(19) DANMARK

(10) **DK/EP 3012181 T3**

Patent- og
Varemærkestyrelsen

(12) Oversættelse af
europæisk patentskrift

(51) Int.Cl.: ***B 62 M 6/55 (2010.01)*** ***B 62 M 11/14 (2006.01)***

(45) Oversættelsen bekendtgjort den: **2019-03-11**

(80) Dato for Den Europæiske Patentmyndigheds
bekendtgørelse om meddelelse af patentet: **2019-01-02**

(86) Europæisk ansøgning nr.: **14189743.9**

(86) Europæisk indleveringsdag: **2014-10-21**

(87) Den europæiske ansøgnings publiceringsdag: **2016-04-27**

(84) Designerede stater: **AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR**

(73) Patenthaver: **Wuxi Truckrun Motor Co., Ltd., No. 59, Hongchang Road, Hongshan Street, Xinwu District, Wuxi City, Jiangsu, Kina**

(72) Opfinder: **Lei, Xu, No.18, Jianhong Road, Hongshan Street, the New, District, 214145 Wuxi Jiangsu, Kina**

(74) Fuldmægtig i Danmark: **RWS Group, Europa House, Chiltern Park, Chiltern Hill, Chalfont St Peter, Bucks SL9 9FG, Storbritannien**

(54) Benævnelse: **DRIVSYSTEM TIL CENTERMOTOR TIL EN ELEKTRISK CYKEL**

(56) Fremdragne publikationer:
EP-A1- 2 218 634
EP-A2- 0 825 101
DE-A1-102009 054 480
JP-A- H10 203 466
JP-A- 2003 164 095
US-A- 6 073 717

DESCRIPTION

FIELD OF THE TECHNOLOGY

[0001] The present invention relates to a motor drive system, and more particularly to a mid-motor drive system for an electric bicycle, comprising: a left shell, a right shell mounted to the left shell, a motor assembly, a rotation speed reduction apparatus driven by the motor assembly, a crankshaft, a planetary rotation speed increase apparatus driven by the crankshaft, a chainring driven by the rotation speed reduction apparatus and by the planetary rotation speed increase apparatus, a controller connected to the motor assembly for controlling an output power of the motor assembly, and a torque sensor connected to the controller for providing a torque signal to the controller, wherein the planetary rotation speed increase apparatus comprises a gear ring, a planetary shaft pin, a ratchet fixing seat, an arm, a solar wheel, a ratchet-type unidirectional clutch, and a planetary gear; and the torque sensor is installed on the left shell, and the controller is installed on the right shell.

BACKGROUND

[0002] A mid-motor drive system for an electric bicycle of the generic type specified above is disclosed in document U. S. Patent 6,073,717, which shows a system according to the preamble of claim 1, and in document EP 0 825 101 A2.

[0003] A mid-motor drive system for an electric bicycle is also disclosed in document EP 2 218 634 A1.

[0004] Environmental friendliness is the objective in production and life in the human society nowadays and in the future. Low-carbon and green transport is also the future trend and development direction. Electric bicycles have characteristics such as economy and environmental friendliness, and therefore become desirable exercise devices and vehicles.

[0005] An existing electric bicycle is usually assembled with a mid-motor. A mid-motor refers to a motor drive assembly installed at a bottom bracket of an electric bicycle as compared with a front hub motor and a rear hub motor of the electric bicycle. Currently, more and more mid-motors are installed with a torque sensor. The torque sensor detects a pedaling torque during riding, and sends a detected signal to a system controller to synchronously adjust a rotational speed and output power of the motor, so as to keep a direct proportion relationship between the riding torque and the output torque of the motor, thereby achieving an objective of multiplying the torque.

[0006] CN 103 661 762 A discloses an electric assist electric bicycle and a mid-motor drive system of the electric assist electric bicycle. The mid-motor drive system of the electric assist electric bicycle includes a first stage end-cover component, a second stage end-cover component, a shell component, a torque sensor component, a motor component, a central shaft component, a planetary reduction mechanism, a clutch mechanism, and a crankset and sprocket component. The planetary reduction mechanism bears all the output torque and is the weakest member in the entire transmission system. With the long-term use of the drive system, the planetary reduction gear has a severe wear problem, which significantly lowers the stability and safety of a mid-drive apparatus.

[0007] In addition, an existing torque sensor used for a mid-motor of an electric bicycle is usually a strain gauge sensor. In such a sensor, a strain gauge is disposed on a central shaft of the mid-motor, and a sensor disposed on an outer side of the central shaft then transfers a sensing signal sent by the strain gauge to a controller. Because the strain gauge rotates with the central shaft, the distance between the strain gauge and sensor keeps varying, and therefore a signal is subject to a great extent of attenuation or loss during transmission, resulting in that the controller fails to accurately calculate a pedaling torque of a rider.

SUMMARY

[0008] In view of the defects in the prior art, the present invention introduces a planetary rotation speed increase apparatus in a mid-motor drive system for an electric bicycle, improves a torque sensor, and proposes a mid-motor drive system for an electric bicycle.

[0009] The technical solution of the present invention is as follows:
A mid-motor drive system for an electric bicycle, comprising: a left shell, a right shell mounted to the left shell, a motor assembly, a rotation speed reduction apparatus driven by the motor assembly, a crankshaft, a planetary rotation speed increase apparatus driven by the crankshaft, a chainring driven by the rotation speed reduction apparatus and by the planetary rotation speed increase apparatus, a controller connected to the motor assembly for controlling an output power of the motor assembly, and a torque sensor connected to the controller for providing a torque signal to the controller. In addition the planetary rotation speed increase apparatus comprises a gear ring, a planetary shaft pin, a ratchet fixing seat, an arm, a solar wheel, a ratchet-type unidirectional clutch, and a planetary gear, and the torque sensor is installed on the left shell, and the controller is installed on the right shell. Further, the torque sensor comprises a deformation support, a signal transmission module, and a magnetic component, the deformation support is deformed under a force caused by the torque between the left shell and the solar wheel to actuate the magnetic component to move, and the signal transmission module senses the movement of the magnetic component, converts a change of magnetic flux into an electrical signal, and transfers the electrical signal to the controller; and further one of:

the deformation support of the torque sensor is an aluminum alloy deformation body, and the magnetic component comprises a plastic support, a steel ball, a spring, a circular magnet, and a plastic slider; and the deformation support of the torque sensor comprises a torque transfer support and an aluminum alloy deformation body, and the magnetic component comprises a plastic external thread shell, a circular magnet, a spring, a plastic slider, and a plastic internal thread fixing support.

[0010] Furthermore, the motor assembly includes a motor stator, a motor internal rotor, and a gear shaft.

[0011] Furthermore, the rotation speed reduction apparatus includes a first stage reduction gear wheel, a second stage reduction pinion, a unidirectional bearing, and a second stage reduction gear wheel.

[0012] Furthermore, the first stage reduction gear wheel of the rotation speed reduction apparatus is engaged with the gear shaft of the motor assembly.

[0013] Furthermore, the chainring is installed on the second stage reduction gear wheel of the rotation speed reduction apparatus.

[0014] Furthermore, four planetary gears of the planetary rotation speed increase apparatus are fixed on the arm and rotate with the crankshaft being the center of circle.

[0015] Furthermore, the arm of the planetary rotation speed increase apparatus is installed on the crankshaft through a bearing, and the ratchet-type unidirectional clutch is provided between the crankshaft and the arm.

[0016] Furthermore, the gear ring of the planetary rotation speed increase apparatus is fixed on the second stage reduction gear wheel of the rotation speed reduction apparatus.

[0017] Furthermore, the signal transmission module of the torque sensor includes a linear Hall element and a signal lead wire.

[0018] Furthermore, the solar wheel of the planetary rotation speed increase apparatus is connected to the deformation support through a bearing.

[0019] The beneficial effects of the present invention are as follows: A mid-motor drive system for an electric bicycle is provided. A planetary rotation speed increase apparatus is applied to the system, which not only reduces a transmission ratio and achieves a speed increasing effect, but also reduces torques that a chainring and rotation speed reduction part need to bear, so that the mid-motor drive system becomes more stable and has a longer service life. A novel torque sensor is also applied in the system. The novel torque sensor makes use of a characteristic of deformation under a force of an aluminum alloy material. A sensor for detecting an amount of such a deformation is installed in the torque sensor to convert a manpower pedaling torque signal into a voltage signal, and transfers the voltage signal to a controller to control output power of a motor assembly, so as to accurately convert a manpower pedaling torque into an electrical signal and transfer the electrical signal to the controller in real time, so that the controller can allocate motor assistance more properly, thereby achieving the objectives of comfortable riding, energy conservation, and environmental friendliness.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020] To illustrate the embodiments of the present invention more clearly, the accompanying drawings for describing the embodiments are introduced briefly in the following. Apparently, the accompanying drawings in the following description are only an embodiment of the present invention, and a person skilled in the art can derive other drawings from the accompanying drawings without creative efforts.

FIG. 1 is a schematic structure view of an embodiment of a mid-motor drive system for an electric bicycle of the present invention;

FIG. 2 is an exploded view of a mid-motor drive system for an electric bicycle according to the present invention;

FIG. 3 is an exploded view of an embodiment of a torque sensor in a mid-motor drive system for an electric bicycle according to the present invention; and

FIG. 4 is an exploded view of another embodiment of a torque sensor in a mid-motor drive system for an electric bicycle according to the present invention.

[0021] In the drawings: 1-left shell; 2-right shell; 3-motor assembly; 301-motor stator; 302-motor internal rotor; 303-gear shaft; 304 stator fixing support; 4-rotation speed reduction apparatus; 401-first stage reduction gear wheel; 402-second stage reduction pinion; 403-unidirectional bearing; 404-second stage reduction gear wheel; 5-torque sensor; 501-aluminum alloy deformation body; 502-signal transmission module; 503-plastic support; 504-circular magnet; 505-steel ball; 506-plastic slider; 507-spring; 508-flat-point set screw; 509-solar wheel fixing screw; 510-aluminum alloy deformation body fixing screw; 511-plastic support fixing screw; 520-torque transfer support; 521-signal transmission module fixing support; 522-plastic external thread shell; 523-plastic internal thread fixing support; 524-torque transfer support fixing screw; 525-plastic internal thread fixing support fixing screw; 6-planetary rotation speed increase apparatus; 601-gear ring; 602-planetary shaft pin; 603-ratchet fixing seat; 604-arm; 605-solar wheel; 606-ratchet-type unidirectional clutch; 607-planetary gear; 7-crankshaft; 8-controller; 9-crankset.

DETAILED DESCRIPTION

[0022] The present invention is further illustrated in the following with reference to specific implementation manners. The accompanying drawings are merely used for exemplary illustration and are only schematic views rather than pictures of practical objects, and should not be construed as a limit to the patent; to illustrate the embodiments of the present invention more effectively, some members in the accompanying drawings are omitted or scaled up or down, which do not represent the sizes of a practical product; persons skilled in the art should understand that some common structures in the drawings and illustration thereof may be omitted.

Embodiment 1

[0023] Referring to FIG. 1 and FIG. 2, a mid-motor drive system for an electric bicycle of the present invention includes a left shell 1, a right shell 2, a motor assembly 3, a rotation speed reduction apparatus 4, a torque sensor 5, a planetary rotation speed increase apparatus 6, a crankshaft 7, a controller 8, and a chainring 9. The motor assembly 3 includes a motor stator 301, a motor internal rotor 302, and a gear shaft 303. The rotation speed reduction apparatus 4 includes a first stage reduction gear wheel 401, a second stage reduction pinion 402, a unidirectional bearing 403, and a second stage reduction gear wheel 404. The planetary rotation speed increase apparatus 6 includes a gear ring 601, a planetary shaft pin 602, a ratchet fixing seat 603, an arm 604, a solar wheel 605, a ratchet-type unidirectional clutch 606, and a planetary gear 607. The rotation speed reduction apparatus 4 is connected to the motor assembly 3, the planetary rotation speed increase apparatus 6, and the chainring 9. The planetary rotation speed increase apparatus 6 is connected to the torque sensor 5 and the crankshaft 7. The torque sensor 5 is connected to the controller 8. The controller 8 is connected to the motor assembly 3.

[0024] The rotation speed reduction apparatus 4 is a two stage transmission reduction apparatus. The unidirectional bearing 403 is provided inside the first stage reduction gear wheel 401, so as to achieve an objective of preventing the motor internal rotor 302 from rotating along during manpower pedaling. The controller 8 is used for controlling output power of the motor assembly 3. After the motor assembly 3 is powered on, the motor internal rotor 302 rotates, and because the gear shaft 303 is connected to the internal rotor 302, the gear shaft 303 rotates synchronously. The first stage reduction gear wheel 401 is engaged with the gear shaft 303 to rotate at a fixed reduction ratio. The unidirectional bearing 403 is securely fixed in an inner cavity of the first stage reduction gear wheel 401. The second stage reduction pinion 402 is installed in the unidirectional bearing 403, and because of an unidirectional locking effect of the unidirectional bearing 403, the first stage reduction gear wheel 401 and the second stage reduction pinion 402 rotate synchronously. The second stage reduction pinion 402 is engaged with the second stage reduction gear wheel 404, so as to rotate at a fixed reduction ratio. The chainring 9 is fixed on the second stage reduction gear wheel 404 of the rotation speed reduction apparatus 4 and is used for outputting power of the motor assembly 3.

[0025] The torque sensor 5 is an aluminum alloy deformation-type sensor. By using a characteristic of deformation under a force of an aluminum alloy material, a sensor for detecting an amount of such a deformation is installed inside the torque sensor 5 to convert a manpower pedaling torque signal into a voltage signal, and transfers the voltage signal to the controller 8 to control the output power of the motor assembly 3.

[0026] FIG. 3 is an exploded view of the torque sensor 5 in a mid-motor drive system for an electric bicycle according to the present invention. The torque sensor includes a deformation support, a signal transmission module (502), and a magnetic component. The deformation support is deformed under a force to actuate the magnetic component to move. The signal transmission module (502) senses the movement of the magnetic component, converts a change of magnetic flux into an electrical signal, and transfers the electrical signal to the controller (8). The signal transmission module 502 of the torque sensor further includes a linear Hall element and a signal lead wire. The steps of assembling the torque sensor 5 are as follows:
First, a circular magnet 504 is mounted in a plastic slider 506, a steel ball 505 is mounted inside a steel ball groove on the plastic slider 506, the plastic slider 506 is then also mounted inside a corresponding slot on a plastic support 503, and a spring 507 is mounted inside a corresponding slot of the plastic slider 506, so as to form the magnetic component of the torque sensor 5. Next, the signal transmission module 502 is also mounted inside the corresponding slot on the plastic support 503, and finally, the plastic support 503 is mounted in the deformation support, that is, inside a corresponding slot on an aluminum alloy deformation body 501, and a plastic support fixing screw 511 is used for fastening. Subsequently, a flat-point set screw 508 is mounted at two sides of the aluminum alloy deformation body 501 to further lock the plastic support 503; meanwhile, the horizontal distance inside the groove between the circular magnet 504 and the Hall element on the signal transmission module 502 may also be adjusted conveniently, so as to keep an output initial signal consistent. Further, a bearing is pressed in the solar wheel 605, and four solar wheel fixing screws 509 are used to fix the solar wheel 605 on the aluminum alloy deformation body 501. Finally, an aluminum alloy deformation body fixing screw 510 is used to fix the aluminum alloy deformation body 501 on the left shell 1.

[0027] When manpower pedaling drives the crankshaft 7 to rotate and actuate the arm 604 to rotate, the solar wheel 605 is subject to a driving force in a same direction. The direction of the driving force is a tangent direction of the direction of the rotation. With the increase of a pedaling force, the tangent force that the solar wheel 605 bears increases gradually. The aluminum alloy deformation body 501 is fixedly connected to the solar wheel 605 through a bearing, and therefore the tangent force that the aluminum alloy deformation body 501 bears also increases gradually, and the aluminum alloy deformation body 501 starts to deform in the direction of the tangent force, which forces the steel ball 505 to move in the same direction. The circular magnet 504, the steel ball 505, and the plastic slider 506 displace together. After the displacement occurs, the linear Hall element on the signal transmission module 502 senses a change of a magnetic field of the circular magnet 504 and outputs a corresponding voltage signal. The voltage signal is directly transmitted to the controller 8 through the signal lead wire. The controller 8 properly allocates output power of the motor assembly 3 according to the magnitude of the signal. After pedaling is stopped, the solar wheel 605 no longer bears any force, and the deformation of the aluminum alloy deformation body 501 stops. Under the effect of the spring 507, the spring 507 restores the circular magnet 504, the steel ball 505, and the plastic slider 506 to the original positions. The linear Hall element on the signal transmission module 502 senses no change of the magnetic field and therefore outputs no voltage signal, and the motor assembly 3 stops outputting power.

[0028] The planetary rotation speed increase apparatus 6 includes one solar wheel 605, four planetary gears 607, one arm 604, one gear ring 601, and one ratchet-type unidirectional clutch 606. The solar wheel 605 is connected to the torque sensor 5 to transfer a manpower pedaling torque. The four planetary gears 607 are fixed on the arm 604 and rotate with the crankshaft 7 being the center of circle rotate. The arm 604 is installed on the crankshaft 7 through a bearing. The ratchet-type unidirectional clutch 606 is provided between the crankshaft 7 and the arm 604. The ratchet-type unidirectional clutch 606 may prevent the planetary rotation speed increase apparatus 6 and the motor internal rotor 302 from rotating along when the crankshaft 7 rotates inversely. The gear ring 601 is fixed on the second stage reduction gearwheel 404 of the rotation speed reduction apparatus 4.

[0029] The effects of the planetary rotation speed increase apparatus 6 include the following two: The first is a speed increasing effect. In the planetary rotation speed increase apparatus 6, the solar wheel 605 is fixed on the torque sensor 5. When the arm 604 serves as a driving member, the gear ring 601 is run as a driven member. Assuming that a gear ratio between the gear ring 601 and the solar wheel 605 in the planetary rotation speed increase apparatus 6 is a, the transmission ratio of the gear train is a/(a+1). Because the arm 604 is a gear having the maximum equivalent number of teeth, the passive gear ring 601 provides output in a speed increase manner, and the transmission ratio between the arm 604 and the gear ring 601 is smaller than 1. The second is a torque transfer effect. The manpower pedaling torque is transferred to the crankshaft 7. The crankshaft 7 transfers the torque to the arm 604 through the ratchet-type unidirectional clutch 606. The arm 604 rotates clockwise, and at the same time actuates the planetary gear 607 to rotate clockwise. In this case, the solar wheel 605 exerts a counter force on the planetary gear 607. In this process, under the effect of the counter force, the aluminum alloy deformation body 501 on the torque sensor 5 deforms, and the linear Hall element on the signal transmission module 502 determines an amount of the deformation to output a linear voltage signal.

[0030] The objective of speed increase of the planetary rotation speed increase apparatus 6 is as follows: In a case of ensuring a proper pedaling frequency of riding, the number of teeth of the chainring 9 is reduced, so that the gear ratio between the chainring and a freewheel of a rear wheel of the electric bicycle is reduced, a torque that needs to be provided to drive the rear wheel is then reduced, and the reduction of the output torque of the chainring 9 means that the torque that the rotation speed reduction apparatus 4 needs to bear is also reduced. In this way, the strength requirement of the entire rotation speed reduction apparatus 4 is also reduced correspondingly, so that the safety and stability of a mid-drive apparatus are enhanced to a great extent.

[0031] The controller 8 is installed on the right shell 2, and the wiring between the controller 8 and the motor assembly 3 is accomplished inside a same box, thereby greatly reducing loss caused in the wiring process, so that the efficiency of the motor assembly 3 is enhanced.

Embodiment 2

[0032] A mid-motor drive system for an electric bicycle of the present invention includes a left shell 1, a right shell 2, a motor assembly 3, a rotation speed reduction apparatus 4, a torque sensor 5, a planetary rotation speed increase apparatus 6, a crankshaft 7, a controller 8, and a chainring 9. The differences from Embodiment 1 are as follows: A deformation support of the torque sensor 5 includes a torque transfer support 520 and an aluminum alloy deformation body 501 (the aluminum alloy deformation body 501 has a different form from the aluminum alloy deformation body 501 in Embodiment 1). A magnetic component includes a plastic external thread shell 522, a circular magnet 504, a spring 507, a plastic slider 506, and a plastic internal thread fixing support 523. The torque sensor 5 further includes a torque transfer support fixing screw 524 and a plastic internal thread fixing support fixing screw 525. The deformation support is deformed under a force to actuate the magnetic component to move. A signal transmission module 502 senses the movement of the magnetic component, converts a change of magnetic flux into an electrical signal, and transfers the electrical signal to the controller 8.

[0033] When the torque sensor 5 is being assembled, the circular magnet 504 is first mounted in the plastic slider 506, the spring 507 is mounted in a cylindrical groove behind the plastic slider 506, the signal transmission module 502 is mounted inside a sliding groove of a signal transmission fixing support 521, the signal transmission fixing support 521 is then mounted inside a corresponding slot of the plastic external thread shell 522, the plastic external thread shell 522 is finally screwed inside a corresponding internal thread tube of the plastic internal thread fixing support 523, and a plastic internal thread fixing screw 525 is used to fix the entire plastic internal thread fixing support 523 on the aluminum alloy deformation body 501. A bearing is pressed in the assembled torque sensor 5, and a solar wheel 605 is fixed on the torque transfer support 520 through four torque transfer fixing screws 524.

[0034] When the crankshaft 7 is driven by manpower to rotate and actuate an arm 604 to rotate, the solar wheel 605 is subject to a driving force in a same direction. With the increase of a pedaling force, a torque that the solar wheel 605 bears increases gradually. The solar wheel 605 and the torque transfer support 520 are fixed together, and therefore a torque that the torque transfer support 520 bears also increases gradually. The aluminum alloy deformation body 501 deforms when being pressed by the torque transfer support 520. With the increase of the torque, an amount of the deformation of the aluminum alloy deformation body 501 also increases. The plastic slider 506 displaces to the opposite direction and actuates the circular magnet 504 to displace together. In this case, a linear Hall element on the signal transmission module 502 senses a change of a magnetic field of the circular magnet 504, so as to generate a corresponding voltage signal. The voltage signal is directly transmitted to the controller 8 through a signal lead wire. The controller 8 properly allocates output power of the motor assembly 3 according to the magnitude of the signal. After pedaling is stopped, the solar wheel 605 no longer bears any force, and the deformation of the aluminum alloy deformation body 501 stops. Under the effect of the spring 507, the spring 507 restores the circular magnet 504, the steel ball 505, and the plastic slider 506 to the original positions. The linear Hall element on the signal transmission module 502 senses no change of the magnetic field and therefore outputs no voltage signal, and the motor assembly 3 stops outputting power.

[0035] The foregoing only provides preferred embodiments of the present invention rather than to limit the present invention.

REFERENCES CITED IN THE DESCRIPTION

Patent documents cited in the description

- US6073717A **[0002]**
- EP0825101A2 **[0002]**
- EP2218634A1 **[0003]**
- CN103661762A **[0006]**

Patentkrav

1. Drivsystem til centermotor til en elektrisk cykel, hvilket drivsystem omfatter:
en venstre skal (1),
en højre skal (2) der er monteret på den venstre skal (1),
en motorenhed (3),
en indretning til reduktion af rotationshastighed (4) der er drevet af motorenheden (3),
en krumtapaksel (7),
en indretning til forøgelse af planetrotationshastighed (6) der er drevet af krumtapakslen (7),
en kædering (9) der er drevet af indretningen til reduktion af rotationshastigheden (4) og af indretningen til forøgelse af planetrotationshastigheden (6),
en styreenhed (8) der er forbundet til motorenheden (3) til styring af en udgangseffekt af motorenheden (3), og
en drejningsmomentsensor (5) der er forbundet til styreenheden (8) for at tilvejebringe et drejningsmomentsignal til styreenheden (8), hvor:
indretningen til forøgelse af planetrotationshastigheden (6) omfatter en tandkrans (601), en planetakselstift (602), et skraldefastgørelsessæde (603), en arm (604), et solhjul (605), en ensrettet kobling af skralde-typen (606) og et planetgear (607); og
drejningsmomentsensoren (5) er installeret på den venstre skal (1), og styreenheden (8) er installeret på den højre skal (2);
kendetegnet ved, at
drejningsmomentsensoren (5) omfatter: en deformationsunderstøtning, et signaloverførselsmodul (502) og en magnetisk komponent, hvilken deformationsunderstøtning deformeres under en kraft der er forårsaget af drejningsmomentet mellem den venstre skal (1) og solhjulet (605) for at aktivere den magnetiske komponent til at bevæge sig, og hvilket signaloverførselsmodul (502) registrerer bevægelsen af den magnetiske komponent, omdanner en ændring af magnetisk flux til et elektrisk signal og overfører det elektriske signal til styreenheden (8); og yderligere omfatter

en af:
deformationsunderstøtningen af drejningsmomentsensoren (5) er et deformationslegeme af en aluminiumlegering (501), og den magnetiske komponent omfatter en understøtning af plast (503), en stålkugle (505), en fjeder (507), en cirkulær magnet (504)) og en skyder af plast (506); og
deformationsunderstøtningen af drejningsmomentsensoren omfatter en understøtning til overførsel af drejningsmoment (520) og et deformationslegeme af aluminiumlegering (501), og den magnetiske komponent omfatter en skal af plast med ydre gevind (522), en cirkulær magnet (504), en fjeder (507), en skyder af plast (506) og en fastgørelsesunderstøtning af plast med indvendigt gevind (523).

2. Drivsystemet til centermotor til en elektrisk cykel ifølge krav 1, hvor motorenheden (3) omfatter en motorstator (301), en indvendig motorrotor (302) og en gearaksel (303).

3. Drivsystemet til centermotor til en elektrisk cykel ifølge krav 2, hvor indretningen til reduktion af rotationshastigheden (4) omfatter et reduktionstandhjul (401) til det første trin, et reduktionsdrev (402) til et andet trin, et ensrettet leje (403), og et reduktionstandhjul til et andet trin (404).

4. Drivsystemet til centermotor til en elektrisk cykel ifølge krav 3, hvor reduktionstandhjulet (401) til det første trin af indretningen til reduktion af rotationshastigheden (4) er forbundet med gearakslen (303) af motorenheden (3) .

5. Drivsystemet til centermotor til en elektrisk cykel ifølge krav 3, hvor kæderingen (9) er installeret på reduktionstandhjulet for det andet trin (404) af indretningen til reduktion af rotationshastigheden (4).

6. Drivsystemet til centermotor til en elektrisk cykel ifølge krav 1, hvor fire planetgear (607) af indretningen til forøgelse af planetrotationshastigheden (6) er fastgjort på

armen (604) og roterer med krumtapakslen (7), der er centrum af cirklen.

7. Drivsystemet til centermotor til en elektrisk cykel ifølge krav 1, hvor armen (604) af indretningen til forøgelse af planetrotationshastigheden (6) er fastgjort på krumtapakslen (7) ved et leje, og den ensrettede kobling af skralde-typen (606) er tilvejebragt mellem krumtapakslen (7) og armen (604).

8. Drivsystemet til centermotor til en elektrisk cykel ifølge krav 1, hvor tandkransen (601) af indretningen til forøgelse af planetrotationshastigheden (6) er fastgjort på det andet trin af reduktionstandhjulet (404) af indretningen til reduktion af rotationshastigheden (4).

9. Drivsystemet til centermotor til en elektrisk cykel ifølge krav 1, hvor signaloverføringsmodulet (502) af drejningsmomentsensoren (5) omfatter et lineært Hall-element og en signalledning.

10. Drivsystemet til centermotor til en elektrisk cykel ifølge krav 1, hvor solhjulet (605) af indretningen til forøgelse af planetrotationshastigheden (6) er forbundet til deformationsunderstøtningen gennem et leje.

DRAWINGS

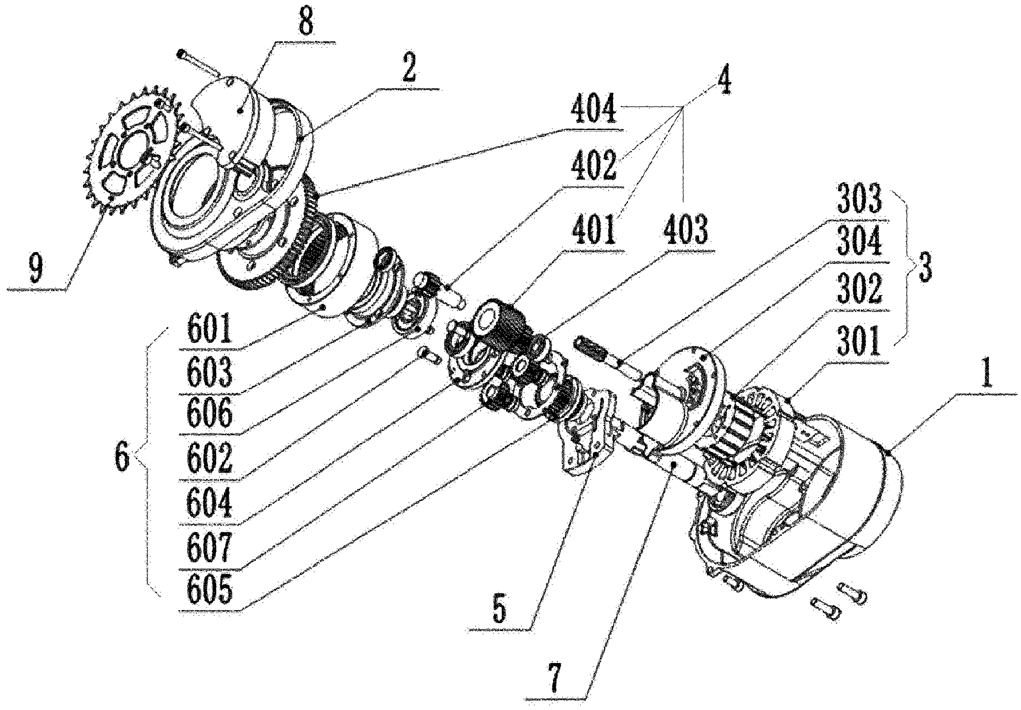

FIG. 1

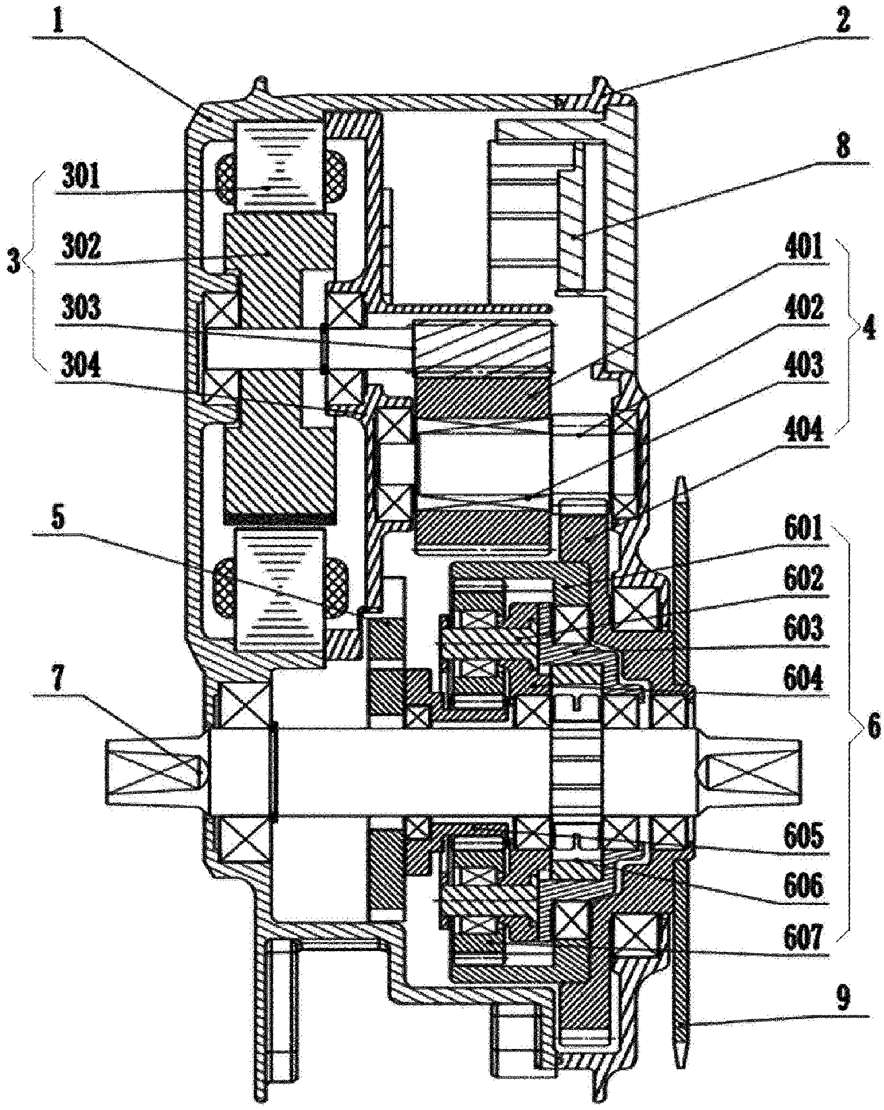
1
2
301
302
3
303
304
8
401
402
403
404
4
5
601
602
603
604
6
7
605
606
607
9

FIG. 2

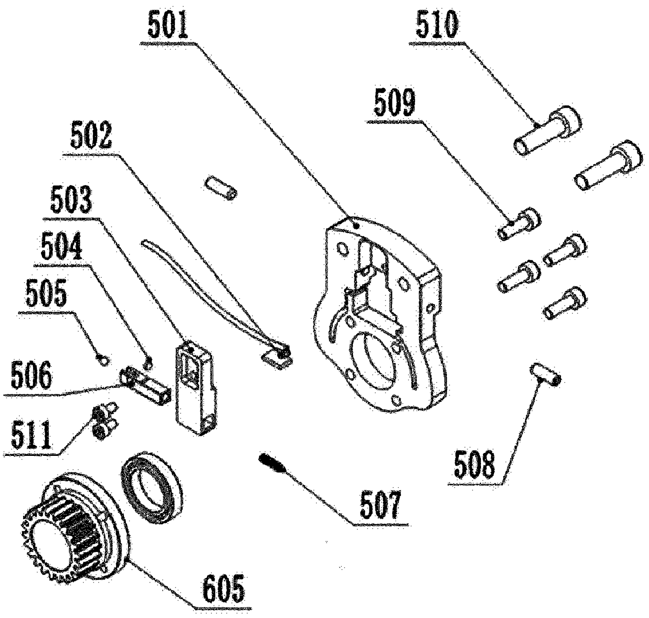
501
510
509
502
503
504
505
506
511
508
507
605

FIG. 3

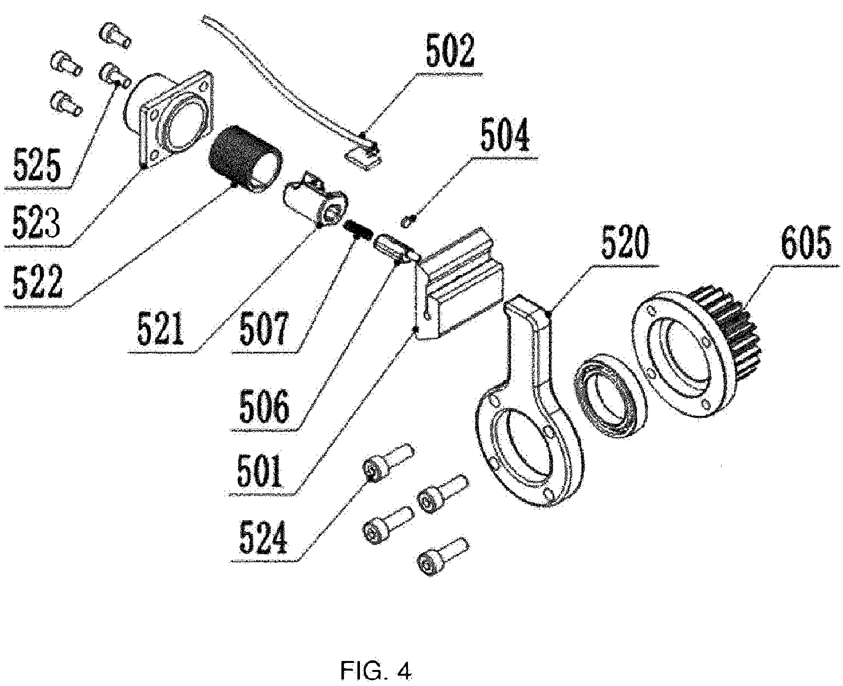
502
504
525
523
522
521
507
506
501
524
520
605

FIG. 4