



(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
06.07.2022 Bulletin 2022/27

(21) Application number: **20921835.3**

(22) Date of filing: **04.08.2020**

(51) International Patent Classification (IPC):
E05B 63/14 (2006.01) **E05B 47/00** (2006.01)
E05B 15/00 (2006.01) **E05B 15/10** (2006.01)
E05B 67/22 (2006.01)

(86) International application number:
PCT/CN2020/106847

(87) International publication number:
WO 2021/169180 (02.09.2021 Gazette 2021/35)

(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: **26.02.2020 CN 202010122069**

(71) Applicant: **Zhuhai Utaiot Technology Co., Ltd.**
Zhuhai, Guangdong 519000 (CN)

(72) Inventors:
• **JIN, Shuqiang**
Zhuhai, Guangdong 519000 (CN)
• **LI, Baofu**
Zhuhai, Guangdong 519000 (CN)
• **YANG, Shaohua**
Zhuhai, Guangdong 519000 (CN)
• **LI, Qiping**
Zhuhai, Guangdong 519000 (CN)
• **ZHANG, Yongcheng**
Zhuhai, Guangdong 519000 (CN)

(74) Representative: **Germain Maureau**
12, rue Boileau
69006 Lyon (FR)

(54) **LOCK CYLINDER AND LOCK**

(57) The present invention provides a lock cylinder and a lock, and belongs to the field of locks. The lock cylinder includes a base, a lock bolt, a cam, an energy storage member, a driving device, and a one-way locking mechanism. The lock bolt is movably provided on the base. The cam is rotatably provided on the base. The cam has a first position in which the lock bolt is prevented from retracting and a second position in which the lock bolt is allowed to retract. The energy storage member is connected between the driving device and the cam. While the lock bolt locks the cam, the driving device operates to cause the energy storage member to store an elastic force. While the lock bolt unlocks the cam, the elastic force drives the cam to rotate. The one-way locking mechanism is configured to restrict retraction of the lock bolt after the lock bolt extends and unlocks the cam located in the second position. After the lock bolt extends and unlocks the cam in the second position, the one-way locking mechanism restricts retraction of the lock bolt. Even if a lock beam applies thrust to the lock bolt during a process in which the lock beam is pulled outwards, the lock bolt may not retract to a position in which the lock bolt locks the cam, and the lock bolt always engages with a lock beam gap of the lock beam, thereby eliminating false locking.

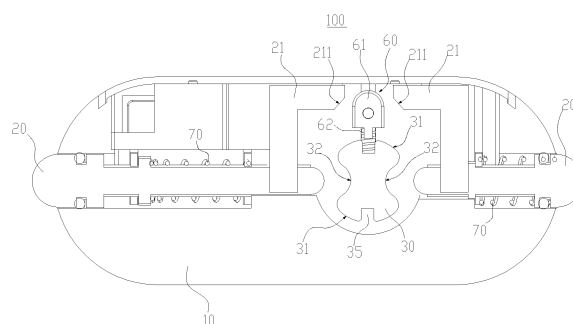


Fig. 2

Description

Technical Field

[0001] The present invention relates to the field of locks, in particular to a lock cylinder and a lock.

Background

[0002] In an existing lock, a lock beam is locked or unlocked by a lock bolt of a lock cylinder generally, as to achieve locking or unlocking. During a locking process, after the lock bolt extends and enters a lock beam gap, while the lock beam is pulled, the lock bolt may retract under the action of the lock beam, the locking action may not be completed, so a hidden danger of false locking (a user thinks it is locked, but the lock beam may actually be pulled out quickly) is caused.

Summary

[0003] Some embodiments of the present invention provides a lock cylinder and a lock, as to improve a problem of false locking in an existing lock cylinder.

[0004] In an embodiment of the present invention, a lock cylinder is provided, including a base, a lock bolt, a cam, an energy storage member, a driving device, and a one-way locking mechanism.

[0005] The lock bolt is movably provided on the base.

[0006] The cam is rotatably provided on the base, and the cam has a first position in which the lock bolt is prevented from retracting and a second position in which the lock bolt is allowed to retract.

[0007] The energy storage member is connected between the driving device and the cam. While the lock bolt locks the cam, the driving device operates to cause the energy storage member to store an elastic force. While the lock bolt unlocks the cam, the elastic force drives the cam to rotate.

[0008] The one-way locking mechanism is configured to restrict retraction of the lock bolt after the lock bolt extends and unlocks the cam located in the second position.

[0009] In the above technical scheme, in an unlocked state, the cam is located in the second position. In this case, if the lock bolt is subjected to an external force (a force applied to the lock bolt while an outer peripheral wall of a lock beam abuts against the lock bolt), while the cam is locked in the second position, the cam may not be rotated. While unlocking is performed in this case, the driving device operates to cause the energy storage member to store an elastic force. In a process that the lock beam is pulled outwards so that the lock bolt extends and is locked in a lock beam gap on the lock beam, the lock bolt extends and unlocks the cam located in the second position, and the cam is finally rotated to the first position under the action of the elastic force accumulated by the energy storage member, as to achieve locking.

After the lock bolt extends and unlocks the cam located in the second position, the one-way locking mechanism plays a role in restricting retraction of the lock bolt. Even if the lock beam applies thrust to the lock bolt during a process in which the lock beam is pulled outwards, the lock bolt may not retract to a position in which the cam is locked, the lock bolt always engages with the lock beam gap of the lock beam, and the lock beam may not be pulled out, thereby a false locking phenomenon does not appear.

[0010] In an embodiment of the present invention, the one-way locking mechanism includes a locking member movably arranged on the base.

[0011] The locking member has a third position and a fourth position.

[0012] The retraction of the lock bolt may drive the locking member to move from the fourth position to the third position, so that the lock bolt may lock the cam located in the second position.

[0013] While the lock bolt extends and unlocks the cam located in the second position, the elastic force may drive the cam to rotate, so that the cam may prevent the locking member from moving from the fourth position to the third position, thus the locking member restricts the retraction of the lock bolt.

[0014] In the above technical scheme, the locking member may be moved between the third position and the fourth position, and the position of the locking member may be changed by the movement of the lock bolt. After the locking tongue unlocks the cam located in the second position, the cam may be rotated under the action of the elastic force accumulated by the energy storage member, so that the cam prevents the locking member from moving from the fourth position to the third position, thus the locking member may not return to the third position in which the cam located in the second position may be locked, and finally the locking member restricts the retraction of the lock bolt. The retraction of the lock bolt is restricted by a mode of preventing the movement of the locking member through the cam, and the structure form is simple.

[0015] In an embodiment of the present invention, the one-way locking mechanism further includes an elastic member.

[0016] The elastic member is configured to drive the locking member to move from the third position to the fourth position in a process that the lock bolt extends and unlocks the cam located in the second position.

[0017] In the above structure, the elastic member plays a role in resetting the locking member. In the process that the lock bolt extends and unlocks the cam located in the second position, the locking member may be moved from the third position to the fourth position under the action of the elastic member.

[0018] In an embodiment of the present invention, the locking member is movably arranged on the base.

[0019] In the above technical scheme, the position of the locking member is changed by a mode of moving,

and the mode of changing the position of the locking member is simple.

[0020] In an embodiment of the present invention, a moving direction of the locking member is perpendicular to a moving direction of the lock bolt.

[0021] In the above technical scheme, the moving direction of the locking member is perpendicular to the moving direction of the lock bolt. This structure makes the locking member unable to move while blocked by the cam, and the locking member may effectively block the lock bolt.

[0022] In an embodiment of the present invention, an inserting groove into which the locking member is inserted is arranged on the cam.

[0023] While the cam is located in the second position and the locking member is located in the third position, the locking member is inserted in the inserting groove.

[0024] While the cam is located in the second position and the locking member is located in the fourth position, the locking member exits from the inserting groove.

[0025] In the above technical scheme, the cam is provided with the inserting groove into which the locking member is inserted. While the locking tongue locks the cam located in the second position, the locking member is inserted in the inserting groove. At this time, the locking member may also play a role in preventing the rotation of the cam. In the process that the locking tongue extends and unlocks the cam located in the second position, the locking member may be moved to the fourth position. At this time, the cam is located in the second position and the locking member is located in the fourth position, and the locking member is located outside the inserting groove. The unlocked cam may be rotated under the action of the elastic force accumulated by the energy storage member, thereby the locking member is staggered with the inserting groove, and the locking member may not be inserted into the inserting groove, it means that the locking member may not return to the third position from the fourth position. After the locking member abuts on the outer peripheral wall of the cam, the locking tongue may be restricted from retracting.

[0026] In an embodiment of the present invention, a blocking portion is fixedly arranged on the lock bolt.

[0027] The blocking portion is configured to abut against the locking member while the lock bolt is retracted and drive the locking member to move from the fourth position to the third position.

[0028] In the above technical scheme, the blocking portion on the lock bolt plays a role in transmitting a force. While the lock bolt is retracted, the driving force may be transmitted to the locking member through the blocking portion, so that the locking member may be moved from the fourth position to the third position. In the case that the cam prevents the locking member from moving from the fourth position to the third position, since the blocking portion abuts against the locking member, the blocking portion may not be retracted, thereby the purpose of restricting the retraction of the lock bolt is achieved.

[0029] In an embodiment of the present invention, the blocking portion has a guiding inclined surface for driving the locking member to move.

[0030] In the above technical scheme, the arrangement of the guiding inclined surface on the blocking portion enables the locking member to be more easily driven to move in a process that the blocking portion is retracted with the lock bolt.

[0031] In an embodiment of the present invention, a guiding chute is arranged on the lock bolt, a protrusion is arranged on the locking member, and the protrusion is locked in the guiding chute.

[0032] The retraction of the lock bolt may drive the locking member to move from the fourth position to the third position.

[0033] In the above technical scheme, the protrusion on the locking member is locked in the guiding chute on the locking tongue, and the locking tongue may directly transmit power to the locking member, as to move the locking member. The retraction of the lock bolt may drive the locking member to move from the fourth position to the third position, and the extension of the lock bolt may drive the locking member to move from the third position to the fourth position.

[0034] In an embodiment of the present invention, the locking member is rotatably arranged on the base.

[0035] In the above technical scheme, the position of the locking member is changed by a mode of rotating, and the mode of changing the position of the locking member is simple.

[0036] In an embodiment of the present invention, the lock cylinder further includes a controller.

[0037] The controller is configured to control the driving device to drive the cam to rotate from the first position to the second position through the energy storage member according to an unlocking signal, and delay-control the driving device to drive the cam to rotate from the second position to the first position through the energy storage member.

[0038] In the above technical scheme, the controller has a function of controlling the driving device to operate to achieve the unlocking and delay-controlling the driving device to re-operate to achieve the locking. While the controller receives the unlocking signal, the controller may control the driving device to operate according to the unlocking signal, and finally the cam is rotated from the first position to the second position, and the lock bolt may be retracted, as to achieve the unlocking. After a preset time, the controller may control the driving device to re-operate, and finally the cam is rotated from the second position to the first position, and the cam may prevent the retraction of the lock bolt, as to achieve delay-locking.

[0039] In an embodiment of the present invention, there are two lock bolts, and the two lock bolts are arranged oppositely on two sides of the cam.

[0040] In the above technical scheme, the two lock bolts are arranged oppositely on the two sides of the cam, and the two lock bolts may lock the lock beam, so the

locking ability of the lock cylinder to the lock beam is improved.

[0041] In an embodiment of the present invention, the outer peripheral wall of the cam includes two oppositely arranged convex arc surfaces and two oppositely arranged concave arc surfaces.

[0042] While the cam is located in the first position, each lock bolt abuts against one convex arc surface.

[0043] While the cam is located in the second position, each lock bolt is aligned with one concave arc surface.

[0044] In the above technical scheme, the outer peripheral wall of the cam includes the two oppositely arranged convex arc surfaces and the two oppositely arranged concave arc surfaces, and the overall structure of the cam is simple. While the cam is located in the first position, the two convex arc surfaces of the cam may respectively prevent the two lock bolts from retracting; and while the cam is located in the second position, the two lock bolts are respectively aligned with the two concave arc surfaces of the cam, so that the two lock bolts may be retracted under the action of an external force.

[0045] In an embodiment of the present invention, the driving device includes a dial plate, a grooved wheel and a driving member.

[0046] Both the dial plate and the grooved wheel are rotatably arranged on the base, and the dial plate, the grooved wheel and the base constitute a grooved wheel mechanism.

[0047] The driving member is configured to drive the dial plate to rotate relative to the base, and the energy storage member is connected between the grooved wheel and the cam.

[0048] In the above technical scheme, the dial plate, the grooved wheel and the base constitute the grooved wheel mechanism, and this mechanism is an irreversible transmission mechanism, namely, the dial plate may drive the grooved wheel to rotate, but the grooved wheel may not drive the dial plate to rotate.

[0049] The present invention further provides a lock, including a lock body, a lock beam, and the above lock cylinder.

[0050] The lock cylinder is installed in the lock body, and the lock bolt is configured to lock the lock beam and the lock body tightly.

[0051] In the above technical scheme, the lock cylinder of the lock is in a process of storing energy and locking, while the lock beam is pulled out, after the lock bolt enters the lock beam gap of the lock beam, the one-way locking mechanism may play a one-way locking effect on the lock bolt, the lock bolt may not be retracted from the lock beam gap of the lock beam, and the false locking phenomenon may not appear.

Brief Description of the Drawings

[0052] In order to describe technical schemes of embodiments of the present invention more clearly, used drawings needed in the embodiments are briefly intro-

duced below. It should be understood that the following drawings only show some embodiments of the present invention, and therefore it should not be regarded as limitation to a scope. For those of ordinary skill in the art, other related drawings may be obtained on the basis of these drawings without creative work.

Fig. 1 is a structure schematic diagram of a lock cylinder provided by an embodiment of the present invention from a first perspective.

Fig. 2 is a structure schematic diagram of a lock cylinder provided by an embodiment of the present invention from a second perspective.

Fig. 3 is an operating schematic diagram of a lock cylinder (a cam is located in a second position and a locking member is located in a fourth position) provided by an embodiment of the present invention from the first perspective.

Fig. 4 is an operating schematic diagram of a lock cylinder (the cam is located in the second position, and the locking member is located in the fourth position) provided by an embodiment of the present invention from the second perspective.

Fig. 5 is an operating schematic diagram of a lock cylinder (the cam is located in a first position, and the locking member is located in the fourth position) provided by an embodiment of the present invention.

Fig. 6 is an operating schematic diagram of a lock cylinder (the cam is located in the second position, and the locking member is located in a third position) provided by an embodiment of the present invention.

Fig. 7 is an operating schematic diagram of a lock cylinder (the cam is located between the first position and the second position, and the locking member is located in the fourth position) provided by an embodiment of the present invention.

Fig. 8 is an exploded view of a driving device shown in Fig. 1.

Fig. 9 is a schematic diagram of connection between the driving device and the cam shown in Fig. 1.

Fig. 10 is an operating schematic diagram of a lock cylinder (the cam is located in the second position, and the locking member is located in the fourth position) provided by other embodiments of the present invention.

Fig. 11 is an operating schematic diagram of a lock cylinder (the cam is located in the second position, and the locking member is located in the third posi-

tion) provided by other embodiments of the present invention.

Fig. 12 is an operating schematic diagram of a lock cylinder (the cam is located in the second position, and the locking member is located in the fourth position) provided by another embodiment of the present invention.

Fig. 13 is an operating schematic diagram of a lock cylinder (the cam is located in the second position, and the locking member is located in the third position) provided by another embodiment of the present invention.

Fig. 14 is a structure schematic diagram of a lock provided by an embodiment of the present invention.

[0053] Herein, the above drawings include the following reference signs:

100. Lock cylinder; 10. Base; 20. Lock bolt; 21. Blocking portion; 211. Guiding inclined surface; 22. Guiding chute; 30. Cam; 31. Convex arc surface; 32. Concave arc surface; 33. First Convex post; 34. Convex shaft; 35. Inserting groove; 40. Energy storage member; 50. Driving device; 51. Dial plate; 52. Grooved wheel; 521. Second convex post; 53. Driving member; 54. Small gear; 55. Big gear; 60. One-way locking mechanism; 61. Locking member; 611. Protrusion; 62. Elastic member; 70. Resetting member; 80. Mechanical lock cylinder; 81. Lock core; 200. Lock; 210. Lock body; 2101. Lock hole; 220. Lock beam; and 2201. Lock beam gap.

Detailed Description of the Embodiments

[0054] In order to make purposes, technical schemes and advantages of embodiments of the present invention clearer, the technical schemes in the embodiments of the present invention are clearly and completely described below with reference to drawings in the embodiments of the present invention. Apparently, the embodiments described are a part of the embodiments of the present invention, but not all of the embodiments. Assemblies of the embodiments of the present invention generally described and shown in the drawings herein may be arranged and designed in various different configurations.

[0055] An embodiment of the present invention provides a lock cylinder 100, which may effectively avoid a false locking phenomenon. The specific structure of the lock cylinder 100 may be described in detail below with reference to the drawings.

[0056] As shown in Figs. 1 and 2, the embodiment of the present invention provides a lock cylinder 100, including a base 10, a lock bolt 20, a cam 30, an energy storage member 40, a driving device 50 and a one-way locking mechanism 60. The lock bolt 20 is movably arranged on the base 10. The cam 30 is rotatably arranged

on the base 10, and the cam 30 has a first position in which the lock bolt 20 is prevented from retracting and a second position in which the lock bolt 20 is allowed to retract. The energy storage member 40 is connected between the driving device 50 and the cam 30. While the lock bolt 20 locks the cam 30, the driving device 50 is operated to make the energy storage member 40 accumulate an elastic force, and while the lock bolt 20 unlocks the cam 30, the elastic force may drive the cam 30 to rotate. The one-way locking mechanism 60 is configured to restrict the retraction of the lock bolt 20 after the lock bolt 20 extends and unlocks the cam 30 located in the second position.

[0057] In the lock cylinder 100 with the above structure, while a lock beam 220 is pulled out in a process of storing energy and locking, after the lock bolt 20 enters a lock beam gap 2201 of the lock beam 220, the one-way locking mechanism 60 may play a one-way locking effect on the lock bolt 20, the lock bolt 20 may not be retracted from the lock beam gap 2201 of the lock beam 220, and the false locking phenomenon may not appear. An operating principle of the lock cylinder 100 is described in detail below.

[0058] As shown in Figs 3 and 4, in an unlocked state, the cam 30 is located in the second position (the cam 30 allows the lock bolt 20 to retract). At this time, the lock beam 220 may be pulled out by applying an external force to the lock beam 220. In a process of pulling out the lock beam 220, the lock beam 220 may push the lock bolt 20 to retract, so that the lock bolt 20 exits from the lock beam gap 2201 of the lock beam 220.

[0059] As shown in Fig. 4 (the cam 30 is located in the second position in Fig. 4), in the unlocked state, in the case that the lock bolt 20 is inserted into the lock beam 2201, if it is to be locked, the driving device 50 may be operated to transmit power to the cam 30 through the energy storage member 40, so that the cam 30 is rotated from the second position to the first position. As shown in Fig. 5 (the cam 30 is located in the first position in Fig. 5), while the cam 30 is rotated to the first position, the cam 30 has a function of preventing the lock bolt 20 from retracting, and the lock bolt 20 may not be retracted. Because the lock bolt 20 is inserted into the lock beam gap 2201, the lock beam 220 is locked, so that the lock beam 220 may not be pulled out. In the above locking process, the energy storage member 40 does not have an energy storage process, and the energy storage member 40 plays a role in transmitting power, namely the power of the driving device 50 is directly transmitted to the cam 30.

[0060] As shown in Fig. 6 (the cam is located in the second position in Fig. 6). In the unlocked state, the cam 30 is located in the second position. In this case, if the lock bolt 20 is subjected to an external force (a force applied to the lock bolt 20 while an outer peripheral wall of the lock beam 220 abuts against the lock bolt 20), while the cam 30 is locked in the second position, the cam 30 may not be rotated. While unlocking is performed in this case, the driving device 50 operates to cause the energy

storage member 40 to store an elastic force. In a process that the lock beam 220 is pulled outwards so that the lock bolt 20 extends and is locked in the lock beam gap 2201 on the lock beam 220, as shown in Fig. 7, the lock bolt 20 unlocks the cam 30 located in the second position, and the cam 30 may be rotated under the action of the elastic force accumulated by the energy storage member 40. After the lock bolt 20 extends and unlocks the cam 30 in the second position, the one-way locking mechanism 60 plays a role in restricting the lock bolt 20 from retracting. Even if the lock beam 220 applies thrust to the lock bolt 20 in the process that the lock beam 220 is pulled outwards, the lock bolt 20 may not be retracted to the position in which the cam 30 is locked, the lock bolt 20 is always locked in the lock beam gap 2201 of the lock beam 220, the lock beam 220 may not be pulled out, and the false locking phenomenon may not appear.

[0061] In the locked state, the cam 30 is located in the first position. In the case that the lock bolt 20 is inserted into the lock beam gap 2201 and the lock bolt 20 is not subjected to an axial force applied by the lock beam gap 2201, if it is to be unlocked, the driving device 50 may be operated to transmit the power to the cam 30 through the energy storage member 40, so that the cam 30 is rotated from the first position to the second position. In the unlocking process, the energy storage member 40 does not have the energy storage process, and the energy storage member 40 plays a role in transmitting action, namely the power of the driving device 50 is directly transmitted to the cam 30. However in the locked state, while the lock bolt 20 is inserted into the lock beam 2201 and the lock beam 220 is subjected to a pull force, the lock beam 220 may apply an axial thrust to the lock bolt 20, the lock bolt 20 may lock the cam 30, and the cam 30 may not be rotated. During unlocking, the driving device 50 operates to cause the energy storage member 40 to accumulate the elastic force. After the pulling force received by the lock beam 220 is removed, the lock bolt 20 unlocks the cam 30, and the cam 30 is driven to be rotated to the second position under the action of the elastic force accumulated by the energy storage member 40, as to achieve the unlocking.

[0062] In the embodiment, the base 10 is a housing structure, and the lock bolt 20, the cam 30, the energy storage member 40, the driving device 50 and the one-way locking mechanism 60 are all arranged in the housing. One end of the lock bolt 20 may be protruded from one side of the base 10.

[0063] A resetting member 70 which is configured to enable the lock bolt 20 to be protruded from one side of the base 10 is arranged between the lock bolt 20 and the base 10. Exemplarily, the resetting member 70 is a spring.

[0064] As shown in Fig. 6, while an end portion of the lock bolt 20 abuts against the outer peripheral wall of the lock beam 220, the resetting member 70 is in a compressed state; and as shown in Fig. 7, while the lock beam 220 is pulled so that the lock beam gap 2201 is

aligned with the lock bolt 20, the lock bolt 20 extends and is inserted into the lock beam gap 2201 under the action of the resetting member 70.

[0065] Further, the lock cylinder 100 further includes a controller, and the controller is configured to control the driving device 50 to drive the cam 30 to rotate from the first position to the second position through the energy storage member 40 according to an unlocking signal, and delay-control the driving device 50 to drive the cam 30 to rotate from the second position to the first position through the energy storage member 40.

[0066] The controller has a function of controlling the driving device 50 to operate so as to achieve the unlocking and delay-controlling the driving device 50 to re-operate so as to achieve the locking. While a user sends an unlocking signal through a terminal, after the controller receives the unlocking signal, the controller may control the driving device 50 to operate according to the unlocking signal, and finally the cam 30 is rotated from the first position to the second position, and the lock bolt 20 may be retracted, as to achieve the unlocking. After a preset time, the controller may control the driving device 50 to re-operate, and finally the cam 30 is rotated from the second position to the first position, and the cam 30 may prevent the lock bolt 20 from retracting, as to achieve delay locking. Certainly, it may be that the cam 30 is rotated clockwise during the unlocking process, and the cam 30 is rotated counterclockwise during the locking process; and it may also be that the cam 30 is rotated clockwise for a certain angle during the unlocking process, and the cam 30 is rotated clockwise again for a certain angle during the locking process.

[0067] The controller is arranged in the base 10, and the controller may be a single-chip microcomputer, a Programmable Logic Controller (PLC) and the like. The controller and the terminal may achieve signal transmission through a Bluetooth. In use, the user may firstly connect the terminal (a mobile phone, a tablet computer and the like) to the lock cylinder 100 through the Bluetooth. After the Bluetooth connection is successful, the user may send the unlocking signal to the controller through the terminal.

[0068] In the embodiment, the automatic locking is achieved by a delay mode, and the delay time of the delay locking may be set according to specific conditions, and may be 5 seconds, 10 seconds, 20 seconds and the like. In other embodiments, the locking may also be achieved in other modes. For example, the controller controls the driving device 50 to operate to unlock according to the unlocking signal. While the locking is required, the user sends a locking signal to the controller through the terminal, and the controller controls the driving device 50 to operate and lock according to the locking signal. For another example, the position of the lock beam 220 is detected by a sensor, and a control module controls the driving device 50 to operate to lock according to an in-position signal detected by the sensor.

[0069] In the embodiment, the lock cylinder 100 locks

or unlocks the lock beam 220 through the movement of the lock bolt 20, and there may be one or more lock bolts 20. Exemplarily, there are two lock bolts 20, and the two lock bolts 20 are arranged oppositely on two sides of the cam 30. The two lock bolts 20 may lock the lock beam 220 on both sides, so the locking ability to the lock beam 220 after the lock cylinder 100 is locked is improved. Certainly, in the case that there is one lock bolt 20, the lock cylinder 100 may only lock the lock beam 220 on one side.

[0070] As shown in Fig. 2, the outer peripheral wall of the cam 30 includes two oppositely arranged convex arc surfaces 31 and two oppositely arranged concave arc surfaces 32. As shown in Fig. 4, while the cam 30 is located in the second position, each lock bolt 20 is aligned with one concave arc surface 32, the two lock bolts 20 may be retracted after being subjected to the axial force, and the two lock bolts 20 may unlock the lock beam 220; and as shown in Fig. 5, while the cam 30 is located in the first position, each lock bolt 20 abuts on one convex arc surface 31, the two convex arc surfaces 31 of the cam 30 respectively prevent the two lock bolts 20 from retracting, and the two lock bolts 20 both lock the lock beam 220.

[0071] In the embodiment, while the cam 30 is located in the first position, the cam 30 may reach the second position after being rotated by 90 degrees.

[0072] As shown in Fig. 6, in the unlocked state (the cam 30 is located in the second position), while the lock bolt 20 locks the cam 30 due to abutting against the outer peripheral wall of the lock beam 220, the lock bolt 20 is inserted into a concave groove defined by the concave arc surfaces 32 of cam 30, thereby the rotation of the cam 30 is restricted.

[0073] In the embodiment, as shown in Figs. 8 and 9, the driving device 50 includes a dial plate 51, a grooved wheel 52 and a driving member 53 (unshown in Fig. 9). Both the dial plate 51 and the grooved wheel 52 are rotatably arranged in the base 10, and the dial plate 51, the grooved wheel 52 and the base 10 constitute a grooved wheel mechanism. The driving member 53 is configured to drive the dial plate 51 to rotate relative to the base 10, and the energy storage member 40 is connected between the grooved wheel 52 and the cam 30.

[0074] The dial plate 51, the grooved wheel 52 and the base 10 constitute the grooved wheel mechanism, and this mechanism is an irreversible transmission mechanism, namely the dial plate 51 may drive the grooved wheel 52 to rotate, but the grooved wheel 52 may not drive the dial plate 51 to rotate. After the elastic force is accumulated by the energy storage member 40, because the grooved wheel 52 may not drive the dial plate 51 to rotate, the elastic force accumulated by the energy storage member 40 may only drive the cam 30 to rotate, but may not drive the grooved wheel 52 to rotate.

[0075] Exemplarily, the driving member 53 is a motor fixed in the base 10, the motor is electrically connected to the control module, and the control module is configured to control the rotation of the motor according to the

unlocking signal to achieve the unlocking, and delay-control the rotation of the motor to achieve the locking.

[0076] It should be noted that the motor may directly drive the dial plate 51 to rotate, or indirectly drive the dial plate 51 to rotate through the transmission mechanism. Exemplarily, as shown in Fig. 8, the motor is connected to the dial plate 51 by a gear transmission mechanism. The gear transmission mechanism includes a small gear 54 and a large gear 55. The small gear 54 is fixed to an output shaft of the motor, the large gear 55 is fixed to the dial plate 51, and the small gear 54 is meshed with the gear. While the motor is operated, the small gear 54 drives the large gear 55 to rotate, so that the dial plate 51 drives the grooved wheel 52 to rotate. The gear transmission mechanism between the motor and the dial plate 51 may play a decelerating effect.

[0077] Since the energy storage member 40 is connected between the grooved wheel 52 and the cam 30, while the cam 30 is locked and may not be rotated, the motor may still drive the dial plate 51 and the grooved wheel 52 to rotate, so that the elastic force may be accumulated by the energy storage member 40, the motor is avoided from blocking because the cam 30 may not be rotated, it may play a role in overload protection for the motor.

[0078] In other embodiments, the driving device 50 may also be other structures. For example, the driving device 50 includes a worm wheel, a worm, and a motor. Both the worm wheel and the worm are rotatably arranged in the base 10, the worm wheel is meshed with the worm, the cam 30 is fixed to the worm wheel, and an output shaft of the motor is connected with the worm. The motor is operated to drive the worm to rotate, the worm drives the worm wheel to rotate, and the cam 30 may be rotated together with the worm wheel. In the driving device 50, the worm may drive the worm wheel to rotate, but the worm wheel may not drive the worm to rotate.

[0079] In the embodiment, the energy storage member 40 is a torsion spring, and the energy storage is achieved by the torsion spring, the structure is simple, and it is easy to implement.

[0080] Continuing to refer to Fig. 9, an axial end of the cam 30 is provided with a first convex post 33 and a convex shaft 34 coaxial with the cam 30, and an axial end of the grooved wheel 52 is provided with a second convex post 521, the torsion spring is sheathed on an outer side of the convex shaft 34, one free end of the torsion spring is hung on the first convex post 33, and the other free end of the torsion spring is hung on the second convex post 521. The relative rotation between the cam 30 and the grooved wheel 52 may make the torsion spring accumulate the elastic force.

[0081] In other embodiments, the energy storage member 40 may also be other structures. For example, the energy storage member 40 is an elastic rope, two ends of the elastic rope are fixed on the grooved wheel 52, the elastic rope is wound on the convex shaft 34 of

the cam 30, and the grooved wheel 52 is rotated relative to the cam 30 so that the elastic rope is gradually tightened on the convex shaft 34, and the elastic force may be accumulated by the elastic rope.

[0082] As shown in Fig. 4 (the locking member 61 is located in the fourth position in Fig. 4) and Fig. 6 (the locking member 61 is located in the third position in Fig. 6), the one-way locking mechanism 60 includes a locking member 61 movably arranged on the base 10. The locking member 61 has the third position and the fourth position. The retraction of the lock bolt 20 may drive the locking member 61 to move from the fourth position to the third position, so that the lock bolt 20 locks the cam 30 located in the second position.

[0083] As shown in Fig. 7 (the locking member 61 is located in the fourth position in Fig. 7), while the lock bolt 20 extends and unlocks the cam 30 located in the second position, the elastic force accumulated by the energy storage member 40 may drive the cam 30 to rotate, so that the cam 30 may prevent the locking member 61 from moving from the fourth position to the third position, so that the locking member 61 restricts the retraction of the lock bolt 20.

[0084] The locking member 61 may be moved between the third position and the fourth position, and the position of the locking member 61 may be changed by the movement of the lock bolt 20. After the lock bolt 20 unlocks the cam 30 located in the second position, the cam 30 may be rotated under the action of the elastic force accumulated by the energy storage member 40, so that the cam 30 prevents the locking member 61 from moving from the fourth position to the third position, the locking member 61 may not be returned to the third position in which the cam 30 located in the second position may be locked, and finally the locking member 61 restricts the retraction of the lock bolt 20. The retraction of the lock bolt 20 is restricted by a mode of preventing the movement of the locking member 61 through the cam 30, and the structure is simple.

[0085] Further, the one-way locking mechanism 60 further includes an elastic member 62, and the elastic member 62 is configured to drive the locking member 61 to move from the third position to the fourth position in a process that the lock bolt 20 extends and unlocks the cam 30 located in the second position.

[0086] The elastic member 62 plays a role in resetting the locking member 61. In the process that the lock bolt 20 extends and unlocks the cam 30 located in the second position, the locking member 61 may be moved from the third position to the fourth position under the action of the elastic member 62. Exemplarily, the elastic member 62 is a spring.

[0087] Optionally, the locking member 61 is movably arranged on the base 10. The position of the locking member 61 is changed by a mode of moving, and the mode of changing the position of the locking member 61 is simple.

[0088] In the embodiment, a moving direction of the

locking member 61 is perpendicular to a moving direction of the lock bolt 20. In this structure, while the locking member 61 is blocked by the cam 30 and may not be moved, the locking member 61 may play an effective blocking effect on the lock bolt 20. In other embodiments, the moving direction of the locking member 61 and the moving direction of the lock bolt 20 may also form an acute angle or an obtuse angle.

[0089] In addition, the cam 30 is provided with an inserting groove 35 into which the locking member 61 is inserted. While the cam 30 is located in the second position and the locking member 61 is located in the third position, the locking member 61 is inserted into the inserting groove 35; and while the cam 30 is located in the second position and the locking member 61 is located in the fourth position, the locking member 61 exits from the inserting groove 35. Herein, the inserting groove 35 is provided on the convex arc surface 31 of the cam 30.

[0090] While the lock bolt 20 locks the cam 30 located in the second position, the locking member 61 is inserted into the inserting groove 35. At this time, the locking member 61 may also play a role in preventing the cam 30 from rotating. In the process that the lock bolt 20 extends and unlocks the cam 30 located in the second position, the locking member 61 may be moved to the fourth position. At this time, the cam 30 is located in the second position and the locking member 61 is located in the fourth position, and the locking member 61 is located outside the inserting groove 35. The unlocked cam 30 may be rotated under the action of the elastic force accumulated by the energy storage member 40, so that the locking member 61 is staggered with the inserting groove 35, and the locking member 61 may not be inserted into the inserting groove 35. It means that the locking member 61 may not be returned from the fourth position to the third position. After the locking member 61 abuts on the outer peripheral wall of the cam 30, the lock bolt 20 may be restricted from retracting backwards.

[0091] Optionally, the lock bolt 20 is fixedly provided with a blocking portion 21, and the blocking portion 21 is configured to abut against the locking member 61 while the lock bolt 20 is retracted and drive the locking member 61 to move from the fourth position to the third position.

[0092] The blocking portion 21 on the lock bolt 20 plays a role in transmitting a force. While the lock bolt 20 is retracted, the driving force may be transmitted to the locking member 61 through the blocking portion 21, so that the locking member 61 is moved from the fourth position to the third position. In the case that the cam 30 prevents the locking member 61 from moving from the fourth position to the third position, because the blocking portion 21 abuts against the locking member 61, the blocking portion 21 may not be retracted, thereby the purpose of restricting the lock bolt 20 from retracting is achieved.

[0093] In addition, the blocking portion 21 has a guiding inclined surface 211 for driving the locking member 61 to move. This structure enables the locking member 61 to be more easily driven to move in a process that the

blocking portion 21 is retracted with the lock bolt 20.

[0094] Exemplarily, the blocking portion 21 is an L-shaped structure, one end of the blocking portion 21 is fixedly connected to the lock bolt 20, and the guiding inclined surface 211 is arranged on the other end of the blocking portion 21.

[0095] In the embodiment, the power of the lock bolt 20 is indirectly transmitted to the locking member 61 through the blocking portion 21. In other embodiments, the power of the lock bolt 20 may be directly transmitted to the locking member 61, so that the locking member 61 is moved. As shown in Fig. 10 (the locking member is located in the fourth position in Fig. 10) and Fig. 11 (the locking member is located in the third position in Fig. 11), the locking member 61 is approximately in an L-shaped structure, the locking member 61 is provided with a protrusion 611, the lock bolt 20 is provided with a guiding chute 22, and the protrusion 611 is locked in the guiding chute 22. The lock bolt 20 is retracted to drive the locking member 61 to move from the fourth position to the third position (the locking member 61 is inserted in the inserting groove 35), so that the lock bolt 20 locks the cam 30 located in the second position (the lock bolt 20 is inserted in the concave groove defined by the concave arc surfaces 32 of the cam 30). While the lock bolt 20 extends and unlocks the cam 30 located in the second position (the lock bolt 20 exits from the concave groove defined by the concave arc surfaces 32 of the cam 30, and the locking member 61 exits from the inserting groove 35 on the cam 30), the elastic force accumulated by the energy storage member 40 may drive the cam 30 to rotate, the rotation of the cam 30 causes the inserting groove 35 on the cam 30 to be staggered with the locking member 61, the cam 30 plays a role in preventing the locking member 61 from moving from the fourth position to the third position, and the locking member 61 may restrict the retraction of the lock bolt 20. In an extending process of the lock bolt 20, the lock bolt 20 may drive the locking member 61 to reset. Therefore, on the basis of this structure, the elastic member 62 may not be arranged between the locking member 61 and the base 10.

[0096] It should be noted that in other embodiments, the position of the locking member 61 may also be changed in other modes. For example, as shown in Fig. 12 (in Fig. 12, the locking member 61 is located in the fourth position) and Fig. 13 (the locking member 61 is located in the third position in Fig. 13), the locking member 61 is rotatably arranged on the base 10, namely the switching of the locking member 61 between the third position and the fourth position is achieved by a mode of rotating. The locking member 61 is an L-shaped hook-shaped member as a whole, and the elastic member 62 is arranged between the locking member 61 and the base 10. The lock bolt 20 is retracted to drive the locking member 61 to move from the fourth position to the third position (the locking member 61 is inserted in one concave groove defined by the concave arc surface 32 of the cam 30), so that the lock bolt 20 may lock the cam 30 located in

the second position (the lock bolt 20 is inserted in the other concave groove defined by the concave arc surface 32 of the cam 30). While the lock bolt 20 extends and unlocks the cam 30 located in the second position (both the lock bolt 20 and the locking member 61 exit from the corresponding concave grooves), the elastic force accumulated by the energy storage member 40 may drive the cam 30 to rotate, the rotation of the cam 30 causes the concave groove defined by the concave arc surface 32 on the cam 30 to be staggered with the locking member 61, the cam 30 plays a role in preventing the locking member 61 from rotating from the fourth position to the third position, and the locking member 61 may restrict the retraction of the lock bolt 20.

[0097] Further, continuing to refer to Fig. 1, the lock cylinder 100 further includes a mechanical lock cylinder 80, and a lock core 81 of the mechanical lock cylinder 80 is drivingly connected with the cam 30.

[0098] Exemplarily, the lock core 81 of the mechanical lock cylinder 80 is drivingly connected with the cam 30 through a transmission mechanism. The transmission mechanism includes a gear and an incomplete gear. The gear is fixed to the cam 30, the incomplete gear is fixed to the lock core 81, and the gear is meshed with the incomplete gear. While a mechanical key is inserted into a lock hole 2101 in the lock core 81, the lock core 81 may be rotated by rotating the key, and the rotation of the lock core 81 drives the incomplete gear to rotate, so that the cam 30 is rotated with the gear meshed with the incomplete gear, as to achieve manual unlocking or locking.

[0099] In addition, as shown in Fig. 14, an embodiment of the present invention further provides a lock 200, including a lock body 210, a lock beam 220, and the lock cylinder 100 provided in the above embodiments. The lock cylinder 100 is installed in the lock body 210, and the lock bolt 20 is configured to lock the lock beam 220 and the lock body 210 tightly.

[0100] In the embodiment, the lock 200 is a U-shaped lock, the lock beam 220 is a U-shaped structure, and the lock body 210 is provided with two lock holes 2101 into which the lock beam 220 is inserted. After the lock beam 220 is inserted into the two lock holes 2101 on the lock body 210, if the lock bolt 20 locks the lock beam 220 (the lock bolt 20 is inserted in the lock beam gap 2201 of the lock beam 220, and the cam 30 is located in the first position), the lock beam 220 may not be pulled out; and if the lock cylinder 100 unlocks the lock beam 220 (the cam 30 is located in the second position), the lock beam 220 may be pulled out from the lock hole 2101. In other embodiments, the lock 200 may also be a lock of other structure forms, such as a padlock.

[0101] The above are only preferred embodiments of the present invention, and are not configured to limit the present invention. For those skilled in the art, the present invention may have various modifications and changes. Any modifications, equivalent replacements, improvements and the like made within the spirit and principle of the present invention shall be included in a scope of pro-

tection of the present invention.

Claims

1. A lock cylinder, comprising:

a base;
a lock bolt, wherein the lock bolt is movably provided on the base;
a cam, wherein the cam is rotatably provided on the base, and the cam has a first position in which the lock bolt is prevented from retracting and a second position in which the lock bolt is allowed to retract;
an energy storage member;
a driving device, wherein the energy storage member is connected between the driving device and the cam, while the lock bolt locks the cam, the driving device operates to cause the energy storage member to store an elastic force, and while the lock bolt unlocks the cam, the elastic force can drive the cam to rotate; and
a one-way locking mechanism, configured to restrict retraction of the lock bolt after the lock bolt extends and unlocks the cam located in the second position.

2. The lock cylinder as claimed in claim 1, wherein the one-way locking mechanism comprises a locking member movably arranged on the base;

the locking member has a third position and a fourth position;
the retraction of the lock bolt can drive the locking member to move from the fourth position to the third position, so that the lock bolt can lock the cam located in the second position; and
while the lock bolt extends and unlocks the cam located in the second position, the elastic force can drive the cam to rotate, so that the cam can prevent the locking member from moving from the fourth position to the third position, thus the locking member restricts the retraction of the lock bolt.

3. The lock cylinder as claimed in claim 2, wherein the one-way locking mechanism further comprises an elastic member; and the elastic member is configured to drive the locking member to move from the third position to the fourth position in a process that the lock bolt extends and unlocks the cam located in the second position.

4. The lock cylinder as claimed in claim 2, wherein the locking member is movably arranged on the base.

5. The lock cylinder as claimed in claim 4, wherein a

moving direction of the locking member is perpendicular to a moving direction of the lock bolt.

6. The lock cylinder as claimed in claim 4, wherein an inserting groove into which the locking member is inserted is arranged on the cam;

while the cam is located in the second position and the locking member is located in the third position, the locking member is inserted in the inserting groove; and
while the cam is located in the second position and the locking member is located in the fourth position, the locking member exits from the inserting groove.

7. The lock cylinder as claimed in any one of claims 4-6, wherein a blocking portion is fixedly arranged on the lock bolt; and the blocking portion is configured to abut against the locking member while the lock bolt is retracted and drive the locking member to move from the fourth position to the third position.

8. The lock cylinder as claimed in claim 7, wherein the blocking portion has a guiding inclined surface for driving the locking member to move.

9. The lock cylinder as claimed in any one of claims 4-6, wherein a guiding chute is arranged on the lock bolt, a protrusion is arranged on the locking member, and the protrusion is locked in the guiding chute; and the retraction of the lock bolt can drive the locking member to move from the fourth position to the third position.

10. The lock cylinder as claimed in claim 2, wherein the locking member is rotatably arranged on the base.

11. The lock cylinder as claimed in claim 1, wherein the lock cylinder further comprises a controller; and the controller is configured to control the driving device to drive the cam to rotate from the first position to the second position through the energy storage member according to an unlocking signal, and delay-control the driving device to drive the cam to rotate from the second position to the first position through the energy storage member.

12. A lock, comprising a lock body, a lock beam, and the lock cylinder as claimed in any one of claims 1-11; and the lock cylinder is installed in the lock body, and the lock bolt is configured to lock the lock beam and the lock body tightly.

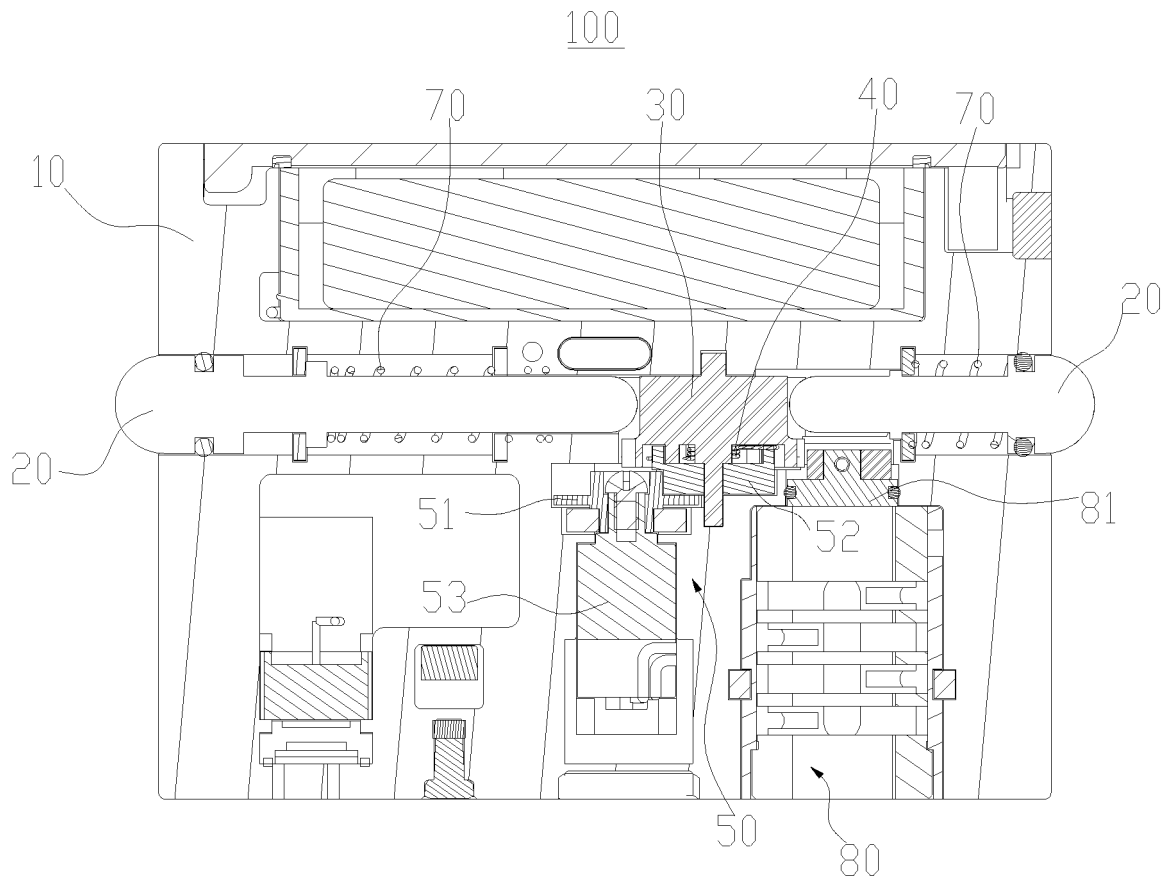


Fig. 1

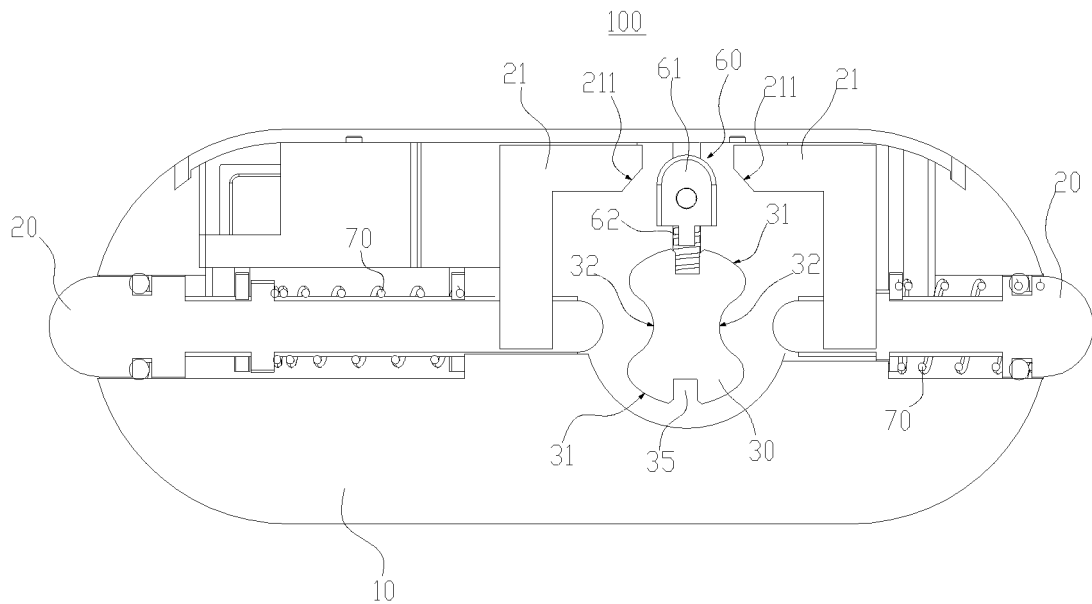


Fig. 2

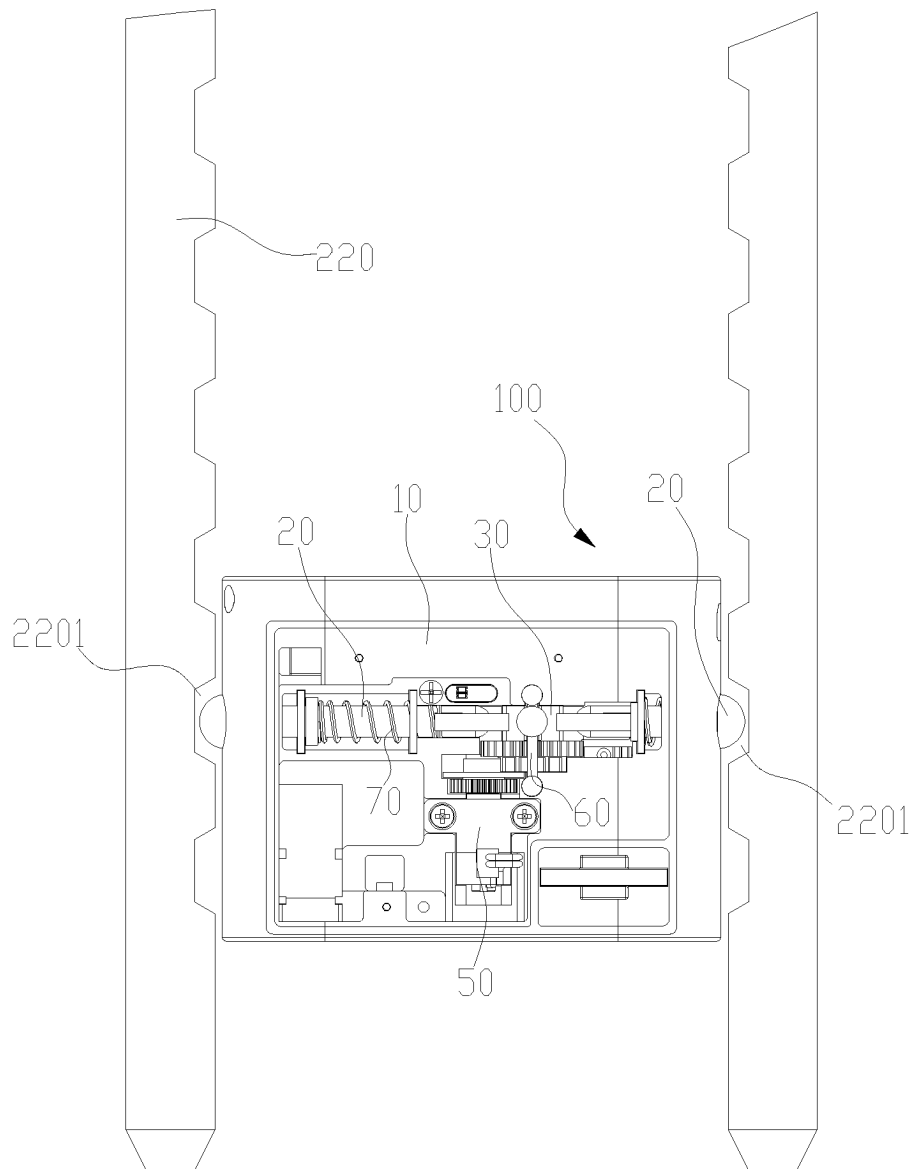


Fig. 3

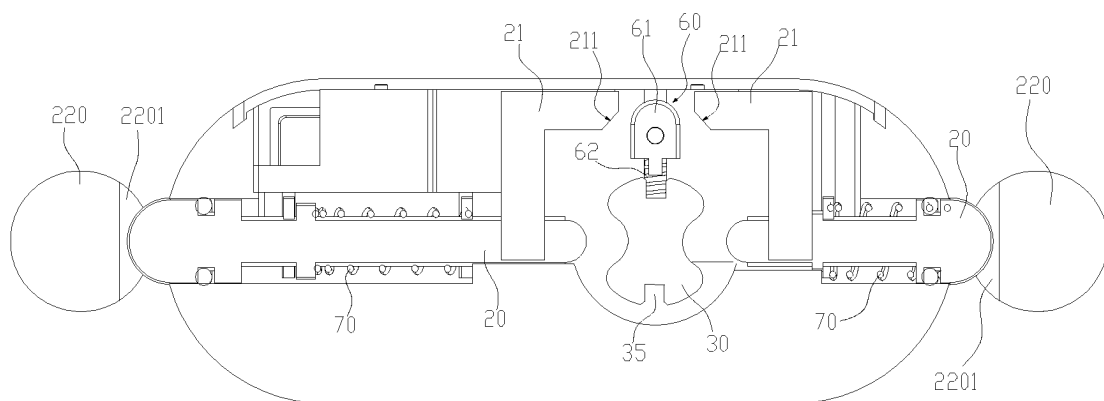


Fig. 4

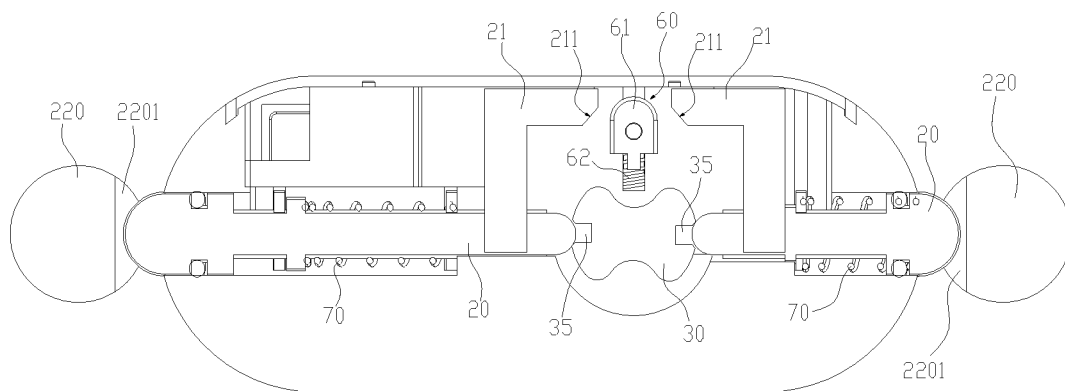


Fig. 5

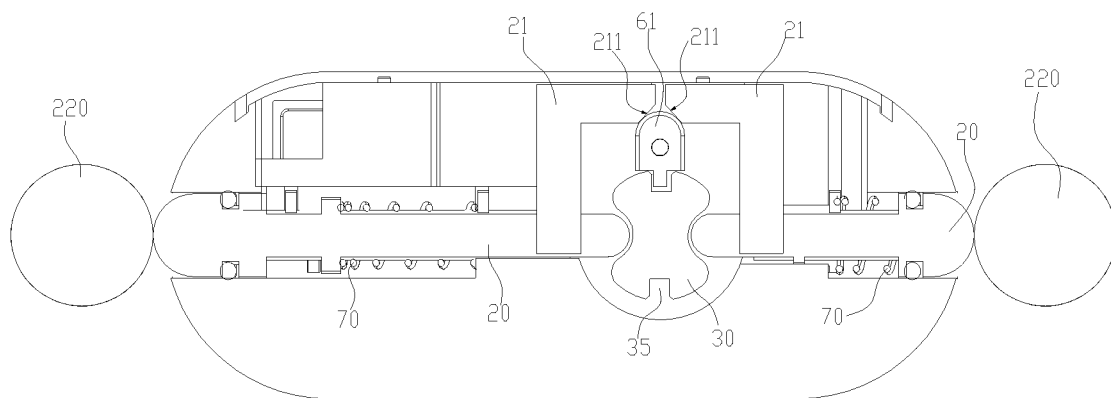


Fig. 6

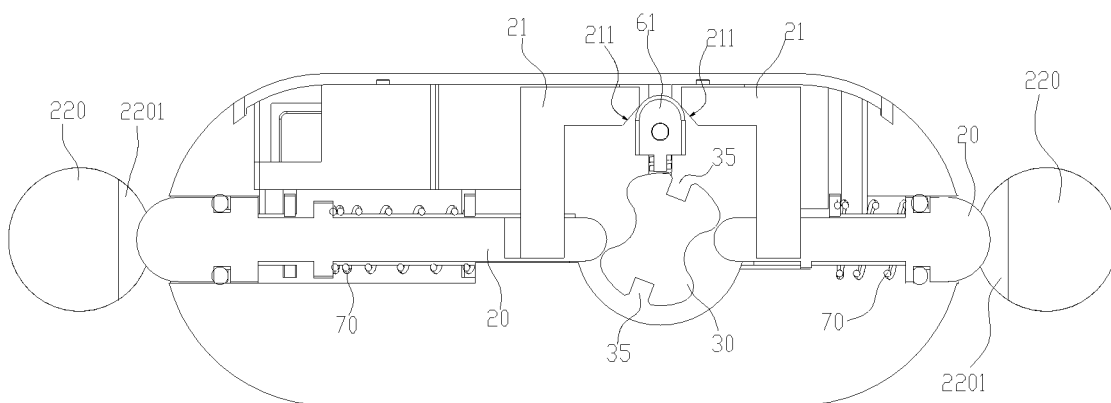


Fig. 7

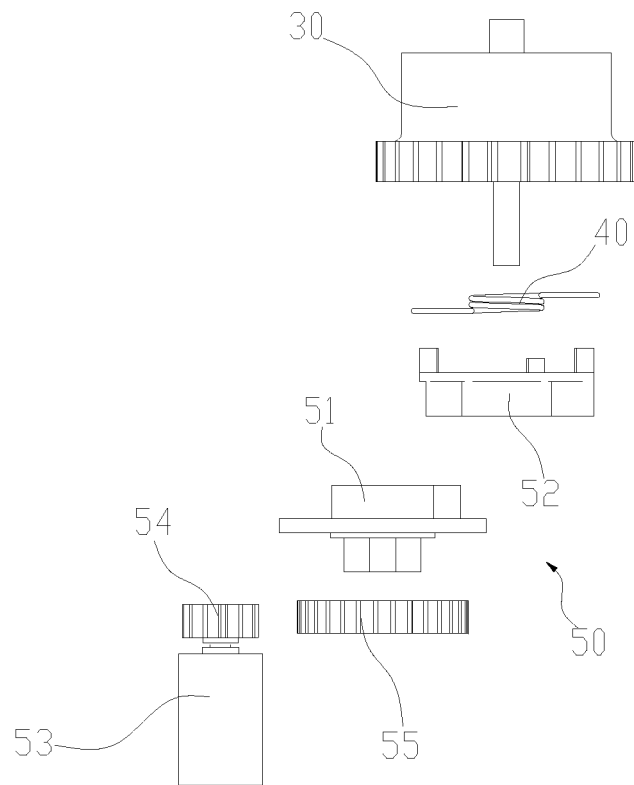


Fig. 8

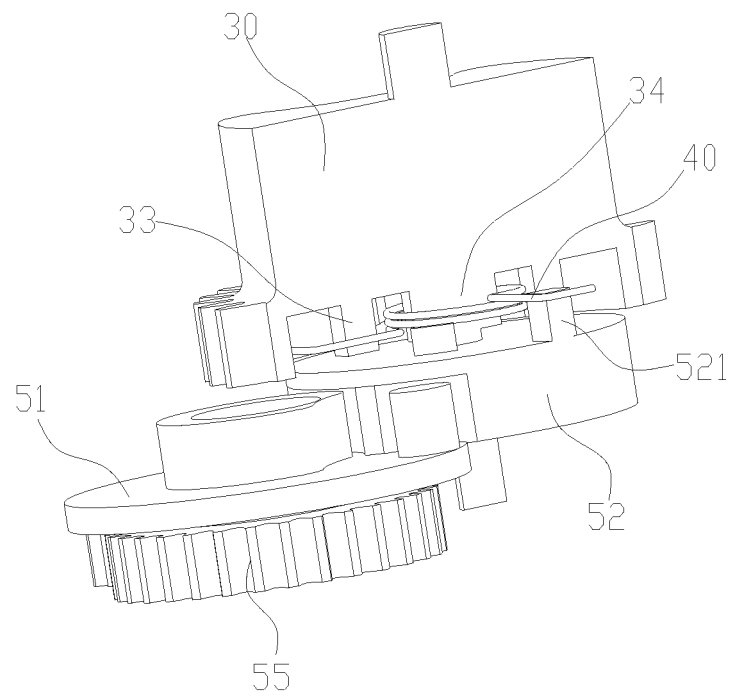


Fig. 9

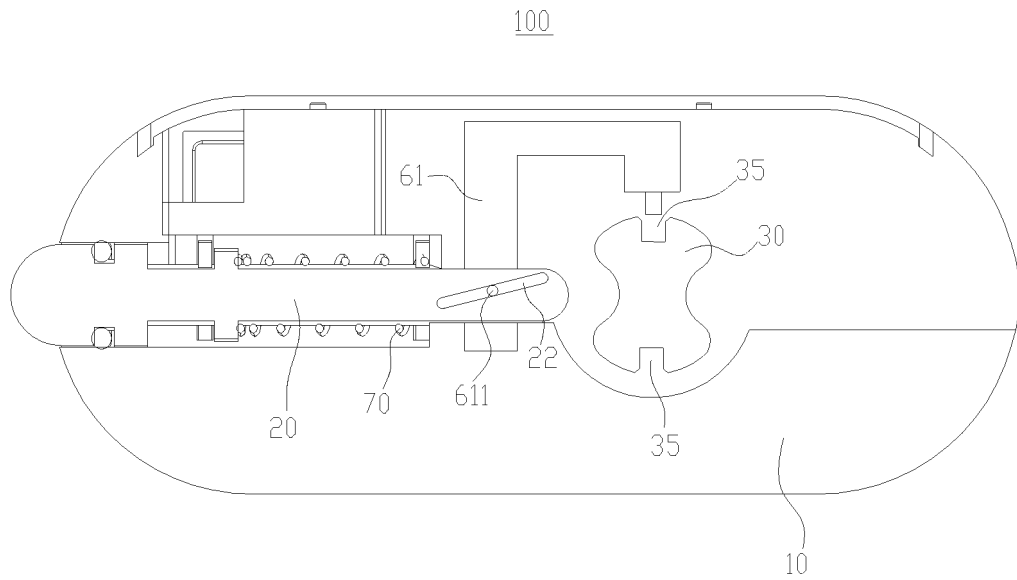


Fig. 10

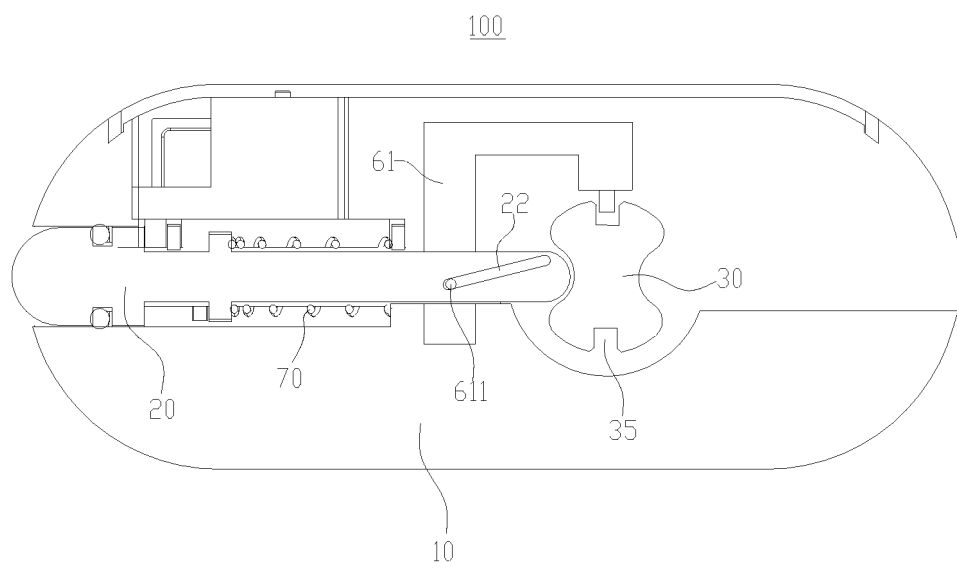


Fig. 11

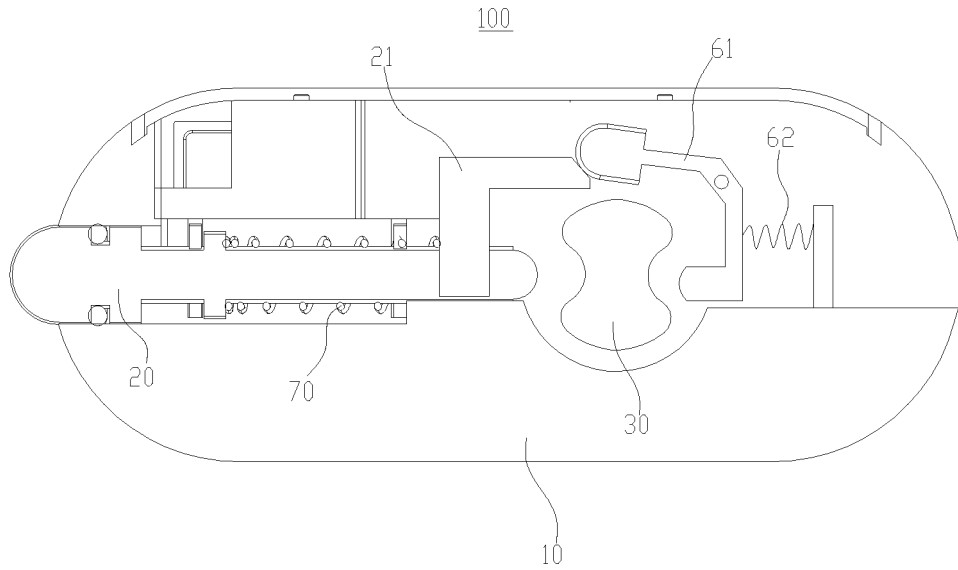


Fig. 12

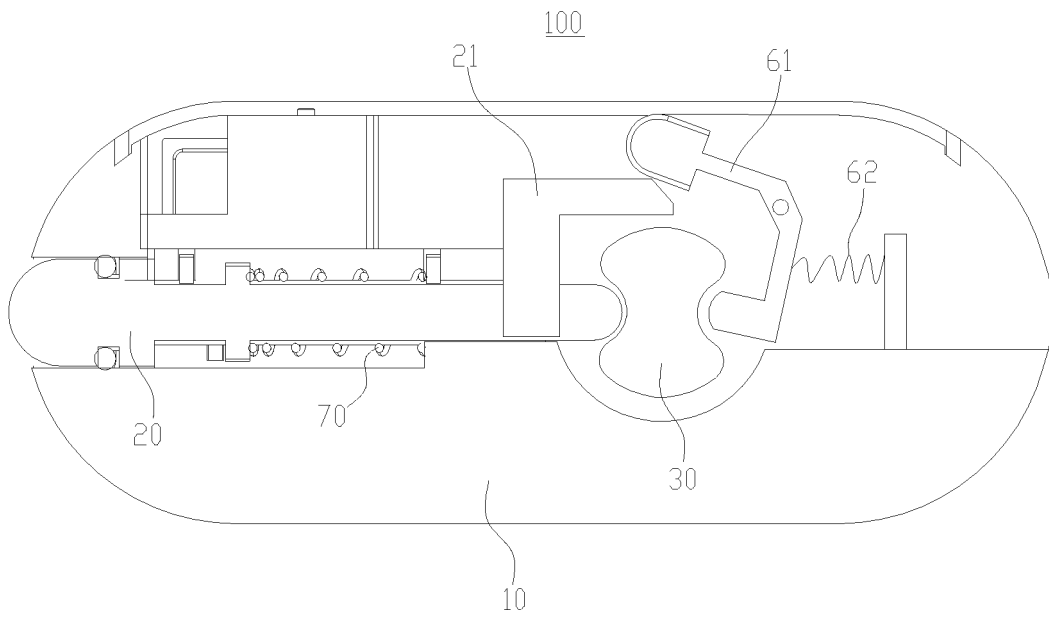


Fig. 13

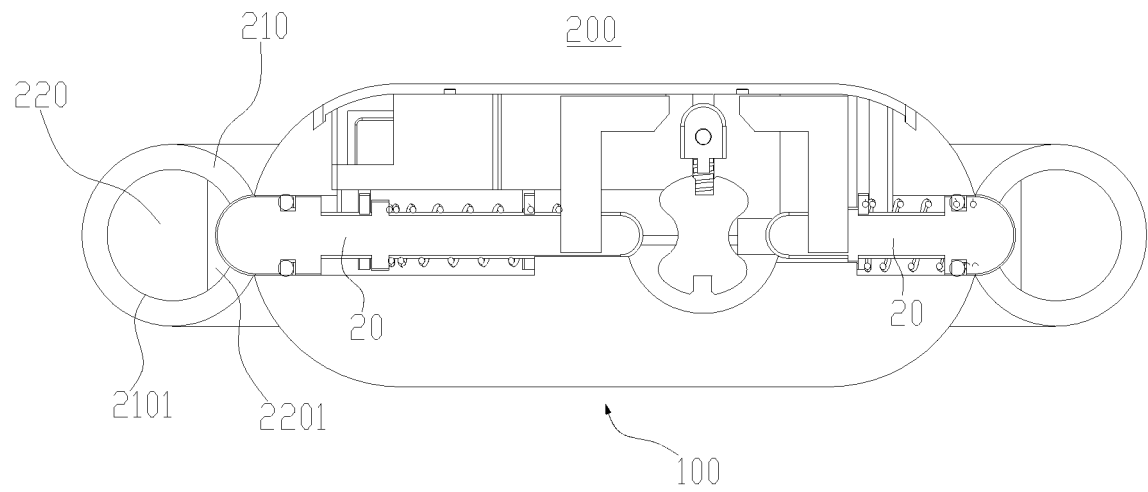


Fig. 14

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2020/106847

A. CLASSIFICATION OF SUBJECT MATTER

E05B 63/14(2006.01)i; E05B 47/00(2006.01)i; E05B 15/00(2006.01)i; E05B 15/10(2006.01)i; E05B 67/22(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

E05B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CNABS, CNTXT, VEN, CNKI: 锁, 凸轮, 偏心轮, 储能, 弹簧, 扭簧, 位置, 回退, 阻止, lock, cam, eccentric, wheel, gear, stored, energy, spring, torsional, position, backing, prevent+, stop

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 111305659 A (ZHUHAI UNILINK TECHNOLOGY CO., LTD.) 19 June 2020 (2020-06-19) claims 1-12	1-12
A	CN 1443912 A (MASTER LOCK CO.) 24 September 2003 (2003-09-24) description, specific embodiments, and figures 1-6	1-12
A	CN 110821298 A (ZHUHAI UNILINK TECHNOLOGY CO., LTD.) 21 February 2020 (2020-02-21) entire document	1-12
A	CN 208996582 U (MASTER LOCK CO.) 18 June 2019 (2019-06-18) entire document	1-12
A	CN 106567626 A (ABUS AUGUST BREMICKER SOHNE KG.) 19 April 2017 (2017-04-19) entire document	1-12
A	CN 100504013 C (ABUS (HONG KONG) LIMITED et al.) 24 June 2009 (2009-06-24) entire document	1-12
A	GB 2421540 A (ASSA ABLOY LTD.) 28 June 2006 (2006-06-28) entire document	1-12

☒ Further documents are listed in the continuation of Box C.
☒ See patent family annex.

* Special categories of cited documents:

“A” document defining the general state of the art which is not considered to be of particular relevance

“E” earlier application or patent but published on or after the international filing date

“L” document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

“O” document referring to an oral disclosure, use, exhibition or other means

“P” document published prior to the international filing date but later than the priority date claimed

“T” later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

“X” document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

“Y” document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

“&” document member of the same patent family

Date of the actual completion of the international search

12 November 2020

Date of mailing of the international search report

26 November 2020

Name and mailing address of the ISA/CN

China National Intellectual Property Administration (ISA/
CN)
No. 6, Xitucheng Road, Jimenqiao, Haidian District, Beijing
100088
China

Authorized officer

Facsimile No. (86-10)62019451

Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2020/106847

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2013158716 A1 (MASTER LOCK CO.) 24 October 2013 (2013-10-24) entire document	1-12

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/CN2020/106847

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
CN 111305659 A	19 June 2020	None	
CN 1443912 A	24 September 2003	US 2003159479 A1	28 August 2003
CN 110821298 A	21 February 2020	None	
CN 208996582 U	18 June 2019	CA 3008424 A1	23 December 2018
		US 2018371802 A1	27 December 2018
		US 10221592 B2	05 March 2019
CN 106567626 A	19 April 2017	US 2017101808 A1	13 April 2017
		AU 2016244176 A1	27 April 2017
		CN 106567626 B	16 June 2020
		EP 3153648 B1	29 April 2020
		DE 102015117253 A1	13 April 2017
		US 10267066 B2	23 April 2019
		EP 3153648 A1	12 April 2017
		BR 102016023509 A2	25 April 2017
CN 100504013 C	24 June 2009	AU 2005201727 B2	24 February 2011
		AU 2011201675 A1	12 May 2011
		CN 1690337 A	02 November 2005
		AU 2005201727 A1	10 November 2005
		AU 2011201675 B2	28 November 2013
		US 2005235709 A1	27 October 2005
		US 7278283 B2	09 October 2007
GB 2421540 A	28 June 2006	GB 2421540 B	11 March 2009
		GB 0428239 D0	26 January 2005
WO 2013158716 A1	24 October 2013	US 2013276487 A1	24 October 2013
		CA 2870705 C	21 March 2017
		AU 2013249409 A1	04 December 2014
		CA 2870705 A1	24 October 2013
		AU 2013249409 B2	31 August 2017
		US 8806905 B2	19 August 2014

Form PCT/ISA/210 (patent family annex) (January 2015)