(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 4 180 596 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
17.05.2023 Bulletin 2023/20

(21) Application number: **22193752.7**

(22) Date of filing: **02.09.2022**

(51) International Patent Classification (IPC):
E05B 47/06 *(2006.01)* ***E05B 15/04*** *(2006.01)*
E05B 47/00 *(2006.01)*

(52) Cooperative Patent Classification (CPC):
E05B 47/0642; E05B 47/0615; E05B 2015/0448; E05B 2047/0023; E05B 2047/0031

(84) Designated Contracting States:
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
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(30) Priority: **10.11.2021 CN 202122749579 U**

(71) Applicant: **Zhong Shan City Jixin Core Lock Co., Ltd.**
Zhongshan, Guangdong 528400 (CN)

(72) Inventors:
- **LI, Jun**
  Zhongshan, 528400 (CN)
- **LIAO, Haiqiang**
  Zhongshan, 528400 (CN)

(74) Representative: **Bayramoglu et al.**
Mira Office
Kanuni Sultan Süleyman Boulevard 5387
Street Beytepe, floor 12, no:50
06800 Cankaya, Ankara (TR)

(54) **TRANSMISSION STRUCTURE OF SMART LOCK CYLINDER AND SMART LOCK**

(57) The present disclosure relates to a transmission structure of a smart lock cylinder and a smart lock, including a lock shell assembly, a cylinder cam and a first transmission shaft. A first transmission member connected with the first transmission shaft and a first electric clutch device driving the first transmission member to connect or separate with the cylinder cam are arranged in the first transmission shaft. The first electric clutch device includes a drive motor, a worm fixedly connected with the output shaft of the drive motor, a nut sleeved on the worm and connected with the worm thread, and a double-layer spring. The worm, the nut and the double-layer spring are used to convert the kinetic energy of the motor into elastic potential energy to promote the connection or separation of the first transmission member and the cylinder cam.

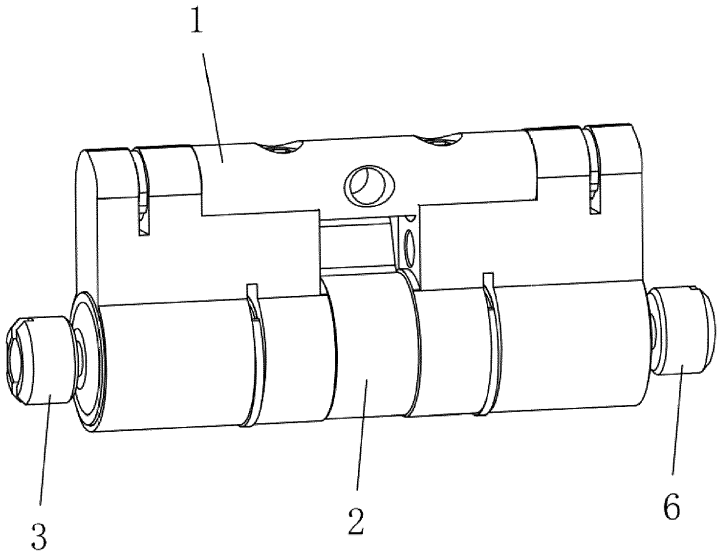

FIG.1

EP 4 180 596 A1

Description

TECHNICAL FIELD

[0001] The present disclosure relates to the technical field of locks, in particular to a transmission structure of a smart lock cylinder and a smart lock.

BACKGROUND

[0002] The transmission device (electric clutch device) of the existing electronic lock is mostly realized by the motor and the transmission mechanism. In order to convert the rotation action of the motor into the left-right movement action of unlocking, a complex transmission mechanism is required to realize, and the time of the forward and reverse rotation of the motor needs to be precisely controlled, otherwise the transmission mechanism may be easily damaged. Since it is difficult to accurately control the forward and reverse rotation time of the motor, if the screw drive is adopted, it is easy to drive over position and form idling. In the prior art, there are also some double spring electronic locks that can solve the above problems, such as a motor drive device used in the electronic lock (the Chinese patent publication No. CN103790443B), the technical solution adopted is as follows: The forward and reverse motor is fixed in the installation cavity of the motor housing. One end of the rotary tooth shaft is fixedly connected with the output shaft of the forward and reverse motor to achieve linkage. The outer diameter of the rotary tooth sleeve is smaller than the diameter of the protruding opening of the motor housing, and the rotary tooth sleeve is sleeved on the rotary tooth shaft through the through hole, so that the first thread on the rotary tooth shaft and the second thread in the rotary tooth sleeve engage with each other. The inner rotary tooth spring is sleeved on the rotary tooth shaft, and both ends of the inner rotary tooth spring are located between the forward and reverse motor and the rotary tooth sleeve. The outer rotary tooth spring is sleeved on the rotary tooth sleeve, and both ends of the outer rotary tooth spring are located between the rotary tooth sleeve and the inner wall of the motor housing. The inner rotary tooth spring are compressed and reacts on the rotary tooth sleeve, so that the second thread of the rotary tooth sleeve and the first thread on the rotary tooth shaft are inversely engaged. Once the motor reverses, the rotary tooth sleeve immediately extends outward through the thread transmission without idling. Similarly, when locking, the outer rotary tooth spring are compressed and reacts on the rotary tooth sleeve, so that the second thread of the rotary tooth sleeve and the first thread on the rotary tooth shaft are inversely engaged. Once the motor reverses, the rotary tooth sleeve immediately extends inward through the thread transmission without idling. Although the technical solution solves the problem that the traditional screw and screw sleeve are easy to form idle rotation by adding two springs, so that the electronic lock does not need to accurately control the time of forward and reverse rotation of the motor, it has the following technical problems:

1. Since the first thread and the second thread are always in reverse engagement, no matter the motor is in forward or reverse, the rotary tooth shaft always drives the rotary tooth sleeve to rotate together. However, when the rotary tooth sleeve and other mechanisms in the lock are mechanically jamming, it will lead to problems such as relative idling, engage failure between the first thread and the second thread, and even damage and failure of the transmission device in serious cases.
2. The inner end face of the rotary tooth sleeve is provided with an annular flange outwardly extended, the outer rotary tooth spring is sleeved on the rotary tooth sleeve, and both ends of the outer rotary tooth spring are located between the annular flange and the inner end face of the protruding opening of the motor housing. The processing technology of this structure is complex, and the inner end face of the rotary tooth sleeve extends outward with an annular flange, resulting in the size of the rotary tooth sleeve becoming larger and unable to meet the requirements of small locks.
3. The specification of the patent mentioned above does not record any actual application of the transmission device. For those skilled in the art, the transmission device has a complex structure, especially the motor housing is connected by the upper housing and the lower housing, and the transmission device cannot be widely used in all locks, especially in electronic locks using a pin tumbler lock housing or a leaf lock housing.

[0003] Subsequently, the inventor disclosed a Chinese utility model patent with the publication number of CN209976212U for an electronic lock cylinder. The technical solution adopted is as follows: The electronic lock cylinder includes an outer rotation key arranged on an outer rotation shaft and a drive motor. The outer rotation key is provided with a transmission cavity, the output shaft of the drive motor is connected with a worm reaching into the drive cavity, and the worm is equipped with a nut that can be connected with its thread. The worm is sleeved with a first return spring and a second return spring respectively on both sides of the nut. The drive motor drives the nut to move axially in the worm so that it can push the outer rotation key and the inner rotation key to engage or separate with the elasticity of the first return spring or the second return spring, and the structure is simple. The first return spring or the second return spring can play a buffering role when the outer rotation key and the inter rotation key are mechanically jammed, and prevent the relative idle and engage failure between the nut and the worm. The design is ingenious and effectively improves the service life of the electric clutch

device. In addition, the first return spring and the second return spring promote the engagement of the nut and the worm, and improve the working stability.

[0004] However, this structure is only applicable to the lock field, and two separate springs are required for cooperative transmission. Therefore, the inventor wants to develop a transmission structure with a wide range of applications, a simpler structure, a higher transmission efficiency and a lower production cost.

SUMMARY

[0005] In order to solve the above problems, the present disclosure is to provide a transmission structure of a smart lock cylinder and a smart lock, which uses elastic potential energy of a double-layer spring to transfer and drive the connection or separation between a transmission member and a cylinder cam, simplifying the product structure.

[0006] In order to achieve the above object, the present disclosure provides the following technical solutions.

[0007] As a further improvement, a transmission structure of a smart lock cylinder, including a lock shell assembly, a cylinder cam movably arranged in an open slot in a middle of the lock shell assembly, and a first transmission shaft installed in the lock shell assembly and located on one side where the cylinder cam is arranged, wherein a first transmission member connected to the first transmission shaft and a first electric clutch device that drives the first transmission member to connect or separate with the cylinder cam are arranged in the first transmission shaft, and a transmission cavity for accommodating the first transmission member is arranged at one end of the first transmission shaft toward the cylinder cam; the first transmission shaft is provided with a driving cavity for accommodating the first electric clutch device and communicating with the transmission cavity, and the other end of the first transmission shaft protrudes out of the lock shell assembly for connecting a handle or a first knob assembly; the first electric clutch device includes a drive motor, a worm fixedly connected with an output shaft of the drive motor, a nut fitted on the worm and threadedly connected with the worm, and a double-layer spring, wherein the double-layer spring is provided with an outer spring cylinder and an inner spring cylinder folded inside the outer spring cylinder and connected with the outer spring cylinder, one end of the outer spring cylinder is fixedly connected with the first transmission member, one end of the inner spring cylinder is fixedly connected with the nut, and the other end of the outer spring cylinder is fixedly connected with the other end of the inner spring cylinder; when the worm drives the nut to move toward the first transmission member, the inner spring cylinder is stretched and the outer spring cylinder pushes the first transmission member to connect with the cylinder cam at the same time; when the worm drives the nut to move away from the first transmission member, the inner spring cylinder is compressed and the outer spring cylinder pulls the first transmission member to separate from the cylinder cam at the same time.

[0008] As a further improvement, one end of the first transmission member toward the cylinder cam is provided with an insertion part outwardly protruding, one end of the cylinder cam toward the first transmission member is provided with a first transmission accommodation cavity into which the first transmission member partially inserts and an insertion hole communicating with the first transmission accommodation cavity and into which the insertion part is inserted; when the insertion part is inserted into the insertion hole, the first transmission member is interlocked with the cylinder cam; when the insertion part is separated from the insertion hole, the first transmission member and the cylinder cam are not interlocked.

[0009] As a further improvement, one end of the first transmission member facing away from the cylinder cam is provided with a spring accommodation cavity for fixed connection with one end of the outer spring cylinder, and the outer spring cylinder partially inserts into the spring accommodation cavity and is fixedly connected with an inner wall and/or a bottom wall of the spring accommodation cavity.

[0010] As a further improvement, the first transmission member is further provided with a through hole communicating with the spring accommodation cavity, and the worm passes through the through hole; a peripheral surface of the first transmission shaft is provided with a locking groove communicating with the transmission cavity, and a peripheral surface of the first transmission member is provided with a locking block protruding outward and matched with the locking groove, so that the first transmission member and the first transmission shaft are kept in linkage. The insertion part is provided on the locking block. The first electric clutch device further includes an encryption circuit arranged in the first transmission shaft and electrically connected to the drive motor.

[0011] As a further improvement, a second transmission shaft located on the other side of the cylinder cam is also arranged in the lock shell assembly, and the first transmission shaft is symmetrically arranged with the second transmission shaft; a second transmission member interlocked with the second transmission shaft and a second electric clutch device driving the second transmission member to connect or separate with the cylinder cam are arranged in the second transmission shaft; the first transmission member has the same structure as the second transmission member, and the first electric clutch device has the same structure as the second electric clutch device.

[0012] As a further improvement, a smart lock which applies a transmission structure mentioned above, including the lock shell assembly, the cylinder cam movably arranged in the open slot in the middle of the lock shell assembly, and the first transmission shaft installed in the lock shell assembly and located on one side where the cylinder cam is arranged, wherein the first transmis-

sion member connected to the first transmission shaft and the first electric clutch device that drives the first transmission member to connect or separate with the cylinder cam are arranged in the first transmission shaft, and a transmission cavity for accommodating the first transmission member is arranged at one end of the first transmission shaft toward the cylinder cam; the first transmission shaft is provided with the driving cavity for accommodating the first electric clutch device and communicating with the transmission cavity, and the other end of the first transmission shaft protrudes out of the lock shell assembly for connecting the handle or the first knob assembly; the first electric clutch device includes the drive motor, the worm fixedly connected with the output shaft of the drive motor, the nut fitted on the worm and threadedly connected with the worm, and the double-layer spring, wherein the double-layer spring is provided with the outer spring cylinder and the inner spring cylinder folded inside the outer spring cylinder and connected with the outer spring cylinder, one end of the outer spring cylinder is fixedly connected with the first transmission member, one end of the inner spring cylinder is fixedly connected with the nut, and the other end of the outer spring cylinder is fixedly connected with the other end of the inner spring cylinder; when the worm drives the nut to move toward the first transmission member, the inner spring cylinder is stretched and the outer spring cylinder pushes the first transmission member to connect with the cylinder cam at the same time; when the worm drives the nut to move away from the first transmission member, the inner spring cylinder is compressed and the outer spring cylinder pulls the first transmission member to separate from the cylinder cam at the same time; the first transmission shaft protrudes out of the lock shell assembly and is fixedly connected with the first knob assembly, and a first intelligent identification device for controlling the drive motor is arranged in the first knob assembly.

[0013] As a further improvement, one end of the first transmission member toward the cylinder cam is provided with the insertion part outwardly protruding, the cylinder cam is provided with the insertion hole for an insertion of the insertion part; when the insertion part is inserted into the insertion hole, the first transmission member is interlocked with the cylinder cam.

[0014] As a further improvement, one end of the first transmission member facing away from the cylinder cam is provided with the spring accommodation cavity for fixed connection with one end of the outer spring cylinder, and the outer spring cylinder partially inserts into the spring accommodation cavity and is fixedly connected with the inner wall and/or the bottom wall of the spring accommodation cavity.

[0015] As a further improvement, the first transmission member is further provided with the through hole communicating with the spring accommodation cavity, and the worm passes through the through hole; the peripheral surface of the first transmission shaft is provided with the locking groove communicating with the transmission cavity, and the peripheral surface of the first transmission member is provided with the locking block protruding outward and matched with the locking groove, so that the first transmission member and the first transmission shaft are kept in linkage.

[0016] As a further improvement, the first knob assembly includes a knob shell, a fixed plate arranged at one end of the knob shell and fixedly connected to the first transmission shaft, and a knob outer cover detachably connected to the other end of the knob shell. A battery device is disposed in the knob shell, and the first intelligent identification device is disposed in the knob outer cover.

[0017] As a further improvement, the second transmission shaft located on the other side of the cylinder cam is also arranged in the lock shell assembly, and the first transmission shaft is symmetrically arranged with the second transmission shaft; the second transmission member interlocked with the second transmission shaft and the second electric clutch device driving the second transmission member to connect or separate with the cylinder cam are arranged in the second transmission shaft; the first transmission member has the same structure as the second transmission member, and the first electric clutch device has the same structure as the second electric clutch device; the second transmission shaft protrudes out of the lock shell assembly and is fixedly connected to a second knob assembly, and the second knob assembly is provided with a second intelligent identification device for controlling the second electric clutch device, and the first knob assembly has the same structure as the second knob assembly, and the first intelligent identification device has the same structure as the second intelligent identification device.

[0018] The advantageous effect of the present disclosure is that the worm, the nut and the double-layer spring are used to convert the kinetic energy of the motor into elastic potential energy to push the first transmission member to connect or separate with the cylinder cam, thereby simplifying the product structure.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019]

FIG. 1 is a structural diagram of a transmission structure;

FIG. 2 is a structural diagram of the first electric clutch device;

FIG. 3 is an exploded structural diagram of the first electric clutch device;

FIG. 4 is the first transverse sectional view of the transmission structure;

FIG. 5 is the second transverse sectional view of the transmission structure;

FIG. 6 is an exploded view of the transmission structure;

FIG. 7 is a structural diagram of a double-layer

spring;

FIG. 8 is a structural diagram of the cylinder cam;

FIG. 9 is a structural diagram of the first transmission member;

FIG. 10 is a structural diagram of the first transmission shaft;

FIG. 11 is a structural diagram of an smart lock;

FIG. 12 is an exploded view of the structure of the smart lock;

FIG. 13 is an exploded structural view of the first knob assembly.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0020] The present disclosure will be further described in detail below in combination with the drawings and specific embodiments:

As shown in FIG. 1 to FIG. 10, a transmission structure of an smart lock cylinder includes a lock shell assembly 1, a cylinder cam 2 movably arranged in an open slot in the middle of the lock shell assembly 1, and a first transmission shaft 3 installed in the lock shell assembly 1 and located on one side of the cylinder cam 2. A first transmission member 4 connected with the first transmission shaft 3 and a first electric clutch device 5 driving the first transmission member 4 to connect or separate the cylinder cam 2 are arranged in the first transmission shaft 3. One end of the first transmission shaft 3 toward the cylinder cam 2 is provided with a transmission cavity 31 for accommodating the first transmission member 4, the first transmission shaft 3 is further provided with a driving cavity 32 for accommodating the first electric clutch device 5 and communicating with the transmission cavity 31, and the other end of the first transmission shaft 3 protrudes out of the lock shell assembly 1 for connecting a handle or a first knob assembly 9. The first electric clutch device 5 includes a drive motor 51, a worm 52 fixedly connected to the output shaft of the drive motor 51, a nut 53 fitted on the worm 52 and threadedly connected to the worm 52, and a double-layer spring 54. The double-layer spring 54 includes an outer spring cylinder 541 and an inner spring cylinder 542 folded inside the outer spring cylinder 541 and connected to the outer spring cylinder 541. One end of the outer spring cylinder 541 is fixedly connected to the first transmission member 4, one end of the inner spring cylinder 542 is fixedly connected to the nut 53, and the other end of the outer spring cylinder 541 is connected to the other end of the inner spring cylinder 542. When the worm 52 drives the nut 53 to move toward the first transmission member 4, the inner spring cylinder 542 is compressed, and the outer spring cylinder 541 pushes the first transmission member 4 to connect with the cylinder cam 2 at the same time. More specifically, when the nut 53 moves toward the first transmission member 4, the inner spring cylinder 542 is stretched, the elastic potential energy generated by the inner spring cylinder 542 in the opposite direction from the movement of the nut 53 is transmitted to the outer spring cylinder 541 at the same time. The outer spring cylinder 541 generates the elastic potential energy in the same direction as the movement of the nut 53 to force the first transmission member 4 to move toward the direction of the cylinder cam 2 and link with the cylinder cam 2, such that when the handle or the first knob assembly 9 is rotated, the first transmission shaft 3, the first transmission member 4 and the cylinder cam 2 are moved in linkage.

[0021] When the worm 52 drives the nut 53 to move away from the first transmission member 4, the inner spring cylinder 542 is compressed, and the outer spring cylinder 541 pulls the first transmission member 4 to separate from the cylinder cam 2. More specifically, when the nut 53 moves away from the first transmission member 4, the inner spring cylinder 542 is compressed, and the elastic potential energy generated by the inner spring cylinder 542 in the opposite direction from the movement of the nut 53 is transmitted to the outer spring cylinder 541 at the same time. The outer spring cylinder 541 generates the elastic potential energy in the same direction as the movement direction of the nut 53 to pull the first transmission member 4 to move toward the opposite direction from the cylinder cam 2 and separate from it, such that when the handle or the first knob assembly 9 is rotated, the first transmission shaft 3 and the first transmission member 4 move, but the cylinder cam 2 is not interlocked and doesn't move. The worm, the nut and the double-layer spring are used to convert the kinetic energy of the motor into elastic potential energy to promote the connection or separation of the first transmission member and the cylinder cam, thereby simplifying the product structure and reducing the production cost.

[0022] In this embodiment, one end of the first transmission member 4 toward the cylinder cam 2 is provided with an insertion part 41 outwardly protruding, one end of the cylinder cam 2 toward the first transmission member 4 is provided with a first transmission accommodation cavity 21 into which the first transmission member 4 partially inserts and an insertion hole 20 communicating with the first transmission accommodation cavity 21 and into which the insertion part 41 is inserted. When the insertion part 41 is inserted into the insertion hole 20, the first transmission member 4 is interlocked with the cylinder cam 2. When the insertion part 41 is separated from the insertion hole 20, the first transmission member 4 and the cylinder cam 2 are not interlocked. The insertion part 41 is cylindrical. One end of the first transmission member 4 facing away from the cylinder cam 2 is provided with a spring accommodation cavity 42 for fixed connection with one end of the outer spring cylinder 541, and the outer spring cylinder 541 partially inserts into the spring accommodation cavity 42 and is fixedly connected with the inner wall and/or the bottom wall of the spring accommodation cavity 42. The fixed connection may be by pasting, welding or interference fitting, etc.

[0023] In this embodiment, the first transmission member 4 is further provided with a through hole 40 commu-

nicating with the spring accommodation cavity 42, and the worm 52 passes through the through hole 40, which can further reduce the space occupied by accessories and provide a compact structure. The peripheral surface of the first transmission shaft 3 is provided with a locking groove 33 communicating with the transmission cavity 31, and the peripheral surface of the first transmission member 4 is provided with a locking block 43 protruding outward and matched with the locking groove 33, so that the first transmission member 4 and the first transmission shaft 3 are kept in linkage. The insertion part 41 is provided on the locking block 43. The first electric clutch device 5 further includes an encryption circuit 57 arranged in the first transmission shaft 3 and electrically connected to the drive motor 51. The encryption circuit 57 performs data processing on the external unlocking signal to provide security. The first electric clutch device 5 also includes a motor sleeve 56 which is fitted on the drive motor 51, so that the drive motor 51 is more firmly assembled in the driving cavity 32. The driving cavity 32 is also provided with an anti-rotation pin 34 located on the outer side of the encryption circuit 57 to prevent lawbreakers from opening locks with violence.

[0024] In this embodiment, a second transmission shaft 6 located on the other side of the cylinder cam 2 is also arranged in the lock shell assembly 1, and the first transmission shaft 3 is symmetrically arranged with the second transmission shaft 6. A second transmission member 7 interlocked with the second transmission shaft 6 and a second electric clutch device 8 driving the second transmission member 7 to connect or separate with the cylinder cam 2 are arranged in the second transmission shaft 6. The first transmission member 4 has the same or similar structure as the second transmission member 7, and the first electric clutch device 5 has the same or similar structure as the second electric clutch device 8. That is, the inner side of the door and the outer side of the door use the same structure to achieve transmission unlocking.

[0025] As shown in FIG. 1 to FIG. 13, a smart lock which applies a transmission structure as mentioned above, including the lock shell assembly 1, the cylinder cam 2 movably arranged in the open slot in the middle of the lock shell assembly 1, and the first transmission shaft 3 installed in the lock shell assembly 1 and located on one side where the cylinder cam 2 is arranged. Wherein the first transmission member 4 connected to the first transmission shaft 3 and the first electric clutch device 5 that drives the first transmission member 4 to connect or separate with the cylinder cam 2 are arranged in the first transmission shaft 3. A transmission cavity 31 for accommodating the first transmission member 4 is arranged at one end of the first transmission shaft 3 toward the cylinder cam 2, the first transmission shaft 3 is provided with the driving cavity 32 for accommodating the first electric clutch device 5 and communicating with the transmission cavity 31, and the other end of the first transmission shaft 3 protrudes out of the lock shell assembly 1 for connecting the handle or the first knob assembly 9. The first electric clutch device 5 includes the drive motor 51, the worm 52 fixedly connected with the output shaft of the drive motor 51, the nut 53 fitted on the worm 52 and threadedly connected with the worm 52, and the double-layer spring 54. Wherein the double-layer spring 54 is provided with the outer spring cylinder 541 and the inner spring cylinder 542 folded inside the outer spring cylinder 541 and connected with the outer spring cylinder 541. One end of the outer spring cylinder 541 is fixedly connected with the first transmission member 4, one end of the inner spring cylinder 542 is fixedly connected with the nut 53, and the other end of the outer spring cylinder 541 is fixedly connected with the other end of the inner spring cylinder 542. When the worm 52 drives the nut 53 to move toward the first transmission member 4, the inner spring cylinder 542 is stretched and the outer spring cylinder 541 pushes the first transmission member 4 to connect with the cylinder cam 2 at the same time. Further, when the nut 53 moves toward the first transmission member 4, the inner spring cylinder 542 is stretched, and the inner spring cylinder 542 generates elastic potential energy in the opposite direction of the movement of the nut 53, and the elastic potential energy is transmitted to the outer spring cylinder 541. The outer spring cylinder 541 generates elastic potential energy in the same direction as the movement of the nut 53 to push the first transmission member 4 in the direction of the cylinder cam 2 and link with the cylinder cam 2, such that when the handle or the first knob assembly 9 is rotated, the first transmission shaft 3, the first transmission member 4 and the cylinder cam 2 are moved in linkage.

[0026] When the worm 52 drives the nut 53 to move away from the first transmission member 4, the inner spring cylinder 542 is stretched, and the outer spring cylinder 541 pulls the first transmission member 4 to separate from the cylinder cam 2. More specifically, when the nut 53 moves away from the first transmission member 4, the inner spring cylinder 542 is compressed, and the elastic potential energy generated by the inner spring cylinder 542 in the opposite direction from the movement of the nut 53 is transmitted to the outer spring cylinder 541 at the same time. The outer spring cylinder 541 generates the elastic potential energy in the same direction as the movement direction of the nut 53 to pull the first transmission member 4 to move toward the opposite direction from the cylinder cam 2 and separate from it, such that when the handle or the first knob assembly 9 is rotated, the first transmission shaft 3 and the first transmission member 4 move, but the cylinder cam 2 is not interlocked and doesn't move. The worm, the nut and the double-layer spring are used to convert the kinetic energy of the motor into elastic potential energy to promote the connection or separation of the first transmission member and the cylinder cam, thereby simplifying the product structure and reducing the production cost. The first transmission shaft 3 protrudes out of the lock shell assembly 1 and is fixedly connected with the first knob as-

sembly 9, and a first intelligent identification device for controlling the drive motor 51 is arranged in the first knob assembly 9. Through the first intelligent identification device to conduct user identification when open the lock, such as swipe card, fingerprint, password or portrait and other biometric identification methods. The first intelligent identification device will collect the data for determination, and through the first electric clutch device 5 wired or wireless connection, the user only need to turn the first knob assembly 9 to complete the unlocking after the user identification successfully are recognized, which having a high degree of intelligence.

[0027] In this embodiment, one end of the first transmission member 4 toward the cylinder cam 2 is provided with an insertion part 41 outwardly protruding, one end of the cylinder cam 2 toward the first transmission member 4 is provided with a first transmission accommodation cavity 21 into which the first transmission member 4 partially inserts and an insertion hole 20 communicating with the first transmission accommodation cavity 21 and into which the insertion part 41 is inserted. When the insertion part 41 is inserted into the insertion hole 20, the first transmission member 4 is interlocked with the cylinder cam 2. When the insertion part 41 is separated from the insertion hole 20, the first transmission member 4 and the cylinder cam 2 are not interlocked. The insertion part 41 is cylindrical. One end of the first transmission member 4 facing away from the cylinder cam 2 is provided with a spring accommodation cavity 42 for fixed connection with one end of the outer spring cylinder 541, and the outer spring cylinder 541 partially inserts into the spring accommodation cavity 42 and is fixedly connected with the inner wall and/or the bottom wall of the spring accommodation cavity 42. The fixed connection may be by pasting, welding or interference fitting, etc.

[0028] In this embodiment, the first transmission member 4 is further provided with a through hole 40 communicating with the spring accommodation cavity 42, and the worm 52 passes through the through hole 40, which can further reduce the space occupied by accessories and provide a compact structure. The end of the first transmission shaft 3 toward cylinder cam 2 is provided with the transmission cavity 31 for accommodating the first transmission member 4, and the first transmission shaft 3 is further provided with a driving cavity 32 for accommodating the first electric clutch device 5 and communicating with the transmission cavity 31. The peripheral surface of the first transmission shaft 3 is provided with a locking groove 33 communicating with the transmission cavity 31, and the peripheral surface of the first transmission member 4 is provided with a locking block 43 protruding outward and matched with the locking groove 33, so that the first transmission member 4 and the first transmission shaft 3 are kept in linkage. The insertion part 41 is provided on the locking block 43. The first electric clutch device 5 further includes an encryption circuit 57 arranged in the first transmission shaft 3 and electrically connected to the drive motor 51. The encryption circuit 57 performs data processing on the external unlocking signal to provide security. The first electric clutch device 5 also includes a motor sleeve 56 which is fitted on the drive motor 51, so that the drive motor 51 is more firmly assembled in the driving cavity 32. The driving cavity 32 is also provided with an anti-rotation pin 34 located on the outer side of the encryption circuit 57 to prevent lawbreakers from opening locks with violence.

[0029] In this embodiment, as shown in FIG. 13, the first knob assembly 9 includes a knob shell 91, a fixed plate 92 arranged at one end of the knob shell 91 and fixedly connected to the first transmission shaft 3, and a knob outer cover 93 detachably connected to the other end of the knob shell 91. A battery device 94 is disposed in the knob shell 91, and the first intelligent identification device is disposed in the knob outer cover 93. The first transmission shaft 3 is fixedly connected to the fixed plate 92 by means of, but not limited to, a pin, a screw, or a snap-fit. The knob outer cover 93 can be connected to the knob shell 91 by means of a snap-fit or a thread to facilitate the disassembly and replacement of the battery. The battery device 94 may be a detachable and replaceable lithium battery or a rechargeable lithium battery.

[0030] In this embodiment, the second transmission shaft 6 located on the other side of the cylinder cam 2 is arranged in the lock shell assembly 1, and the first transmission shaft 3 is symmetrically arranged with the second transmission shaft 6. The second transmission member 7 interlocked with the second transmission shaft 6 and the second electric clutch device 8 driving the second transmission member 7 to connect or separate with the cylinder cam 2 are arranged in the second transmission shaft 6. The first transmission member 4 has the same or similar structure as the second transmission member 7, and the first electric clutch device 5 has the same or similar structure as the second electric clutch device 8. The second transmission shaft 6 protrudes out of the lock shell assembly 1 and is fixedly connected to a second knob assembly 10, and the second knob assembly 10 is provided with a second intelligent identification device for controlling the second electric clutch device 8. The first knob assembly 9 has the same or similar structure as the second knob assembly 10, and the first intelligent identification device has the same or similar structure as the second intelligent identification device. That is, the inner side of the door and the outer side of the door use the same structure to achieve transmission unlocking.

Claims

1. A transmission structure of a smart lock cylinder, comprising a lock shell assembly (1), a cylinder cam (2) movably arranged in an open slot in a middle of the lock shell assembly (1), and a first transmission shaft (3) installed in the lock shell assembly (1) and located on one side where the cylinder cam (2) is arranged, **characterized in that** a first transmission

member (4) connected to the first transmission shaft (3) and a first electric clutch device (5) that drives the first transmission member (4) to connect or separate with the cylinder cam (2) are arranged in the first transmission shaft (3), and a transmission cavity (31) for accommodating the first transmission member (4) is arranged at one end of the first transmission shaft (3) toward the cylinder cam (2); the first transmission shaft (3) is provided with a driving cavity (32) for accommodating the first electric clutch device (5) and communicating with the transmission cavity (31), and the other end of the first transmission shaft (3) protrudes out of the lock shell assembly (1) for connecting a handle or a first knob assembly (9); the first electric clutch device (5) comprises a drive motor (51), a worm (52) fixedly connected with an output shaft of the drive motor (51), a nut (53) fitted on the worm (52) and threadedly connected with the worm (52), and a double-layer spring (54), wherein the double-layer spring (54) is provided with an outer spring cylinder (541) and an inner spring cylinder (542) folded inside the outer spring cylinder (541) and connected with the outer spring cylinder (541), one end of the outer spring cylinder (541) is fixedly connected with the first transmission member (4), one end of the inner spring cylinder (542) is fixedly connected with the nut (53), and the other end of the outer spring cylinder (541) is fixedly connected with the other end of the inner spring cylinder (542); when the worm (52) drives the nut (53) to move toward the first transmission member (4), the inner spring cylinder (542) is stretched and the outer spring cylinder (541) pushes the first transmission member (4) to connect with the cylinder cam (2) at the same time; when the worm (52) drives the nut (53) to move away from the first transmission member (4), the inner spring cylinder (542) is compressed and the outer spring cylinder (541) pulls the first transmission member (4) to separate from the cylinder cam (2) at the same time.

2. The transmission structure of the smart lock cylinder according to claim 1, **characterized in that** one end of the first transmission member (4) toward the cylinder cam (2) is provided with an insertion part (41) outwardly protruding, one end of the cylinder cam (2) toward the first transmission member (4) is provided with a first transmission accommodation cavity (21) into which the first transmission member (4) partially inserts and an insertion hole (20) communicating with the first transmission accommodation cavity (21) and into which the insertion part (41) is inserted; when the insertion part (41) is inserted into the insertion hole (20), the first transmission member (4) is interlocked with the cylinder cam (2); when the insertion part (41) is separated from the insertion hole (20), the first transmission member (4) and the cylinder cam (2) are not interlocked.

3. The transmission structure of the smart lock cylinder according to claim 2, **characterized in that** one end of the first transmission member (4) facing away from the cylinder cam (2) is provided with a spring accommodation cavity (42) for fixed connection with one end of the outer spring cylinder (541), and the outer spring cylinder (541) partially inserts into the spring accommodation cavity (42) and is fixedly connected with an inner wall and/or a bottom wall of the spring accommodation cavity (42).

4. The transmission structure of the smart lock cylinder according to claim 3, **characterized in that** the first transmission member (4) is further provided with a through hole (40) communicating with the spring accommodation cavity (42), and the worm (52) passes through the through hole (40); a peripheral surface of the first transmission shaft (3) is provided with a locking groove (33) communicating with the transmission cavity (31), and a peripheral surface of the first transmission member (4) is provided with a locking block (43) protruding outward and matched with the locking groove (33), so that the first transmission member (4) and the first transmission shaft (3) are kept in linkage.

5. The transmission structure of the smart lock cylinder according to claim 1, **characterized in that** a second transmission shaft (6) located on the other side of the cylinder cam (2) is also arranged in the lock shell assembly (1), and the first transmission shaft (3) is symmetrically arranged with the second transmission shaft (6); a second transmission member (7) interlocked with the second transmission shaft (6) and a second electric clutch device (8) driving the second transmission member (7) to connect or separate with the cylinder cam (2) are arranged in the second transmission shaft (6); the first transmission member (4) has the same structure as the second transmission member (7), and the first electric clutch device (5) has the same structure as the second electric clutch device (8).

6. A smart lock, which applies a transmission structure as claimed in any one of claims 1-5, comprising the lock shell assembly (1), the cylinder cam (2) movably arranged in the open slot in the middle of the lock shell assembly (1), and the first transmission shaft (3) installed in the lock shell assembly (1) and located on one side where the cylinder cam (2) is arranged, **characterized in that** the first transmission member (4) connected to the first transmission shaft (3) and the first electric clutch device (5) that drives the first transmission member (4) to connect or separate with the cylinder cam (2) are arranged in the first transmission shaft (3), and a transmission cavity (31) for accommodating the first transmission member (4) is arranged at one end of the first transmission shaft

(3) toward the cylinder cam (2); the first transmission shaft (3) is provided with the driving cavity (32) for accommodating the first electric clutch device (5) and communicating with the transmission cavity (31), and the other end of the first transmission shaft (3) protrudes out of the lock shell assembly (1) for connecting the handle or the first knob assembly (9); the first electric clutch device (5) comprises the drive motor (51), the worm (52) fixedly connected with the output shaft of the drive motor (51), the nut (53) fitted on the worm (52) and threadedly connected with the worm (52), and the double-layer spring (54), wherein the double-layer spring (54) is provided with the outer spring cylinder (541) and the inner spring cylinder (542) folded inside the outer spring cylinder (541) and connected with the outer spring cylinder (541), one end of the outer spring cylinder (541) is fixedly connected with the first transmission member (4), one end of the inner spring cylinder (542) is fixedly connected with the nut (53), and the other end of the outer spring cylinder (541) is fixedly connected with the other end of the inner spring cylinder (542); when the worm (52) drives the nut (53) to move toward the first transmission member (4), the inner spring cylinder (542) is stretched and the outer spring cylinder (541) pushes the first transmission member (4) to connect with the cylinder cam (2) at the same time; when the worm (52) drives the nut (53) to move away from the first transmission member (4), the inner spring cylinder (542) is compressed and the outer spring cylinder (541) pulls the first transmission member (4) to separate from the cylinder cam (2) at the same time; the first transmission shaft (3) protrudes out of the lock shell assembly (1) and is fixedly connected with the first knob assembly (9), and a first intelligent identification device for controlling the drive motor (51) is arranged in the first knob assembly (9).

7. The smart lock according to claim 6, **characterized in that** one end of the first transmission member (4) toward the cylinder cam (2) is provided with the insertion part (41) outwardly protruding, the cylinder cam (2) is provided with the insertion hole (20) for an insertion of the insertion part (41); when the insertion part (41) is inserted into the insertion hole (20), the first transmission member (4) is interlocked with the cylinder cam (2).

8. The smart lock according to claim 7, **characterized in that** one end of the first transmission member (4) facing away from the cylinder cam (2) is provided with the spring accommodation cavity (42) for fixed connection with one end of the outer spring cylinder (541), and the outer spring cylinder (541) partially inserts into the spring accommodation cavity (42) and is fixedly connected with the inner wall and/or the bottom wall of the spring accommodation cavity (42).

9. The smart lock according to claim 8, **characterized in that** the first transmission member (4) is further provided with the through hole (40) communicating with the spring accommodation cavity (42), and the worm (52) passes through the through hole (40); the peripheral surface of the first transmission shaft (3) is provided with the locking groove (33) communicating with the transmission cavity (31), and the peripheral surface of the first transmission member (4) is provided with the locking block (43) protruding outward and matched with the locking groove (33), so that the first transmission member (4) and the first transmission shaft (3) are kept in linkage.

10. The smart lock according to any one of claims 6-9, **characterized in that** the second transmission shaft (6) located on the other side of the cylinder cam (2) is also arranged in the lock shell assembly (1), and the first transmission shaft (3) is symmetrically arranged with the second transmission shaft (6); the second transmission member (7) interlocked with the second transmission shaft (6) and the second electric clutch device (8) driving the second transmission member (7) to connect or separate with the cylinder cam (2) are arranged in the second transmission shaft (6); the first transmission member (4) has the same structure as the second transmission member (7), and the first electric clutch device (5) has the same structure as the second electric clutch device (8); the second transmission shaft (6) protrudes out of the lock shell assembly (1) and is fixedly connected to a second knob assembly (10), and the second knob assembly (10) is provided with a second intelligent identification device for controlling the second electric clutch device (8), and the first knob assembly (9) has the same structure as the second knob assembly (10), and the first intelligent identification device has the same structure as the second intelligent identification device.

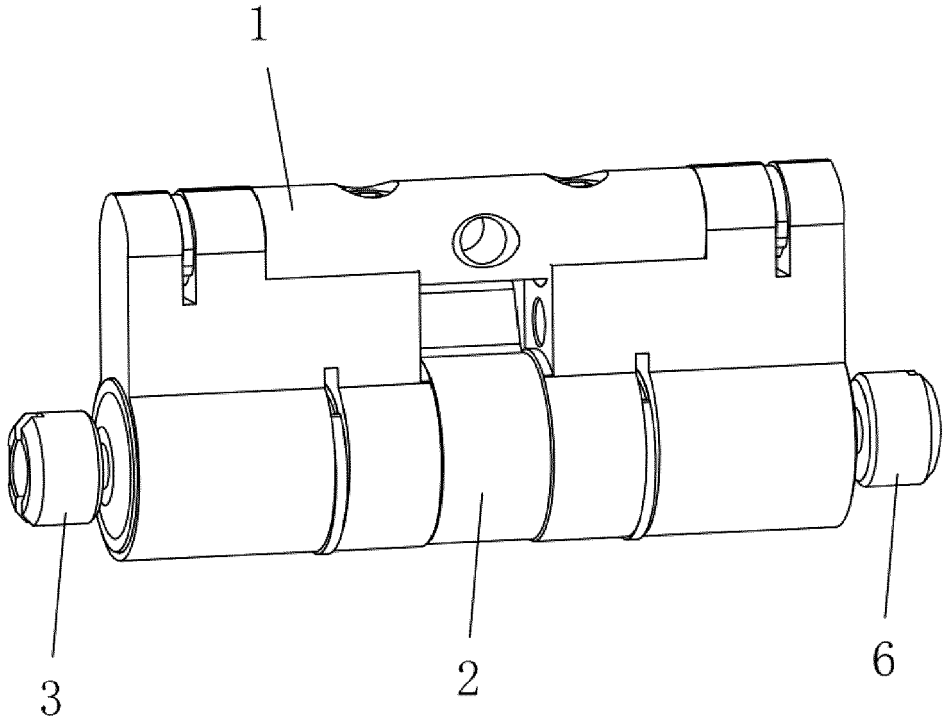

FIG.1

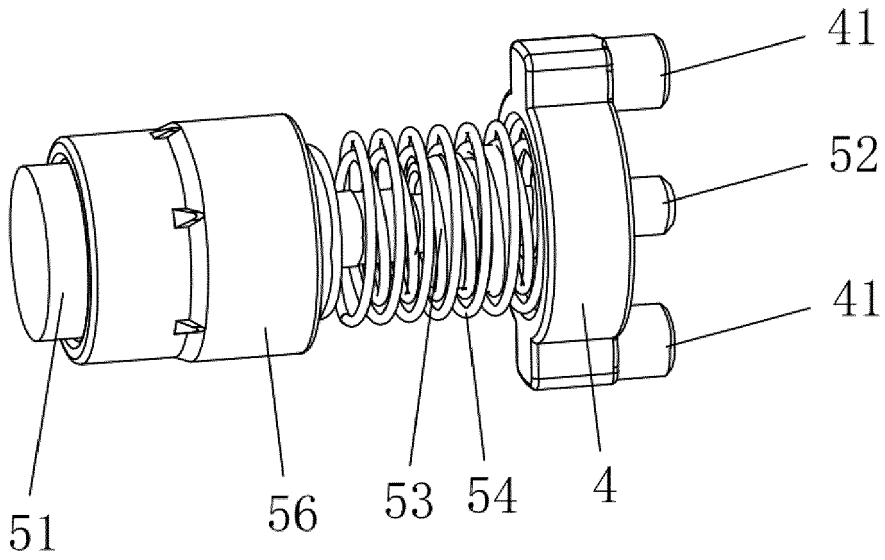

FIG.2

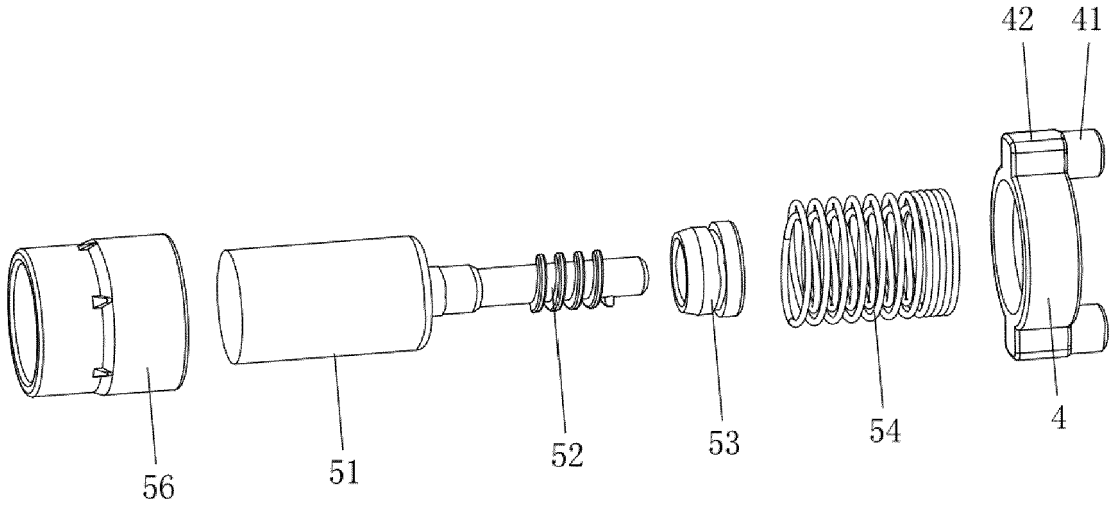

FIG.3

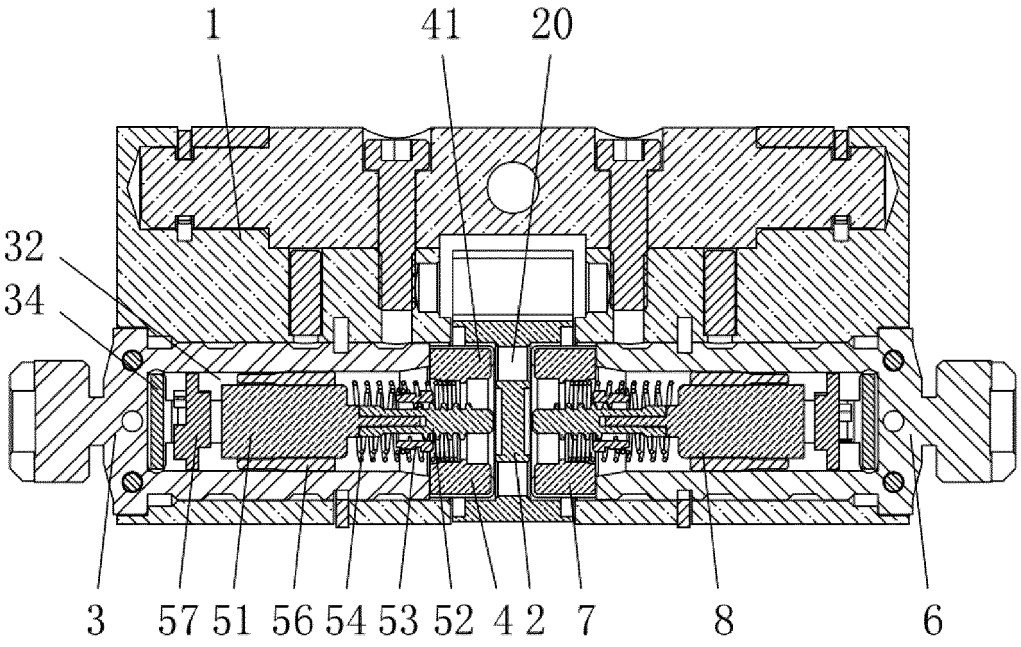

FIG.4

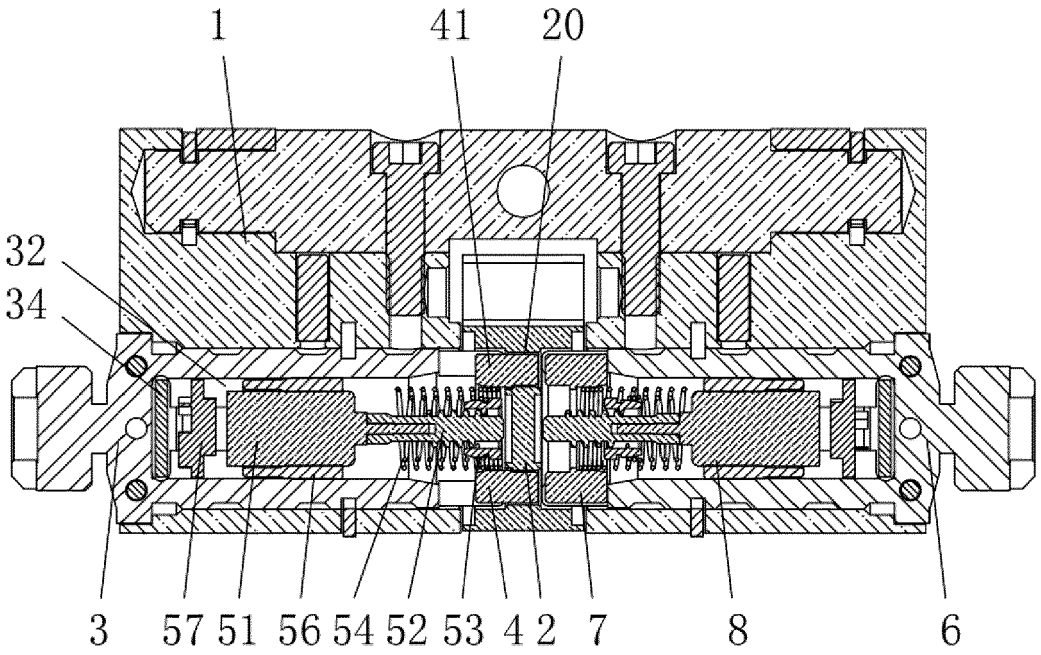

FIG.5

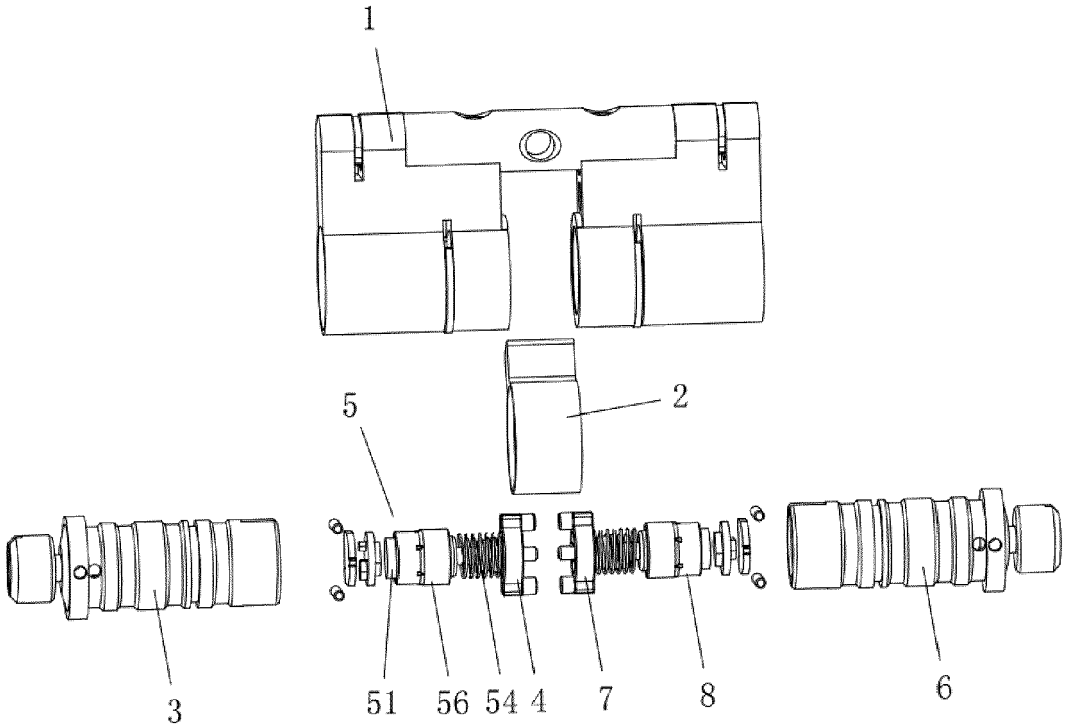

FIG.6

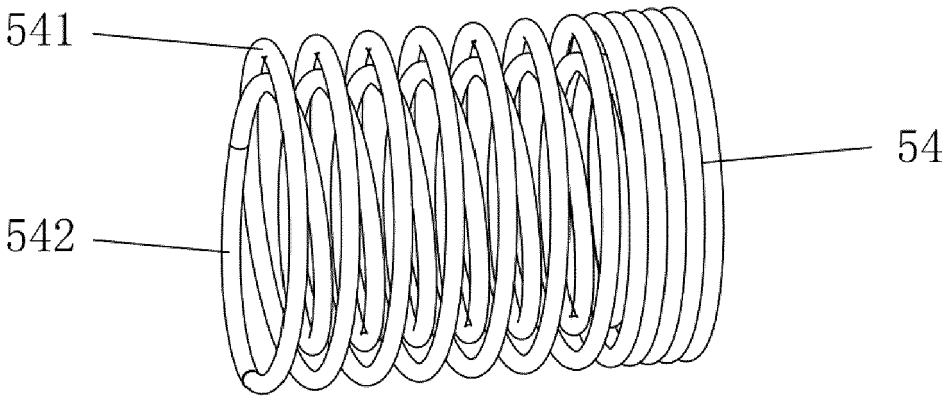

FIG.7

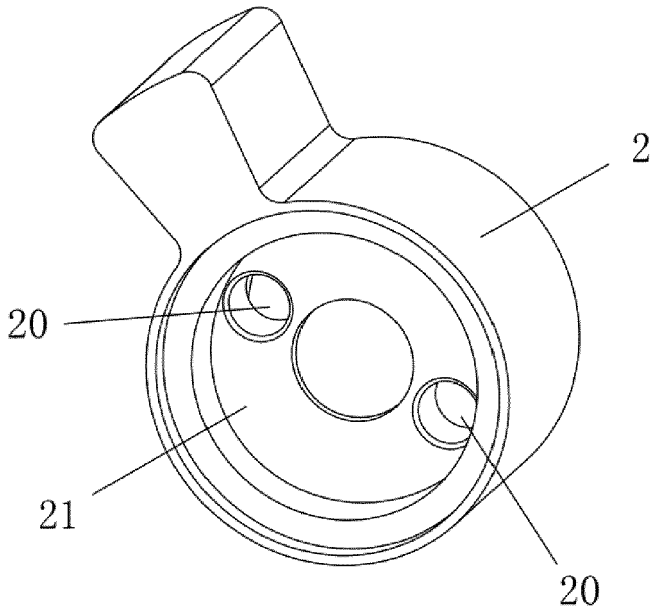

FIG.8

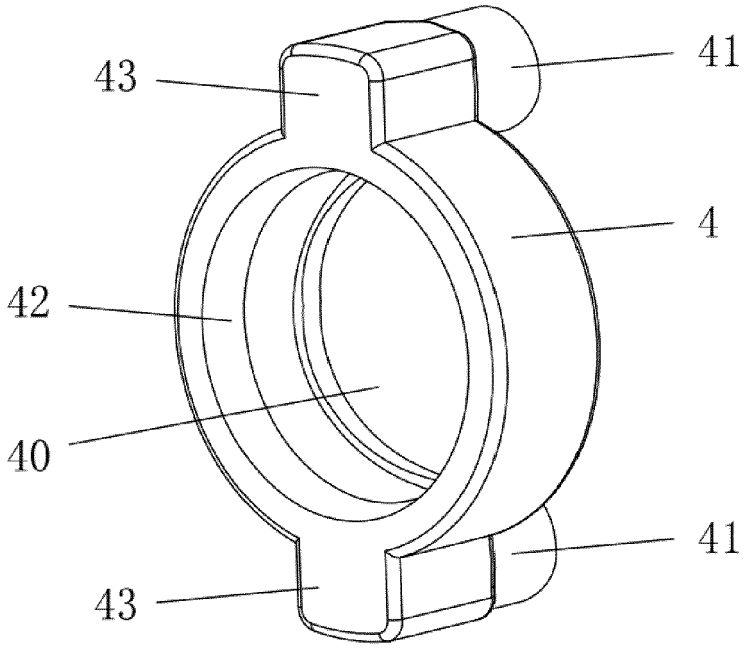

FIG.9

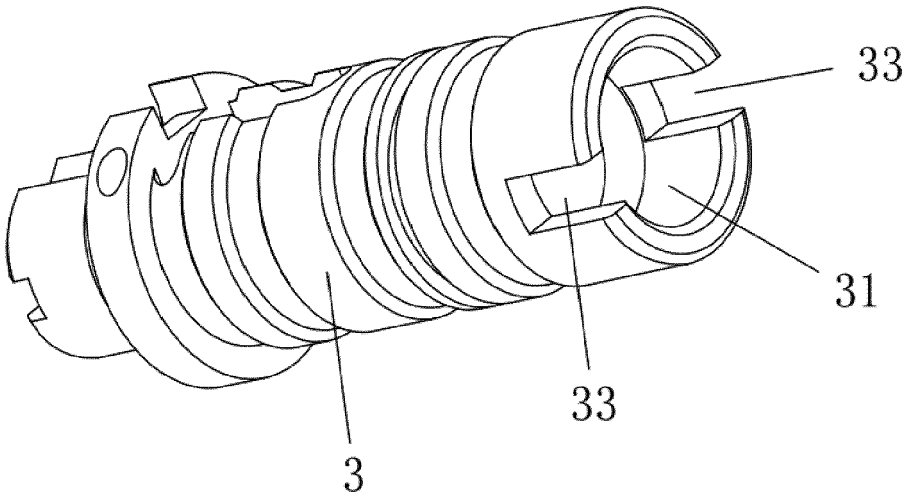

FIG.10

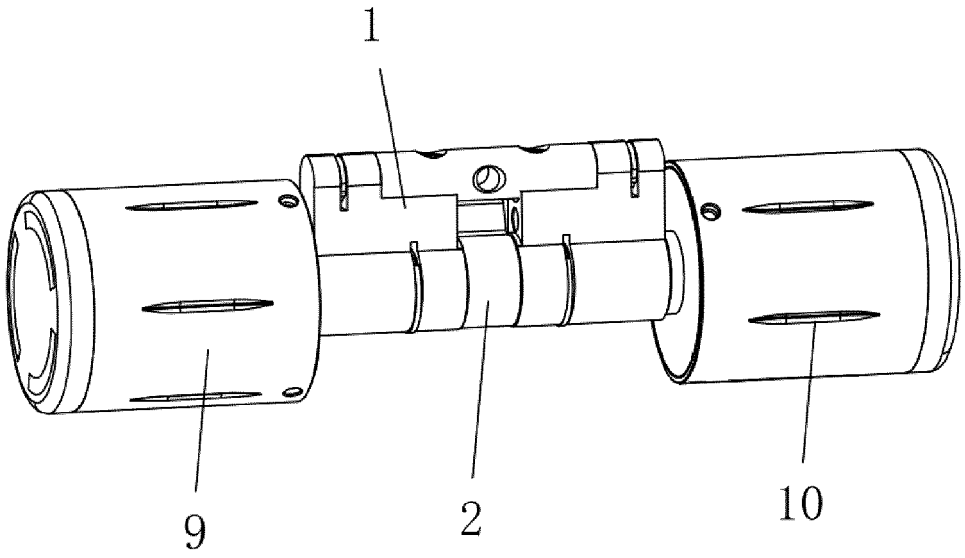

FIG.11

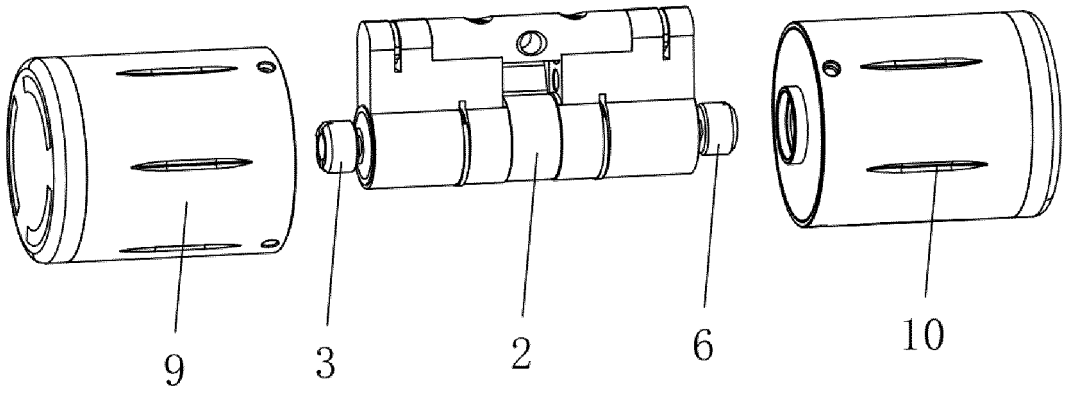

FIG.12

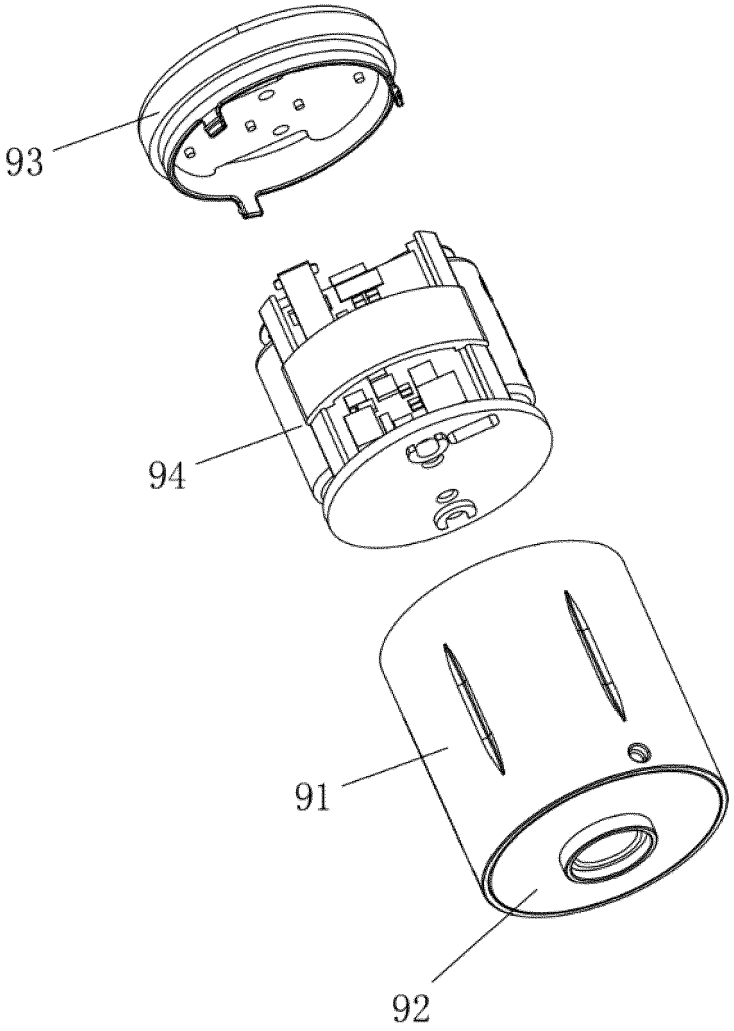

FIG.13

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 22 19 3752

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A,D	CN 209 976 212 U (ZHONGSHAN JIXIN CORE LOCK CO LTD) 21 January 2020 (2020-01-21) * the whole document *	1-10	INV. E05B47/06 E05B15/04 E05B47/00
A	WO 2020/100172 A1 (OMEC SERRATURE S P A [IT]) 22 May 2020 (2020-05-22) * the whole document *	1-10	
A	CN 109 667 484 A (ZHONGSHAN JIXIN CORE LOCK CO LTD) 23 April 2019 (2019-04-23) * the whole document *	1-10	
A	WO 2014/128099 A1 (ISEO SERRATURE SPA [IT]) 28 August 2014 (2014-08-28) * the whole document *	1-10	

TECHNICAL FIELDS SEARCHED (IPC)

E05B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	23 February 2023	Geerts, Arnold

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 22 19 3752

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

23-02-2023

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
CN 209976212 U	21-01-2020	NONE	
WO 2020100172 A1	22-05-2020	CN 112955619 A	11-06-2021
		EP 3880909 A1	22-09-2021
		WO 2020100172 A1	22-05-2020
CN 109667484 A	23-04-2019	NONE	
WO 2014128099 A1	28-08-2014	EP 2959081 A1	30-12-2015
		ES 2674523 T3	02-07-2018
		WO 2014128099 A1	28-08-2014

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- CN 103790443 B **[0002]**
- CN 209976212 U **[0003]**