**Smart Lock**

**Field**

1. The subject matter described herein relates to a lock, and more particularly relates to a smart lock.

**Background**

1. Different from a traditional lock, a smart lock is more intelligent in user recognition, security, and manageability. The smart lock is an execution unit for door locking in a gate access system. In cases of replacing an original mechanical lock, a majority of smart locks require whole-piece replacement as well as re-drilling of bores in a door. With only the cylinder replaced, the lock would not support unlocking by password, fingerprint, or card swiping. Even if a cylinder-replaced lock supports unlocking by password, fingerprint, or card swiping, the new cylinder cannot retain the original mechanical unlocking feature, a consequence of which is that many users would worry about unlocking failure in case of broken cylinder, because the lock does not support keyed unlocking anymore. In addition, the smart lock is prone to power interruption, and the electric elements are also easily broken. Smart locks have a high faulty rate; once broken, the entire set of lock needs to be replaced, which induces a high cost. Such a smart lock has been developed, which comprises a lock body and a rear panel portion, the rear panel portion being disposed at a right end of the lock body, the rear panel portion comprising a smart kit and a handle, the smart kit comprising an outer case, in the outer case being arranged an inner case, the inner case being partitioned into a smart compartment and a battery compartment, the smart compartment being disposed at an upper end of the inner case and comprising a control mechanism and a transmission mechanism, the lock body comprising a handle structure, an exterior lock housing, and an interior lock housing. Despite being divided into the lock body and the rear panel portion, that existing smart lock still fails to address a convenient replacement manner, which is not user friendly.

**Summary**

1. A smart lock is described herein, which overcomes a drawback that it is inconvenient to replace respective parts of a conventional smart lock, so that a user can quickly assembly and dismantle a lock body and a smart control box.
2. Embodiments of the disclosure provide a technical solution *infra*: a smart lock comprises a lock body and a smart control box, the lock body comprising an interior cylinder core, a thumb turn, and an exterior cylinder core, a transmission clutch assembly being provided at an inner end of the interior cylinder core, the thumb turn being connected to an outer end of the interior cylinder core and driven to turn by the interior cylinder core, an inner end of the exterior cylinder core being connected to the interior cylinder core, an outer end of the exterior cylinder core being provided with a first mechanical unlocking assembly, the smart control box comprising a control circuit board, an electric actuator, and a second mechanical unlocking assembly, the control circuit board controlling the electric actuator to operate to actuate the transmission clutch assembly so that the first mechanical unlocking assembly is in transmitting connection with the thumb turn via the interior cylinder core and the transmission clutch assembly and the second mechanical unlocking assembly maintains transmitting connection with the thumb turn via the transmission clutch assembly, wherein the smart control box is formed with an accommodation groove in which the transmission clutch assembly moves, a fitting base is further provided at the inner end of the interior cylinder core, the fitting base being disposed at an outer end side of the transmission clutch assembly, and the lock body and the smart control box are detachably connected via rotatable snap-fitting between the fitting base and the smart control box.
3. With the technical solution *supra*, the disclosure offers the following benefits: the lock body according to the disclosure is adapted to the original bolt assembly of the old mechanical lock to replace, resulting in more convenient replacement and upgrade with a lower upgrade cost. The rotatable fitting between the fitting base and the smart control box achieves detachable connection between the lock body and the smart control box, allowing for convenient and quick assembly between the lock body and the smart control box. As such, after purchasing the smart lock, the user may easily replace the old lock body, which improves user experience. In subsequent use, if the smart control box is broken, the user may just dismantle the smart control box; if the lock body is broken, the lock body may be removed subsequent to removal of the smart control box. Hence, the lock body and the smart control box may be separately replaced, eliminating a need to replace the whole smart lock, thereby reducing the maintenance cost. Considering that the lock body is not rotatable after being installed in the bores of the door and fitted with the bolt assembly, the detachable connection between the lock body and the smart control box may be achieved by rotatable snap-fitting between the fitting base with the smart control box. To dismantle the smart lock, the smart control box should be rotated first; by installing the smart control box to the inner side of the door, it may effectively prevent one from first destroying the lock body from the outside of the door and then dismantling the lock body from the smart control box, thereby enhancing security.
4. Furthermore, a connecting convex rib is provided on an outer peripheral surface of the fitting base, an opening portion of the accommodation groove is adapted to the outer peripheral surface of the fitting base, and a rotating slot for mounting the connecting convex rib is provided at an inner wall of the opening portion of the accommodation groove, the rotating slot opening towards the fitting base. With this technical solution, since the connecting convex rib is disposed at the outer peripheral surface of the fitting base, when the fitting base is connected to the smart control box, at least a portion of the fitting base projects into the opening portion of the accommodation groove for fitting with the latter. The lock body is connected to the smart control box only via the fitting base, i.e., the smart control box is suspended to the inner end of the lock body; therefore, the fitting manner of at least a portion of the fitting base projecting into the opening portion of the accommodation groove may improve connection firmness between the smart control box and the fitting base. The fitting base may seal the opening portion of the accommodation groove, which serves as a protection to the transmission clutch assembly, effectively preventing dusts and winged insects from entering the accommodation groove.
5. Furthermore, a lockup member, which is operable to lock up the smart control box after the connecting convex rib and the rotating slot are fitted in place, is provided between the fitting base and the smart control box. With this technical solution, accidental rotation of the smart control box causing disengagement from the fitting base may be prevented.
6. Furthermore, a mounting hole for mounting the lockup member and a cover plate for preventing the lockup member from escaping out of the mounting hole are provided on an outer peripheral surface of the fitting base, an outer surface of the cover plate being in flush with the outer peripheral surface of the fitting base; the cover plate is provided with a through hole for the lockup member to pass through; the lockup member maintains a tendency of projecting out of the through hole; and a locking hole for the lockup member to project into for fitting purpose is formed at the inner wall of the opening portion of the accommodation groove. With this technical solution, fitting between the fitting base and the opening portion of the accommodation groove is not affected.
7. Furthermore, a locking hole is formed on an outer peripheral surface of the fitting base, the lockup member is provided at the smart control box and falls into the locking hole after the connecting convex rib and the rotating slot are fitted in place, and the lockup member comprises a ferromagnet or magnet and is operable to move out of the locking hole when being subjected to a magnetic force. With this technical solution, automatic lockup is realized under the gravitational force of the lockup member, whereby the structure is simplified.
8. Furthermore, a battery compartment is provided at a bottom of the smart control box, a mounting through-hole for the interior cylinder core to pass through is formed at the fitting base, the outer peripheral surface of the fitting base being downwardly eccentric relative to the mounting through-hole; and a locating step for supporting and locating the fitting base is provided at an inner wall of the accommodation groove, an outer edge of the locating step being downwardly eccentric relative to an inner edge thereof. With this technical solution, by disposing the battery compartment at the bottom of the smart control box, on one hand, the battery compartment is not interfered with by the second mechanical unlocking assembly, whereby battery replacement is facilitated, and on the other hand, the gravitational center of the smart control box may be lowered. In the latter case, since the fitting base is disposed at the outer end side of the transmission clutch assembly, to further enhance structural stability of the assembled smart control box with the fitting base, disposing the battery compartment at the bottom of the smart control box achieves an effect that the gravitational center of the smart control box is lower than the fitting base. After the connecting convex rib and the rotating slot are fitted in place, the locating step and the fitting base are pressed tightly against each other under the gravitational force of the smart control box; therefore, by providing a wider locating step to support the smart control box, the stability of the assembled smart control box may be further enhanced, which does not shake easily.
9. Furthermore, a mating slot is formed on an outer end surface of the fitting base, the inner end of the interior cylinder core being securely insertion-fitted into the mating slot. With this technical solution, pre-locating is realized by locating the inner end of the interior cylinder core into the mating slot, which facilitates secure assembly between the interior cylinder core and the fitting base.
10. Furthermore, the interior cylinder core comprises an internal locking lever and an internal locking sleeve, an outer end of the internal locking lever being in transmitting connection with the exterior cylinder core, the internal locking sleeve being sleeved at an outer periphery of the internal locking lever, an outer end of the internal locking sleeve being connected to the thumb turn and co-rotating with the latter; the transmission clutch assembly comprises a clutch transmission wheel, a slipping collar, and a shift fork, the clutch transmission wheel being axially located at an inner end of the internal locking lever and co-rotating with the latter, the slipping collar being in sliding connection with an inner end of the internal locking sleeve and being peripherally limited by the latter, the slipping collar maintaining transmitting connection with the second mechanical unlocking assembly and under action of the second mechanical unlocking assembly, maintaining separated from the clutch transmission wheel; the shift fork comprises a driven end, a connecting portion, and a fork body, the driven end being connected to the electric actuator, the connecting portion being rotatably connected to the fitting base, and the fork body extending till an outer end side of the slipping collar; and a notch for avoiding the driven end is formed at the inner wall of the accommodation wall. With this technical solution, the notch design may ease mounting of the smart control box.
11. Furthermore, the electric actuator comprises an electric motor and a transmission member, the electric motor being electrically connected to the control circuit board, the transmission member being secured on an output shaft of the electric motor, the transmission member projecting into the notch so as to be in transmitting connection with the driven end. This technical solution contributes a stable, reliable transmission and a simple, low-cost structure.
12. Furthermore, the exterior cylinder core comprises an exterior lock housing and an external locking lever axially located in the exterior lock housing, an inner end of the external locking lever projecting into the internal locking sleeve so as to be connected to and co-rotate with the outer end of the internal locking lever, an outer end of the external locking lever projecting out of the exterior lock housing for a user to turn.

**Brief Description of the Drawings**

1. Hereinafter, the disclosure will be further described with reference to the accompanying drawings:
2. Fig. 1 is a schematic diagram of a smart lock according to the disclosure;
3. Fig. 2 is a schematic diagram of a smart lock according to the disclosure (illustrating a first presentation of the inside of the smart control box);
4. Fig. 3 is a first schematic diagram of a smart control box according to the disclosure;
5. Fig. 4 is a second schematic diagram of a smart control box according to the disclosure;
6. Fig. 5 is a first schematic diagram of a fitting base according to the disclosure;
7. Fig. 6 is a second schematic diagram of the fitting base according to the disclosure;
8. Fig. 7 is a third schematic diagram of the fitting base according to the disclosure;
9. Fig. 8 is a schematic diagram of a smart lock according to the disclosure (illustrating a second presentation of the inside of a smart control box);
10. Fig. 9 is a sectional view of a smart lock according to the disclosure (illustrating fitting between a clutch transmission wheel and a slipping collar);
11. Fig. 10 is an enlarged view of part I of Fig. 9;
12. Fig. 11 is a third schematic diagram of a smart control box according to the disclosure;
13. Fig. 12 is a schematic diagram illustrating the lock body connected to a transmission clutch assembly and a second mechanical unlocking assembly according to the disclosure;
14. Fig. 13 is a schematic diagram of direction B-B in Fig. 12;
15. Fig. 14 is a schematic diagram of direction A-A in Fig. 12;
16. Fig. 15 is a sectional view of a smart lock according to the disclosure (illustrating disengagement of the clutch transmission wheel from the slipping collar).

**Detailed Description of Embodiments**

1. To make the objectives, technical solutions, and advantages of the embodiments of the disclosure more apparent, the technical solutions in the embodiments of the disclosure will be described in a clear and comprehensive manner with reference to the accompanying drawings; it is apparent that the example embodiments described herein are only part of the embodiments of the disclosure, not all of them.
2. The terms such as “first,” “second,” “third,” and “fourth” (if existent) referred to in the specification and claim of the disclosure are used for distinguishing like objects, not necessarily used for describing a specific sequence or priority. Even if a technical feature is referred to with “second,” it does not necessary indicate that there surely exists a “first” such feature. It is understood that the data modified with such terms may be replaceable with each other in appropriate circumstances so that the embodiments of the disclosure as described herein may also be implemented in sequences aside from those illustrated or described herein.
3. It will be understood that the terms “comprise” and “have,” as well as any of their variants, intend for a non-exclusive inclusion. For example, a process, method, system, product, or apparatus comprising a series of steps or units is not limited to the steps or units listed, but may comprise other steps or units which are not explicitly listed or which are inherent in the process, method, product, or apparatus.
4. It will be understood that in the disclosure, the term “plurality” refers to two or more. The term “and/or” only describes an association relationship of associated objects, which indicates that there may exist three relationships, e.g., X and/or Y may indicate three circumstances: X individually, or both X and Y together, or Y individually. The character “/” generally indicates a relationship of “or” between the former and latter associated objects. The term “comprising X, Y, and Z” or “comprising X, Y, Z” refers to comprising all of X, Y, and Z; the term “comprising X, Y, or Z” refers to comprising one of X, Y, and Z; the term “comprising X, Y and/or Z” refers to comply any one, or any two, or three of X, Y, and Z.
5. Hereinafter, the technical solution of the disclosure will be described in detail through specific implementations. The specific implementations described infra may be combined or replaced with each other dependent on actual circumstances, and same or similar concepts or processes may be omitted in some implementations.
6. Figs. 1 to 4 illustrates a smart lock according to the disclosure, comprising a lock body 100 and a smart control box 200. The lock body 100 comprises an interior cylinder core 11, a thumb turn 12, and an exterior cylinder core 13. A transmission clutch assembly 101 is provided at an inner end of the interior cylinder core 11. The thumb turn 12 is connected to an outer end of the interior cylinder core 11 and driven to turn by the interior cylinder core 11. An inner end of the exterior cylinder core 13 being connected to the interior cylinder core 11, and an outer end of the exterior cylinder core 13 is provided with a first mechanical unlocking assembly 102. The smart control box 200 comprises a control circuit board 21, an electric actuator 201, and a second mechanical unlocking assembly 202. The control circuit board 21 controls the electric actuator 201 to operate to actuate the transmission clutch assembly 101, so that the first mechanical unlocking assembly 102 is in transmitting connection with the thumb turn 12 via the interior cylinder core 11 and the transmission clutch assembly 101, and the second mechanical unlocking assembly 202 maintains transmitting connection with the thumb turn 12 via the transmission clutch assembly 101. The smart control box 200 is formed with an accommodation groove 29 in which the transmission clutch assembly 101 moves. The inner end of the interior cylinder core 11 is further provided with a fitting base 18, the fitting base 18 being disposed at an outer end side of the transmission clutch assembly 101. The fitting base 18 is rotatably snap-fit to the smart control box 200, which implements detachable connection between the lock body 100 and the smart control box 200. It is noted that the inner and outer orientations referred to therein are determined based on the inner side and the outer side of a door to which the smart lock has been installed, e.g., the inner end of the interior cylinder core 11 is located at the inner side of the door, and the outer end of the interior cylinder core 110 is located closer to the outer side of door than the inner end; correspondingly, the outer end of the exterior cylinder core 13 is located at the outer side of the door; the inner and outer orientations may also refer to Fig. 2, where the left refer to the inner, and the right refers to the outer.
7. The lock body 100 according to the disclosure is adapted to the original bolt assembly of the old mechanical lock to replace, resulting in more convenient replacement and upgrade with a lower upgrade cost. The rotatable fitting between the fitting base 18 and the smart control box 200 achieves detachable connection between the lock body 100 and the smart control box 200, allowing for convenient and quick assembly between the lock body 100 and the smart control box 200. As such, after purchasing the smart lock, the user may easily replace the old lock body, which improves user experience. In subsequent use, if the smart control box 200 is broken, the user may just dismantle the smart control box 200; if the lock body 100 is broken, the lock body 100 may be removed subsequent to removal of the smart control box 200. Hence, the lock body 100 and the smart control box 200 may be separately replaced, eliminating a need to replace the whole smart lock, thereby reducing the maintenance cost. Considering that the lock body 100 is not rotatable after being installed in the bores of the door and fitted with the bolt assembly, the detachable connection between the lock body 100 and the smart control box 200 may be achieved by rotatable snap-fitting between the fitting base 18 with the smart control box 200. To dismantle the smart lock, the smart control box 200 should be rotated first; by installing the smart control box 200 to the inner side of the door, it may effectively prevent one from first destroying the lock body 100 from the outside of the door and then dismantling the lock body 100 from the smart control box 200, thereby enhancing security.
8. The second mechanical unlocking assembly 202 maintains transmitting connection with the thumb turn 12 via the transmission clutch assembly 101, which ensures that the user may unlock freely from the inner side of the door, while the first mechanical unlocking assembly 102 disposed at the outer side of the door requires that the control circuit board 21 receive an unlocking signal to control the electric actuator 201 to actuate the transmission clutch assembly 101, whereby the first mechanical unlocking assembly 102 performs unlocking from the outer side of the door by virtue of the transmitting connection to the thumb turn 12 via the interior cylinder core 11 and the transmission clutch assembly 101; without the unlocking signal, the transmission clutch assembly 101 would disconnect the first mechanical unlocking assembly 102 from the thumb turn 12, so that even if the first mechanical unlocking assembly 102 is turned from the outer side of the door, the thumb turn 12 cannot be driven to rotate.
9. Referring to Figs. 3 to 6, to realize rotational snap-fitting, in an implementation, a connecting convex rib 181 is provided on an outer peripheral surface of the fitting base 18. An opening portion of the accommodation groove 29 is adapted to the outer peripheral surface of the fitting base 18, an inner wall of the opening portion of the accommodation groove 29 being provided with a rotating slot 291 for mounting the connecting convex rib 181, the rotating slot 291 opening towards the fitting base 18. Since the connecting convex rib 181 is disposed at the outer peripheral surface of the fitting base 18, when the fitting base 18 is connected to the smart control box 200, at least a portion of the fitting base 18 projects into the opening portion of the accommodation groove 29 for fitting with the latter. The lock body 100 is connected to the smart control box 200 only via the fitting base 18, i.e., the smart control box 200 is suspended to the inner end of the lock body 100; therefore, the fitting manner of at least a portion of the fitting base 18 projecting into the opening portion of the accommodation groove 29 may improve connection secureness between the smart control box 200 and the fitting base 18. The fitting base 18 may seal the opening portion of the accommodation groove 29, which serves as a protection to the transmission clutch assembly 101, effectively preventing dusts and winged insects from entering the accommodation groove 29.
10. It is understood that, after the smart control box 200 is assembled with the fitting base 18, the assembled state needs to be maintained in daily use; therefore, it is necessary to prevent accidental rotation of the smart control box 200 causing disengagement from the fitting base 18. In an implementation, a check protrusion may be provided for the connecting convex rib 181, while a check recess is provided in the rotating slot 291, so that the check protrusion and the check recess are fitted to prevent accidental rotation of the smart control box 200; this scheme increases dismantling difficulty and likely causes wear and failure after repeated dismantling. Therefore, in another implementation, a lockup member 112, which is operable to lock up the smart control box 200 after the connecting convex rib 181 and the rotating slot 291 are fitted in place, may be provided between the fitting base 18 and the smart control box 200.
11. Specifically, a mounting hole 182 for mounting the lockup member 112 and a cover plate 183 for preventing the lockup member 112 from escaping out of the mounting hole 182 may be provided on the outer peripheral surface of the fitting base 18. As illustrated in Figs. 5 to 10, an outer surface of the cover plate 183 is in flush with the outer peripheral surface of the fitting base 18 so as not to affect fitting between the fitting base 18 and the opening portion of the accommodation groove 29; the cover plate 183 is provided with a through hole 184 for the lockup member 112 to pass through; the lockup member 112 maintains a tendency of projecting out of the through hole 184 for example via a compression spring 187; a locking hole 292 for the lockup member 112 to project into for fitting purpose is formed at the inner wall of the opening portion of the accommodation groove 29. After the connecting convex rib 181 and the rotating slot 291 are fitted in place, the lockup member 112 projects into the locking hole 292 to fit with the latter, thereby locking up the smart control box 200. To dismantle the smart control box 200, it is needed to eject the lockup member 112 out of the locking hole 292; therefore, an ejecting pin may be arranged, which is inserted into the locking hole 292 from the outer side of the smart control box 200 to eject the lockup member 112 out of the locking hole 292. Since the lockup member 112 is disposed on the outer peripheral surface of the fitting base 18, the locking hole 292 may be distributed at the outer peripheral side of the fitting base 18 to facilitate user operation, which, for example, may be formed on the top, or the left side surface, or the right side surface of the smart control box 200. To enhance wearability, a metallic sleeve 295 may be provided for the smart control box 200, the locking hole 202 extending through the metallic sleeve 295, the lockup member 112 being inserted in the metallic sleeve so as to fit with the latter.
12. In addition to disposing the lockup member 112 at the fitting base 18 and ejecting the lockup member 112 out of the locking hole 292 with the ejector pin, in another implementation, the locking hole 292 may be formed on the outer peripheral surface of the fitting base 18, while the lockup member 112 is provided at the smart control box 200, so that the lockup member 112 falls into the locking hole 292 after the connecting convex rib 181 and the rotating slot 291 are fitted in place. The lockup member 112 comprises a ferromagnet or magnet and is operable to move out of the locking hole 292 by magnetic force, e.g., a magnetic needle is arranged to draw the lockup member 112 out of the locking hole 292. The lockup member 112 may fall into the locking hole 292 under its own gravity, so that it is required to dispose the lockup member 112 directly above the fitting base 18. The lockup member 112 may also fall into the locking hole 292 by an elastic force of a spring, so that the lockup member 112 may be distributed at the outer periphery of the fitting base 18, e.g., disposed on top of, or on the left side surface of, or on the right side surface of the smart control box 200, so long as the magnetic force applied by the magnetic needle to the lockup member 112 is greater than the elastic force of the spring.
13. To power the control circuit board 21 and the electric actuator 201, a battery compartment 22 may be provided for the smart control box 200; without a special requirement, the battery compartment 22 may be disposed on top of, in the middle of, or at the bottom of the smart control box 200. Since the second mechanical unlocking assembly 202 is generally disposed at a same height as the lock body 100, in an implementation, the battery compartment 22 is disposed at the bottom of the smart control box 200; on one hand, the battery compartment 22 as such arranged is not interfered with by the second mechanical unlocking assembly 202, whereby battery replacement is facilitated, and on the other hand, the gravitational center of the smart control box 200 may be lowered. In the latter case, since the fitting base 18 is disposed at the outer end side of the transmission clutch assembly 101, to assemble the transmission clutch assembly 101 with the interior cylinder core 11, a mounting through-hole 185 for the interior cylinder core 11 to pass through may be formed at the fitting base 18. Considering that the smart control box 200 is suspended to the inner end of the lock body 100, in order to further enhance structural stability after the smart control box 200 is assembled with the fitting base 18, disposing the battery compartment 22 at the bottom of the smart control box 200 achieves an effect that the gravitational center of the smart control box 200 is lower than the fitting base 18. It may be designed such that the outer peripheral surface of the fitting base 18 is downwardly eccentric relative to the mounting through-hole 185, and a locating step 293 for supporting and locating the fitting base 18 is provided at the inner wall of the accommodation groove 29, the outer edge of the locating step 293 being downwardly eccentric relative to the inner edge thereof, as illustrated in Figs. 3, 4, and 11. After the connecting convex rib 181 and the rotating slot 291 are fitted in place, the locating step 293 and the fitting base 18 are pressed tightly against each other under the gravitational force of the smart control box 200; therefore, by providing a wider locating step 293 at the bottom of the inner wall of the accommodation groove 29 to support the smart control box 200, stability of the assembled smart control box 200 may be further enhanced, which does not shake easily.
14. To facilitate assembly and connection between the fitting base 18 and the interior cylinder core 11, a mating slot 186 may be provided on the outer end surface of the fitting base 18, as illustrated in Figs. 6 and 7; the inner end of the interior cylinder core 11 is inserted in the mating slot 186 for secure connection. Pre-locating is realized by locating the inner end of the interior cylinder core 11 into the mating slot 186, which facilitates subsequent secure connection between the interior cylinder core 11 and the fitting base 18 via a screw 188.
15. Figs. 9 and 11 illustrate an example structure of the lock body 100. The interior cylinder core 11 comprises an internal locking lever 113 and an internal locking sleeve 114. An outer end of the internal locking lever 113 is in transmitting connection with the exterior cylinder core 13, the internal locking sleeve 114 is sleeved at the outer periphery of the internal locking lever 113, and an outer end of the internal locking sleeve 114 is connected to the thumb turn 12 and co-rotate with the latter. The transmission clutch assembly 101 comprises a clutch transmission wheel 14, a slipping collar 15, and a shift fork 16. The clutch transmission wheel 14 is axially located at the inner end of the internal locking lever 113 and co-rotates with the latter. The slipping collar 15 is in sliding connection with the inner end of the internal locking sleeve 114 and is peripherally limited by the latter, i.e., the slipping collar 15 is axially slidable along the internal locking sleeve 114 and maintains synchronous rotation with the internal locking sleeve 114. The slipping collar 15 maintains transmitting connection with the second mechanical unlocking assembly 202 and under the action of the second mechanical unlocking assembly 202, maintains separated from the clutch transmission wheel 14. The shift fork 16 comprises a driven end 161, a connecting portion 162, and a fork body 163, the driven end 161 being connected to the electric actuator 201, the connecting portion 162 being rotatably connected to the fitting base 18, the fork body 163 extending till the outer end side of the slipping collar 15. The inner wall of the accommodation groove 29 is provided with a notch 294 for avoiding the driven end 161. The electric actuator 201 drives the driven end 161 so that the fork body 163 abuts against the slipping collar 15, allowing for fitting between the slipping collar 15 and the clutch transmission wheel 14 for transmission purpose, whereby the internal locking lever 113 may drive, sequentially via the clutch transmission wheel 14, the slipping collar 15, and the internal locking sleeve 114, the thumb turn 12 to enable unlocking. To enable engagement and disengagement between the slipping collar 15 and the clutch transmission wheel 14, a plug pin 151 is provided for the slipping collar 15, and a socket 141 is provided on an end surface of the clutch transmission wheel 14, so that when the slipping collar 15 is engaged with the clutch transmission wheel 14, the plug pin 151 is insert-fitted in the socket 141, as illustrated in Fig. 9. As the clutch transmission wheel 14 rotates, the slipping collar 15 is driven to rotate; the first mechanical unlocking assembly 102 may drive, sequentially via the exterior cylinder core 13, the internal locking lever 113, the clutch transmission wheel 14, the slipping collar 15, and the internal locking sleeve 114, the thumb turn 12 to enable unlocking. When the slipping collar 15 is disengaged from the clutch transmission wheel 14, as illustrated in Fig. 15, the plug pin 151 departs from the socket 141, in which case the clutch transmission wheel 14 cannot transmit a torque to the slipping collar 15, so that the internal locking lever 113 cannot drive the internal locking sleeve 114 to move; hence, unlocking is disabled, and the first mechanical unlocking assembly 102 only rotates idly. Since the user cannot spot the condition of the interior cylinder core 11 when installing the smart control box 200, design of the notch 294 may ease installation of the smart control box 200. The interior cylinder core 11 generally further comprises an interior lock housing 115, the interior lock housing 115 housing the internal locking lever 113 and the internal locking sleeve 114, the internal locking sleeve 114 being axially located in the interior lock housing 115, the internal locking lever 113 being axially located in the internal locking sleeve 114.
16. After unlocking is completed, locking may be performed by existing manners such as delayed electric locking, elastic reset locking, or manually mechanical locking. To realize locking, the clutch transmission wheel 14 employs a rachet, and meanwhile an elastic ejector pin 152 is provided on the slipping collar 15, as illustrated in Figs. 9, 13, and 15. The elastic ejector pin 152 always acts upon teeth 142 of the rachet irrespective of whether the slipping collar 15 and the clutch transmission wheel 14 are engaged or disengaged. For example, viewed inwardly from the outer side of the door, counterclockwise turning of the thumb turn 12 results in unlocking, while clockwise turning results in locking. If the teeth 142 of the rachet 142 extend and protrude in a clockwise direction, as illustrated in Fig. 13, clockwise rotation of the clutch transmission wheel 14 drives the elastic ejector pin 152 to abut against the teeth 142 of the rachet, thereby bringing the slipping collar 15 to rotate clockwise, which further drives the thumb turn 12 to rotate clockwise, thereby realizing locking. When the clutch transmission wheel 14 rotates counterclockwise, the elastic ejector pin 152 would repeatedly misses the teeth 142 of the rachet, unable to drive the slipping collar 15 to rotate; now, the first mechanical unlocking assembly 102 can only rotate idly, and the thumb turn 12 would not rotate. In addition, the door may be opened to the left or right; to be adapted to the two door opening manners, the rachet may be flipped in use; for example, the rachet may be adjusted such that the teeth 142 of the rachet extend and protrude in a counterclockwise direction. Adjustment of the rachet depends upon an actual installation environment.
17. To drive the shift fork 16 to swing, the electric actuator 201 may comprise an electric motor 23 and a transmission member 24; as illustrated in Fig. 9, the electric motor 23 is electrically connected to the control circuit board 21, the transmission member 24 is secured on an output shaft of the electric motor 23, and the transmission member 24 extends into the notch 294 to be thereby in transmitting connection with the driven end 161. In an implementation, the transmission member 24 is a cam with a transmitting recessed groove 241, the driven end 161 projects into the transmitting recessed groove 241, and the cam is driven by the electric motor 23 to rotate, driving the driven end 161 to move, whereby the fork body 163 is moved, further causing the slipping collar 15 to move relative to the internal locking sleeve 114 to thereby engage with the clutch transmission wheel 14 in a transmission manner. The transmission member 24 may adopt the rotating cam disclosed in CN218759296U.
18. Referring to Figs. 9 and 12, in an implementation, the second mechanical unlocking assembly 202 comprises an interior handle 25, an inner coupling shaft 26, and an inner drive wheel 27, the interior handle 25 being mounted to an inner end of the inner coupling shaft 26, an outer end of the inner coupling shaft 26 projecting into the accommodation groove 29, the inner drive wheel 27 being disposed in the accommodation groove 29 and mounted to the outer end of the inner coupling shaft 26, the inner drive wheel 27 being in transmitting connection with the slipping collar 15. The inner drive wheel 27 and the slipping collar 15 may be fitted via a cogging structure to realize transmission. To maintain transmitting connection between the inner drive wheel 27 and the slipping collar 15 without affecting clutching operation of the transmission clutch assembly 101, the inner drive wheel 27 may be arranged in sliding connection to an outer end of the inner coupling shaft 26 so as to be peripherally limited thereby, i.e., the inner drive wheel 27 is arranged slidable axially along the inner coupling shaft 26 while maintaining co-rotation with the inner coupling shaft 26; meanwhile, a keeper spring 28 is disposed between the inner drive wheel 27 and the smart control box 200. The elastic force of the keeper spring 28 keeps the inner drive wheel 27 in connecting transmission with the slipping collar 15, so that when it is needed to engage the slipping collar 15, the electric actuator 201 may overcome the elastic force of the keeper spring 28 to push the slipping collar 15 to move. The inner coupling shaft 26 may also abut against the clutch transmission wheel 14 to axially limit the latter.
19. In an implementation, the lock body 100 is a keyless structure, i.e., the user can only unlock the first mechanical unlocking assembly 102 from the outside of the door by a smart control lit controlling the electric actuator 201 to operate. As illustrated in Fig. 9, the exterior cylinder core 13 comprises an exterior lock housing 131 and an external locking lever 132 axially located in the exterior lock housing 131, an inner end of the external locking lever 132 projecting into the internal locking sleeve 114 so as to be connected to and co-rotate with the outer end of the internal locking lever 113, an outer end of the external locking lever 132 projecting out of the exterior lock housing 131 for the user to turn, the external locking lever 132 being axially located in the exterior lock housing 131. In another implementation, the lock body 100 may also adopt a keyhole structure, e.g., the exterior cylinder core 13 comprises a key cylinder-locking lever structure as disclosed in CN210622523. The inner end of the external locking lever 132 and the outer end of the internal locking lever 113 may be connected via a flat-side shaft structure to transmit a torque, as illustrated in Fig. 14. The exterior lock housing 131 and the interior lock housing 115 are securely connected and may simultaneously axially locate the thumb turn 12.
20. In an implementation, the first mechanical unlocking assembly 102 comprises an exterior handle 17, the exterior handle 17 being sleeved at the outer end of the external locking lever 132. The exterior handle 17 is detachably secured with the external locking lever 132, which facilitates the user to turn the external locking lever 132. The manner of locking up the exterior handle 17 to the external locking lever 132 may refer to the structure of the lockup member 112 as described *supra*, which may be unlocked via an ejector pin or a magnetic needle. It may be understood that, it is also feasible to directly form the exterior handle 17 from the outer end of the external locking lever 132 for the user to operate. In another implementation, if the exterior cylinder core 13 comprises the key cylinder-locking lever structure disclosed in CN210622523U, the first mechanical unlocking assembly 102 may also adopt the exterior handle with a keyway as disclosed in CN210622523U.
21. The control circuit board 21 may receive an unlocking signal from a smart terminal via a wireless communication module, and also may receive an unlocking signal via a conventional manner such as a fingerprint recognition module, a password entry module, or an NFC module, whereby unlocking by a phone, unlocking by a fingerprint, unlocking by a password, or unlocking by card swiping may be realized.
22. The unlocking and locking referred to herein are all implemented by the thumb turn 12 driving the bolt assembly.
23. What have been described above are only example embodiments of the disclosure; however, the protection scope of the disclosure is not limited thereto. A person skilled in the art should understand that the disclosure includes, but is not limited to, the contents described in the drawings and the embodiments. Any modifications without departing from the functions and structural principles of the disclosure will be included within the scope of the claims.

**I/We Claim:**

1. A smart lock, comprising a lock body and a smart control box, the lock body comprising an interior cylinder core, a thumb turn, and an exterior cylinder core, a transmission clutch assembly being provided at an inner end of the interior cylinder core, the thumb turn being connected to an outer end of the interior cylinder core and driven to turn by the interior cylinder core, an inner end of the exterior cylinder core being connected to the interior cylinder core, an outer end of the exterior cylinder core being provided with a first mechanical unlocking assembly, the smart control box comprising a control circuit board, an electric actuator, and a second mechanical unlocking assembly, the control circuit board controlling the electric actuator to operate to actuate the transmission clutch assembly so that the first mechanical unlocking assembly is in transmitting connection with the thumb turn via the interior cylinder core and the transmission clutch assembly and the second mechanical unlocking assembly maintains transmitting connection with the thumb turn via the transmission clutch assembly, wherein the smart control box is formed with an accommodation groove in which the transmission clutch assembly moves, a fitting base is further provided at the inner end of the interior cylinder core, the fitting base being disposed at an outer end side of the transmission clutch assembly, and the lock body and the smart control box are detachably connected via rotatable snap-fitting between the fitting base and the smart control box.

2. The smart lock of claim 1, wherein a connecting convex rib is provided on an outer peripheral surface of the fitting base, an opening portion of the accommodation groove is adapted to the outer peripheral surface of the fitting base, and a rotating slot for mounting the connecting convex rib is provided at an inner wall of the opening portion of the accommodation groove, the rotating slot opening towards the fitting base.

3. The smart lock of claim 2, wherein a lockup member, which is operable to lock up the smart control box after the connecting convex rib and the rotating slot are fitted in place, is provided between the fitting base and the smart control box.

4. The smart lock of claim 3, wherein a mounting hole for mounting the lockup member and a cover plate for preventing the lockup member from escaping out of the mounting hole are provided on an outer peripheral surface of the fitting base, an outer surface of the cover plate being in flush with the outer peripheral surface of the fitting base; the cover plate is provided with a through hole for the lockup member to pass through; the lockup member maintains a tendency of projecting out of the through hole; and a locking hole for the lockup member to project into for fitting purpose is formed at the inner wall of the opening portion of the accommodation groove.

5. The smart lock of claim 3, wherein a locking hole is formed on an outer peripheral surface of the fitting base, the lockup member is provided at the smart control box and falls into the locking hole after the connecting convex rib and the rotating slot are fitted in place, and the lockup member comprises a ferromagnet or magnet and is operable to move out of the locking hole when being subjected to a magnetic force.

6. The smart lock of claim 1, wherein a battery compartment is provided at a bottom of the smart control box, a mounting through-hole for the interior cylinder core to pass through is formed at the fitting base, the outer peripheral surface of the fitting base being downwardly eccentric relative to the mounting through-hole; and a locating step for supporting and locating the fitting base is provided at an inner wall of the accommodation groove, an outer edge of the locating step being downwardly eccentric relative to an inner edge thereof.

7. The smart lock of claim 1, wherein a mating slot is formed on an outer end surface of the fitting base, the inner end of the interior cylinder core being securely insertion-fitted into the mating slot.

8. The smart lock of claim 1, wherein the interior cylinder core comprises an internal locking lever and an internal locking sleeve, an outer end of the internal locking lever being in transmitting connection with the exterior cylinder core, the internal locking sleeve being sleeved at an outer periphery of the internal locking lever, an outer end of the internal locking sleeve being connected to the thumb turn and co-rotating with the latter; the transmission clutch assembly comprises a clutch transmission wheel, a slipping collar, and a shift fork, the clutch transmission wheel being axially located at an inner end of the internal locking lever and co-rotating with the latter, the slipping collar being in sliding connection with an inner end of the internal locking sleeve and being peripherally limited by the latter, the slipping collar maintaining transmitting connection with the second mechanical unlocking assembly and under action of the second mechanical unlocking assembly, maintaining separated from the clutch transmission wheel; the shift fork comprises a driven end, a connecting portion, and a fork body, the driven end being connected to the electric actuator, the connecting portion being rotatably connected to the fitting base, and the fork body extending till an outer end side of the slipping collar; and a notch for avoiding the driven end is formed at the inner wall of the accommodation wall.

9. The smart lock of claim 8, wherein the electric actuator comprises an electric motor and a transmission member, the electric motor being electrically connected to the control circuit board, the transmission member being secured on an output shaft of the electric motor, the transmission member projecting into the notch so as to be in transmitting connection with the driven end.

10. The smart lock of claim 8, wherein the exterior cylinder core comprises an exterior lock housing and an external locking lever axially located in the exterior lock housing, an inner end of the external locking lever projecting into the internal locking sleeve so as to be connected to and co-rotate with the outer end of the internal locking lever, an outer end of the external locking lever projecting out of the exterior lock housing for a user to turn.

**Abstract**

Disclosed is a smart lock, which relates to a lock technology and overcomes a drawback that it is inconvenient to replace respective parts of a conventional smart lock; a technical solution for addressing the problem mainly includes a lock body and a smart control box, the lock body including an interior cylinder core, a thumb turn, and an exterior cylinder core, a transmission clutch assembly being provided at an inner end of the interior cylinder core, the smart control box including a control circuit board, an electric actuator, and a second mechanical unlocking assembly, the control circuit board controlling the electric actuator to operate to actuate the transmission clutch assembly so that the first mechanical unlocking assembly is in transmitting connection with the thumb turn and the second mechanical unlocking assembly maintains transmitting connection with the thumb turn via the transmission clutch assembly; the smart control box is formed with an accommodation groove in which the transmission clutch assembly moves, a fitting base is further provided at the inner end of the interior cylinder core, the fitting base being disposed at an outer end side of the transmission clutch assembly, and the lock body and the smart control box are detachably connected via rotatable snap-fitting between the fitting base and the smart control box. The disclosure mainly allows for a user to quickly assemble and dismantle the lock body and the smart control box.

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