 4 comprises a sector gear 41. Teeth of the sector gear 41 can be engaged with teeth of the brake wheel 51. The second stopper 5 is fixedly connected to the output end of a drive motor 7, for example to the output shaft of the motor. In this way, the sector gear 41 cooperates with the brake wheel 51 when in the first position, and the brake wheel 51 is prevented from rotating, thereby preventing the output end of the door drive assembly from being stopped, which in turn allows the door to be held in the open position.

According to an exemplary embodiment of the sector gear 41, as shown in FIGS. 1 and 2, the sector gear 41 comprises a connecting cylinder 411 and a sector gear body 412 connected to the connecting cylinder 411. The mounting part 32 of the connecting part 3 may also be configured as a portion of a cylindrical part, the mounting part 32 is arranged coaxially with the connecting cylinder 411 and is provided with an opening 321 along a circumferential side of the mounting part 32 (the left side of the mounting part 32 shown in FIG. 1), and the connecting cylinder 411 is provided with a hollow columnar structure in the middle, so that the connecting cylinder 411 is rotatably connected in the mounting part 32 by a pin 6 passing through the hollow columnar structure, and the sector gear body 412 can extend out of the mounting part 32 through the opening 321 to facilitate cooperating with the brake wheel 51 when the first stopper 4 is in the first position.

To provide the sector gear body 412 with the sufficient rotational space when subjected to a force, the opening 321 extends in the circumferential direction of the mounting part 32 and has a width set such that the sector gear body 412 can rotate by an angle about the axial direction at the opening 321.

Referring further to FIGS. 3 and 4, the first stopper 4 further comprises a reset piece 42 (e.g., a torsion spring). The reset piece 42 is arranged between the connecting cylinder 411 and the hollow columnar structure. As shown in FIG. 3, the reset piece 42 has two end portions, namely a first end portion 421 and a second end portion 422, which are axially located at two ends of the reset piece 42 and extend parallel to the axial direction of the reset piece 42.

FIG. 4 shows a schematic view of the sector gear and a cover plate thereof. The connecting cylinder 411 of the sector gear has a bottom plate at one end and an open end at the other end for the reset piece 42 to enter, the open end being closed by the cover plate 43. A first curved groove 4111 coaxial with a circumferential wall of the

connecting cylinder is provided in the bottom plate of the connecting cylinder 411 for one of the end portions of the reset piece 42 to pass through. The cover plate 43 is used to close the open end of the connecting cylinder 411 and has a second curved groove 431 which partially overlaps with, preferably completely overlaps with, the first curved groove 4111 in the connecting cylinder 411 in the axial direction for the other end portion of the reset piece 42 to pass through. The cover plate 43 is further provided with a groove 432 to engage with a protruding part on the connecting cylinder 411 so that the cover plate 43 cannot rotate relative to the connecting cylinder 411.

With reference to FIG. 5, upper and lower parts of the mounting part 32 in a direction perpendicular to the axial direction are provided with stop parts 322. In this way, when the sector gear 41 tends to rotate or starts to rotate, it is subjected to the force of the reset piece 42. When the torque of rotation is greater than the torque provided by the reset piece 42, the sector gear 41 begins to rotate.

When the door is opened to an angle and needs to be held, the motor 11 drives the worm 121 and the worm engaging part 122 to rotate, thereby causing the cam 2 to drive the sector gear body 412 to move and engage with the brake wheel 51, to apply a holding torque. When the door tends to move or moves, the door will cause the brake wheel 51 to tend to rotate or the brake wheel 51 to rotate, in which case the reset piece 42 can provide a certain holding torque. In addition to providing the holding torque, the reset piece 42 may automatically return to a centred position regardless of the direction in which the sector gear body 412 rotates.

Various modifications and variations of the embodiments disclosed above may be made to those skilled in the art without departing from the scope or spirit of the present utility model. Other embodiments of the present utility model are apparent to those skilled in the art from the practice of the present utility model disclosed in this description. This description and the examples disclosed therein are to be regarded as exemplary only, and the true scope of the present utility model is specified by the appended claims and their equivalents.

CLAIMS

1. A door holding mechanism, comprising:
a driving part (1) with a cam (2) provided at the output end;
5 a connecting part (3) with one end thereof abutting against the cam (2);
a first stopper (4) connected to the other end of the connecting part (3) and
provided with a first feature with teeth; and
a second stopper (5) connected to a power transmission mechanism of a door
drive assembly and provided with a second feature with teeth that can be engaged
10 with the first feature;
wherein the rotation of the cam (2) can drive the first stopper (4) into a first
position and a second position; when the first stopper (4) is in the first position, the
second feature and the first feature are engaged to prevent the power transmission
mechanism of the door drive assembly from moving; when the first stopper (4) is in
15 the second position, the second feature and the first feature are disengaged.
2. The door holding mechanism according to claim 1, characterized in that
the driving part (1) comprises a motor (11) and a transmission assembly (12)
connected to the output end of the motor (11).
20
3. The door holding mechanism according to claim 2, characterized in that
the transmission assembly (12) comprises a worm (121) connected to the output end
of the motor (11) and a worm engaging part (122) engaged with the worm (121), and
the cam (2) is coaxially arranged with the worm engaging part (122) and is
25 configured to synchronously rotate with the worm engaging part.
4. The door holding mechanism according to claim 3, characterized in that
the axial direction of the worm (121) is perpendicular to the axial direction of the
worm engaging part (122) and parallel to the movement direction of the connecting
30 part (3).
5. The door holding mechanism according to claim 3, characterized in that
the cam (2) and the worm engaging part (122) are integrally formed.

6. The door holding mechanism according to any of claims 1 to 5, characterized the second stopper (5) comprises a brake wheel (51) with a second feature, and the first stopper (4) comprises a sector gear (41) with a first feature that can mesh with the brake wheel (51).

5

7. The door holding mechanism according to claim 6, characterized the sector gear (41) comprises a connecting cylinder (411) and a sector gear body (412) connected to the connecting cylinder (411), and the connecting part (3) comprises a connecting part body (31) and an mounting part (32) at one end of the connecting part body (31), wherein the mounting part (32) is in the shape of cylinder with an opening on the circumferential surface, in which the connecting cylinder (411) can be rotatably arranged.

8. The door holding mechanism according to claim 7, characterized in that a reset piece (42) is arranged in the connecting cylinder (411), and the first stopper (4) can rotate relative to the mounting part (32) and can be reset to an initial position under the action of the reset piece (42).

9. The door holding mechanism according to claim 8, wherein the reset piece (42) is a torsion spring, and the mounting part (32) is provided with stoppers (322) for stopping two legs of the torsion spring.

10. The door holding mechanism according to any of claims 7 to 9, characterized in that the connecting part body (31) comprises a main body part (311), a cam engaging part (312) at one end of the main body part (311) away from the mounting part (32) and an elastic piece (331) arranged along the moving direction of the connecting part body (31), wherein the elastic piece (331) is configured to keep the cam engaging part (312) abutting against the cam (2).

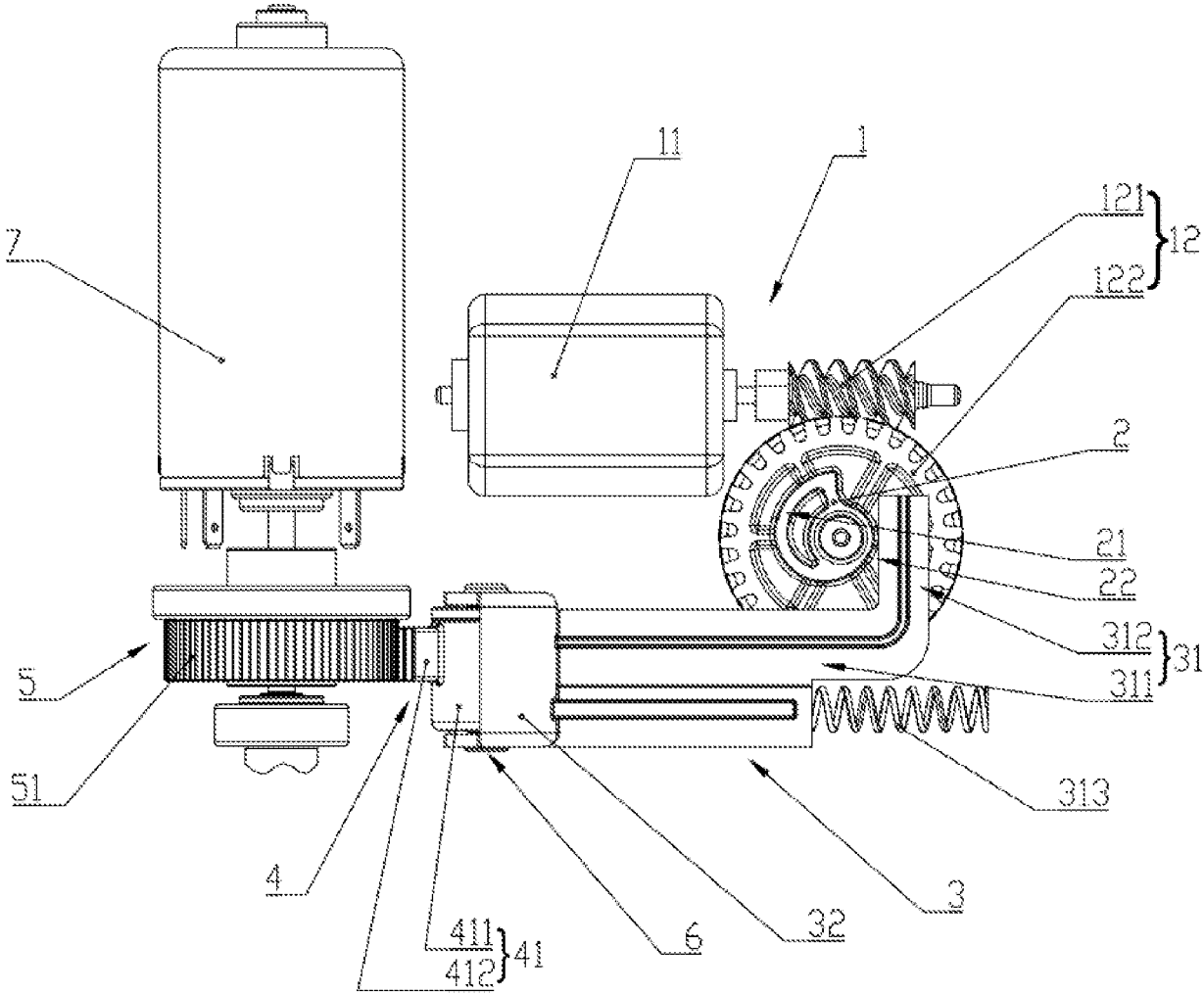


FIG. 1

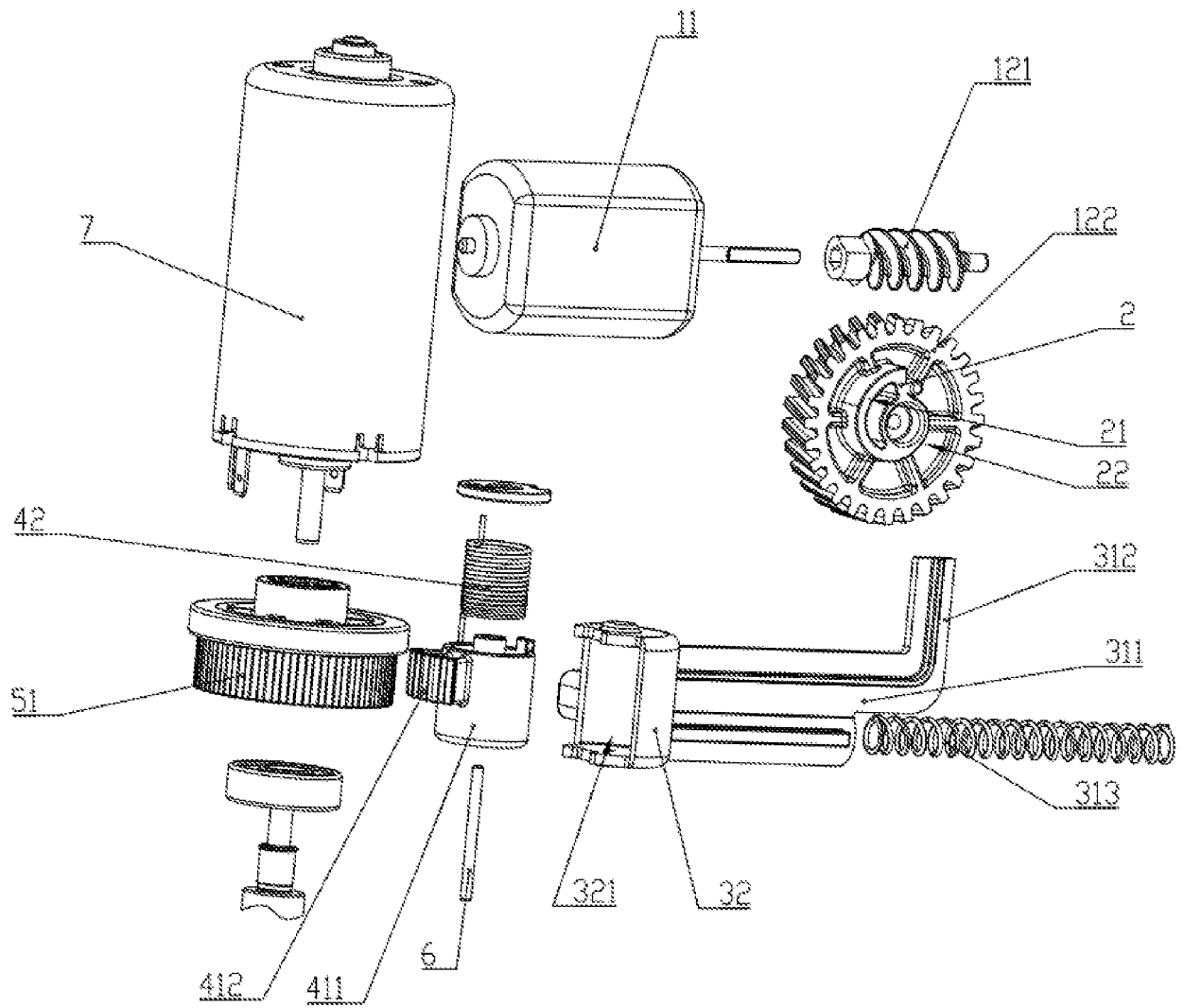
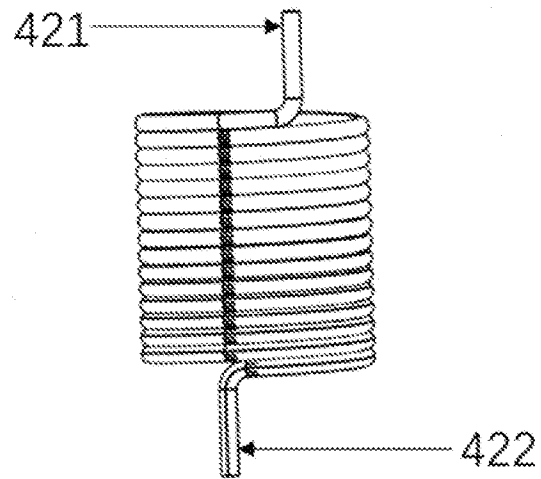
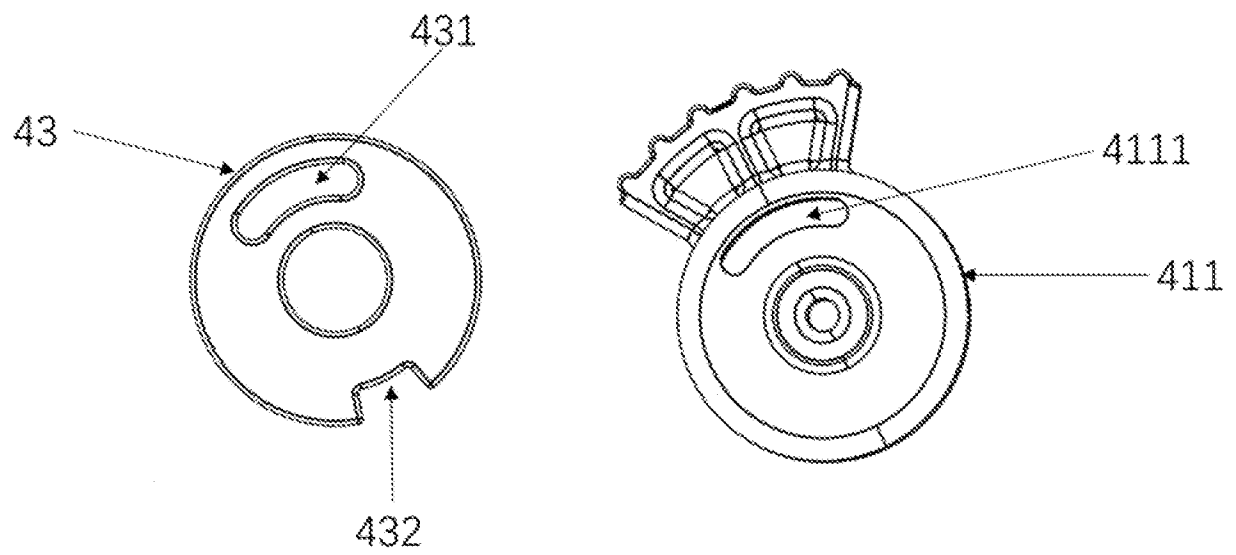


FIG. 2

*FIG. 3**FIG. 4*

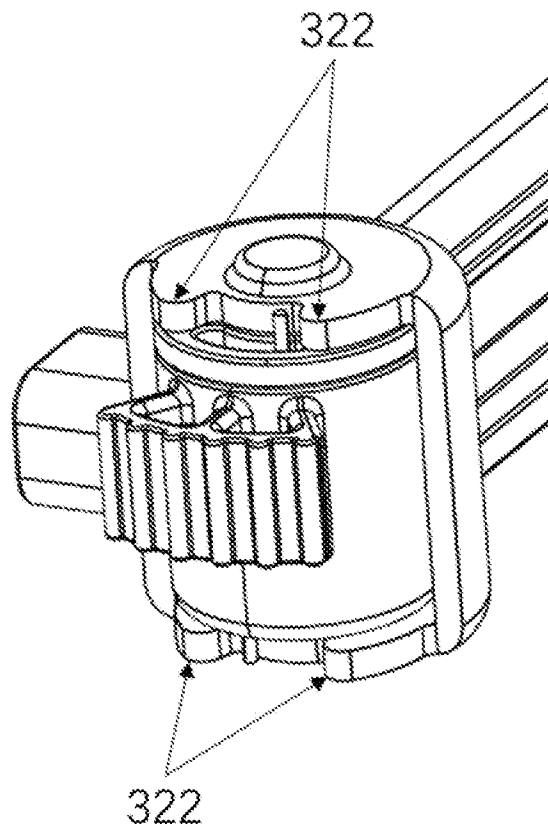


FIG. 5

INTERNATIONAL SEARCH REPORT

International application No
PCT/CN2024/134272

A. CLASSIFICATION OF SUBJECT MATTER INV. E05F15/611 E05C17/00 E05F15/632 ADD.		
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) E05F E05C 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) EPO-Internal		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 10 2019 134975 A1 (KIEKERT AG [DE]) 24 June 2021 (2021-06-24)	1 - 6
A	paragraph [0023] - paragraph [0033]; figures 1-3 -----	7 - 10
☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.		
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Information on patent family members

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