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(54) **Lock system**

Schließsystem

Système de verrouillage

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EP 2 390 441 B1

Description

FIELD OF THE INVENTION

[0001] The invention relates to a lock system comprising a mechanical lock and in particular a mechanical lock that can be actuated by means of an electromechanical actuator.

BACKGROUND OF THE INVENTION

[0002] European patent EP 0 231 532 discloses a lock comprising a day bolt and a night bolt. The lock also comprises an electrical magnet to maintain a tripper in a position where it does not influence tumblers and the tumblers are enabled to block the night bolt. When the magnet force drops out, the tripper is swivelled in a position where tumblers are loaded to a position releasing the night bolt.

[0003] Thus, to keep the lock locked, the magnet requires to be energised continuously by means of an electrical current.

[0004] GB 05354 AD 1914 discloses improvements in electrically controlled locks. A bolt is biased towards a retracted position. With an electrical pulse, a first lever and a second lever are attracted towards a first pair of solenoids and a second pair of solenoids, respectively. The second lever is substantially vertically connected to a third lever, that moves with the second lever. With the third lever moving, a fourth lever is unblocked, removing a tooth from an indentation provided in a rod connected to the bolt. In this way, the bolt is unblocked and allowed to retract due to the biasing force of a spring.

[0005] EP 0 974 719 discloses a lock of which a bolt is operated manually by means of a turning knob. Turning the knob results in a translating movement of the bolt. The bolt is blocked by a pivoting lever, which is biased to a blocking position. The lever is arranged to be moved to an unblocking position by energising a solenoid.

[0006] DE 94 13 062 discloses two locks. In a first lock, a translating movement of a bolt is provided by a gear driven by a worm gear, which in turn is driven by an electromotor. In a second lock, a bolt is connected to a lever. The lever is biased by a spring, urging via the lever the bolt in a retracted position. By energising a first solenoid, the bolt is via the lever pushed to an expelled position. In expelled position, the bolt may be blocked by an armature of a second solenoid, which armature fits in an indentation of the bolt. By energising the second solenoid, the armature is removed from the indentation.

[0007] DE19701761 discloses a self-locking lock for a door. On opening the door the bolt leads the spring bolt. The spring bolt has a fall part and thereby trails the secondary latch bolt (6) so that the slide plate and bolt are locked by the spring bolt until the secondary latch bolt locks the slide plate and thereby the bolt. The fall part is received in the spring bolt during closing of the door and the spring bolt is locked by the slide plate in its excluded

position. The spring bolt adjoins the counter member longer.

[0008] US 2003/0079508 discloses a door lock, in which an outside knob assembled at the outside of a door can be manually controlled to be operationally associated with or dissociated from the door lock. When the door lock is fastened, the outside knob can be selectively decoupled from the door lock and become idle; this is greatly beneficial as to prevent the door lock from being damaged even if the outside knob is exerted with external impact or forcibly turned by a strong force. The door lock is further provided with a fireproof mechanism, which prevents the door from being opened during a fire, thereby confining spreading of the fire to minimize fire-induced damage.

OBJECT AND SUMMARY OF THE INVENTION

[0009] There is a need for a lock that consumes less energy.

[0010] The invention provides in a first aspect a lock system comprising a mechanical lock comprising: a lock casing; a first bolt comprised by the lock casing, the first bolt being movable between an unlocked position in which the first bolt is fully comprised by the lock casing and a locked position in which the first bolt is partially located outside the casing; a biasing element for biasing the first bolt towards the unlocked position; and bolt blocking member movable between a blocked position in which the blocking member blocks the first bolt if the first bolt is in the locked position and an unblocked position in which the first bolt is not blocked by the bolt blocking member; the lock system further comprising an electromechanical actuator connected to an actuating member arranged to engage with the first bolt locking member for moving the bolt blocking member from the blocked position to the unblocked position by the electromechanical actuator moving the actuating member from a first position to a second position. The lock system is characterised in that the lock casing further comprises a second bolt movable between an unlocked position in which the second bolt is substantially fully comprised by the lock casing and a locked position in which the second bolt is partially located outside the casing, the second bolt being movable by operating a spindle if the second bolt and the spindle are connected, the second bolt and the spindle being connectable by a spindle connecting member which is connected to and movable by the bolt blocking member such that movement of the bolt blocking member from the blocked position to the unblocked position causes the spindle connecting member to connect the second bolt and the spindle and movement of the bolt blocking member from the unblocked position to the blocked position causes the spindle connecting member to disconnect the second bolt and the spindle.

[0011] By activating the electromechanical actuator, with the first bolt in the locked position and blocked by the bolt blocking member in the blocking position, the

bolt blocking member is moved to the unblocked position by means of the actuating member, allowing the first bolt to freely move. By virtue of the biasing element, the first bolt is subsequently moved to the unlocked position and the lock is opened. The electromechanical actuator only needs to be activated to move the bolt blocking member to the unblocked state to enable the first bolt to be retracted in the casing, in which unlocked or retracted position it is biased. This means that the electromechanical actuator only needs to be energised for a short amount of time. This saves energy compared to having to provide the electromechanical actuator with a current while the lock needs to be locked.

[0012] In an embodiment of the lock system according to the invention, the first bolt blocks in the unlocked position the bolt blocking member from moving to the blocked position. This allows the first bolt to remain in its position and prevent the first bolt from potentially being moved or blocked by the bolt blocking member in the locked position.

[0013] In a further embodiment of the lock system according to the invention, the electromechanical actuator is further enabled to move the actuating member from the second position to the first position. With the actuating member in the second position, the actuating member may, depending on several factors, block the bolt blocking member from moving to the blocked position, preventing the first bolt to be blocked and hence preventing the lock system from being blocked. By moving the actuating member to the first position, the first bolt blocking is able to move from the unblocked position to the blocked position without interacting with and potentially being blocked by the actuating member.

[0014] Another embodiment of the lock system according to the invention comprises a further biasing element for biasing the first bolt locking member to the blocked position enabling the first bolt to be blocked upon moving to the locked position. This embodiment allows the first bolt to be blocked automatically upon moving to the locked position, preventing it to move to the unlocked position by virtue of the biasing force exerted by the first biasing element.

[0015] Yet a further embodiment of the lock system according to the invention comprises a sensor arranged to sense whether the actuating member is in the second position and the electromechanical actuator and the sensor are couplable to a control unit that is arranged to control the electromechanical actuator to move to the second position if the sensor senses that the actuating member is not in the second position. The actuating member moving out of the second position may be caused by the bolt blocking member moving out of the unblocked position or result in the bolt blocking member moving out of the unblocked position. Both situations may result in the first bolt moving to the locked position, thus locking a door in which the lock system is fit. The actuating moving the bolt blocking member to the unblocked position is in most cases done with the intention to unlock the

door and keep it unlocked. Should, usually by accident, the first bolt move to the lock position, this should be corrected, which can be done with this embodiment.

[0016] The invention provides in a second aspect a building locking system comprising: at least one lock system according to claim 1; and a lock control unit couplable to the lock system and enabled to actuate the electromechanical actuator of the lock system. Such building lock system is particularly well suited for buildings where multiple doors need to remain locked and should be opened instantly upon detection of an emergency situation. Such buildings can be prisons where prisoners should be locked in their cells. Deployment of this building locking system in a nightclub can also be envisaged, where the building locking system is used to keep emergency exits well locked and to open them upon detection of an emergency like fire.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] The invention and embodiments thereof will now be further elucidated by means of figures. In the figures,

- Figure 1 A shows a lock system in a locked position;
- Figure 1 B shows a lock system in an unlocked position;
- Figure 2 shows an embodiment of the lock system;
- Figure 3 shows a locking cylinder; and
- Figure 4 shows an embodiment of the building locking system.

DESCRIPTION OF PREFERRED EMBODIMENTS

[0018] Figure 1 A discloses a first lock system 100. Whereas practical embodiments of the lock system according to the invention comprise more elements than disclosed in Figure 1 A, Figure 1 A primarily discloses the lock system 100 comprising elements that are relevant for describing the invention and embodiments thereof. This applies to Figure 1 B as well, which discloses the lock system 100 in an open state, whereas Figure 1 A discloses the lock system 100 in a closed state. Figure 1 A and Figure 1 B are presented as examples which are useful for understanding the invention.

[0019] The lock system 100 comprises a lock casing 110 comprising a bolt 112. The bolt 112 is slidable between a locked position wherein the bolt is partially located outside the lock casing 110 as shown by Figure 1 A and an unlocked position wherein the bolt 112 is located inside the lock casing 110 as shown by Figure 1 B. The lock system 100 further comprises a bolt spring 116 acting as a biasing element, a bolt blocking tumbler shaft 120 as a bolt blocking member, a blocking spring 128, a

solenoid 130 comprising a plunger 134 and a stationary part 132 comprising a coil (not shown) in which the plunger 134 fits, a lever 136 connected to the plunger 134 and a switch 140. The lock system 100 is preferably fit in a door, with the bolt 112 engaging with a hole in a doorpost for locking the door. The door is locked with the bolt 112 in the locked position and the door is unlocked with the bolt 112 in the unlocked position or in any case substantially comprised by the lock casing 110 that the bolt 112 is not in the hole of the doorpost anymore.

[0020] The blocking tumbler shaft 120 is slidable by virtue of an elongated opening 122 in the blocking tumbler shaft 120 in which a holding pin 124 fits, which holding pin 124 is connected to the lock casing 110. The blocking tumbler shaft 120 is slidable between a blocked position as shown in Figure 1 A and an unblocked position as shown in Figure 1 B. The blocking tumbler shaft 120 is biased towards the blocked position by means of the blocking spring 128 that is connected to the blocking tumbler shaft 120 via a blocking spring pin 126 protruding from the side of the blocking tumbler shaft 120.

[0021] In a normal state of the lock system 100 corresponding to a state of a larger system like a building in which the lock system 100 is fit, the position of the bolt 112 can be controlled by means of a key, as will be discussed later in further detail. By operating the key in a first direction, preferably by turning it clockwise, viewed from the drawing plane, the blocking tumbler shaft 120 can be slid towards the unblocked position and subsequently the bolt 112 can be slid back to the unlocked position by the same key operation. As the bolt 112 is biased towards the unlocked position by means of the bolt spring 116 acting on a bolt spring pin 114 protruding from the side of the bolt 112, sliding the bolt 112 to the unlocked position will be a relatively light operation.

[0022] By operating the key in a second direction, opposite to the first direction, the bolt 112 can be slid from the unlocked position to the locked position. It is noted that this action involves loading the bolt spring 116. If the bolt 112 has been moved to the locked position, the blocking tumbler shaft 120 is slid towards the blocked position by virtue of the biasing force of the blocking spring 128, thus acting as a bolt blocking member that is blocking the bolt 112 from moving from the locked position to the unlocked position.

[0023] As already discussed, the lock system 100 may be opened again by operating a key. Additionally or alternatively, the lock system 100 may be opened remotely by means of the solenoid 130. By applying a first current to the coil of the stationary part 132 of the solenoid 130, the plunger 134 of the solenoid 130, acting as an electromechanical actuator, is pulled inside the stationary part 132. By consequence, the lever 136 is moved towards the stationary part as well. Whereas the solenoid 130 is located outside the lock casing 110, the lever 136, acting as an actuating member, protrudes the lock casing 110 at a location where it is enabled to move the blocking tumbler shaft 120 from the blocked position to the un-

blocked position. If the blocking tumbler shaft 120 is in the unblocked position, it does not block the bolt 112 anymore, resulting in the bolt 112 to move to unlocked position by virtue of the bolt spring 116.

[0024] With the bolt 112 in the unlocked position, it blocks the blocking tumbler shaft 120 from moving to the blocking position. Therefore, the first current only needs to be applied as a pulse until the bolt 112 blocks the blocking tumbler shaft 120 from moving to the blocked position. A sensor can be added to the lock system 100 for sensing the location of the bolt 112 to determine how long the current pulse should be applied for moving the blocking tumbler shaft 120 to the unblocked position.

[0025] Unlocking the lock system 100 remotely is in particular preferred in emergency situations like fire. Upon fire detection, either automatically or by human interaction, the lock system is set from the normal state to an emergency state, upon which transition the solenoid 130 is triggered by applying the first current to the coil of the solenoid 130. Subsequently, the lock system 100 is unlocked as discussed above.

[0026] In such situations, it is also important that once the lock system 100 is unlocked, it remains unlocked. Therefore, the switch 140 is provided. If the plunger 134 has been pulled into the stationary part 132 of the solenoid 130, an end of the plunger 134 opposite to the end to which the lever 136 is attached contacts and operates the switch 140. Depending on the wiring of the switch 140, a circuit is either closed or opened. In this way, the switch 140 acts as a sensor it can be detected whether the solenoid 130 and with that the lever 136 holds the blocking tumbler shaft 120 in the unblocked position or whether the lever 136 is in the position as depicted in Figure 1 A where the blocking tumbler shaft 120 can move freely between the blocked position and the unblocked position without interacting with and possibly being blocked by the lever 136.

[0027] If the plunger 134 moves to a position where it does not actuate the switch 140 anymore, this means that the lever 136 does not hold the blocking tumbler shaft 120 entirely in its unblocked position anymore. The interrupted actuation of the switch 140 can be detected by a control system as will be discussed later, upon which the coil of the solenoid 130 can be actuated again with the first current to move the plunger 134 back to its position where the lever 136 moves the blocking tumbler shaft 120 back to its unblocking position.

[0028] If the emergency has been resolved, for example because the fire has been put out or the alarm has appeared to be false, the state of the lock system 100 is set back from the emergency state to the normal state. With this transition, the plunger 134 is preferably set back to the position depicted by Figure 1, together with the lever 136 where the blocking tumbler shaft 120 cannot be interfered with anymore by the lever 136. The plunger 134 is moved back by applying a second current to the coil of the solenoid 130 that is opposite to the first current. In this case, the solenoid 130 is preferably a bipolar so-

lenoid. Alternatively, the coil in the solenoid 130 comprises two opposite windings and the first current is applied to a first winding and the second current is applied to the second winding. In this alternative, the second current has the same direction as the first current; the opposite effect - moving the plunger 134 in another direction - is established by the second winding being opposite to the first winding.

[0029] Thus far, the bolt 112 and the blocking tumbler shaft 120 have been presented as moving in a linear way, perpendicular to one another. It can be envisaged that they are not entirely perpendicular to one another and/or move in a slightly circular way or another non-linear way.

[0030] Figure 2 shows a lock system 200 according to the invention. The lock system 200 comprises a lock casing 210 comprising a bolt 212 slidable between a locked position depicted by the dashed line and an unlocked position depicted by a solid line. The bolt 212 is biased towards the unlocked position by a bolt spring 216 that acts on a bolt spring pin 214 that is connected to the bolt 212. The lock system further comprises a blocking tumbler shaft 220 that is slidable from the unblocked position depicted in Figure 2 to a lower blocked position in which the blocking tumbler shaft 220 blocks the bolt 212 if the bolt 212 is in the locked position depicted by the dashed line. The blocking tumbler shaft 220 is biased by a blocking spring 228 to the blocked position. The blocking spring 228 interacts with the blocking tumbler shaft 220 at the top of the blocking tumbler shaft 220. If the bolt 212 has been moved to the locked position, the blocking tumbler shaft 220 will move to the blocked position by virtue of the biasing force of the blocking spring 228.

[0031] The bolt 212 is pivotally connected to an opening tumbler 272 and a closing tumbler 274. The bolt 212 can be moved to the unlocked position by moving the opening tumbler 272 to the right and the bolt 212 can be moved to the locked position by moving the closing tumbler 274 to the left, both directions viewed from the plane of Figure 2.

[0032] The lock casing 210 comprises a lock cylinder opening 270 in which a lock cylinder 300 as depicted in Figure 3 may be fit. The lock cylinder 300 comprises a cylinder housing 302, a key slit 308 and a cylinder cam 304 comprising a cylinder notch 306. For operating the lock cylinder 300, a key is stuck in the key slit 308. If the combination of the key fits the combination of the lock cylinder 300, the key can be turned, resulting in turning the cylinder cam 304 with the cylinder notch 306.

[0033] With the lock cylinder 300 fitted in the lock cylinder opening 270, the cylinder notch 306 is able to interact with the closing tumbler 274, the opening tumbler 272 and in particular with the opening tumbler notch 273. Turning the key of the lock cylinder 300 to the left (counter clockwise) will result in the cylinder notch 306 pushing the closing tumbler 274 to the left, resulting in the connected bolt 212 to be moved to the locked position. After the bolt 212 has been moved to the locked position, the blocking tumbler shaft 220 moves to the blocked position

by virtue of the force of the blocking spring 228 acting upon the blocking tumbler shaft 220.

[0034] Turning the key of the lock cylinder 300 subsequently to the right (clockwise) will result in the cylinder notch 306 interacting with the opening tumbler notch 273, pushing the opening tumbler 272 and with that the bolt 212 connected thereto to the unlocked position. Operating the opening tumbler 272 will also result in the blocking tumbler shaft 220 to be moved to the unblocked position, allowing the bolt 212 to be moved to the unlocked position. The blocking tumbler shaft 220 is moved upwards while turning the key clockwise by interaction of the cylinder notch 306 with the lower left part of the tumbler shaft 220.

[0035] Besides being operated by means of a key, the lock system 200 can also be remotely unlocked by means of an electrical pulse. This can for example be done in a case of emergency, where a state of a building in which the lock system 200 is fit is changed from a normal state to an emergency state. To this end, the lock system 200 comprises a solenoid 230 located in a control housing 240. The solenoid 230 comprises a stationary part 232 comprising a coil (not shown) and a plunger 234 that is slidably mounted in the stationary part 232. The plunger 234 has a lever 236 connected to it, protruding the lock casing 210 from the control housing for interacting with the blocking tumbler shaft 220 and in particular the lower part thereof.

[0036] Upon receiving an electrical pulse of a first type, preferably a current pulse with a first direction, the coil of the solenoid 130 attracts the plunger 234, resulting in the lever 236 to move in an upward direction. If the blocking tumbler shaft 220 is in the blocked position, the tumbler shaft 220 is moved in the unblocked position, unblocking movement of the bolt 212. Subsequently, by virtue of the bolt spring 216, the bolt 212 slides to the unlocked position. In this unlocked position, the bolt 212 blocks the blocking tumbler shaft 220 from moving to the blocked position.

[0037] In the unlocked position, the bolt 212 operates a first micro switch 213, thus either closing or opening a circuit, depending on the wiring of the circuit and/or the first micro switch 213. This enables detection of the position of the bolt 212. The lock system 200 also comprises a second micro switch 242 for detecting the position of the plunger 234 and with that of the lever 236. This allows to detect whether a current pulse applied to the solenoid 130 has been sufficiently long and/or powerful to unlock the lock system 200. If the pulse has been too short, the plunger 242 may have moved the blocking tumbler shaft 220 to the unblocked position, but possibly not long enough for the bolt 212 to move to the unlocked position, in which position it would block the blocking tumbler shaft 220 in the unblocked position. This may result in the blocking tumbler shaft 220 from moving back to the blocked position, blocking the bolt 212 to move to the unlocked position.

[0038] In this case, the second micro switch 242 has

been triggered, but not the first micro switch 213. Therefore, the pulse of the first type is preferably applied to the solenoid 130 until the first micro switch 213 is triggered by a fully retracted bolt 212. The triggering of the second micro switch by the plunger 234 may be used to detect any potential issues with the solenoid. If after applying a current to the solenoid 130 for a longer time, for example over two seconds, the second micro switch 242 has not been triggered, this could indicate malfunction of the solenoid 130 or another inability of the solenoid to move the blocking tumbler shaft 220 to the unblocked position.

[0039] Additionally or alternatively, detection of the location of the plunger 234 by the second micro switch 242 can be used to apply the first current again to the solenoid to ensure that the blocking tumbler shaft 220 is kept in the unblocked position by means of the lever 236, while the building in which the lock system 200 is placed is in emergency state. If the second micro switch 242 is not triggered anymore by the upper end of the plunger 234, this means that the lever 236 does not hold the blocking tumbler shaft 220 entirely in the unblocked position. To ensure the blocking tumbler shaft 220 is in emergency state always held in the unblocked position by the lever 236, release of the second micro switch 242 could trigger a control circuit to energise the coil of the solenoid 230 to move the plunger 234 back to a position where it holds the blocking tumbler shaft 220 in the unblocked position.

[0040] The blocking tumbler shaft 220 could in the emergency state move to the blocked position in case a person would accidentally lock the lock system 200 by means of a key. In such case, the bolt 212 would be moved to the locked position and the blocking tumbler shaft 220 to the blocked position, thus locking the lock system 200. In the emergency state, this is undesirable; hence the triggering of the coil in case the second micro switch 242 is released.

[0041] Upon returning to normal state, an electrical pulse of a second type, preferably a second current opposite to that of the first current, is applied to the solenoid 130 to move the plunger back to the location depicted in Figure 2.

[0042] The various electrical components of the lock system can be connected to further units by virtue of the socket 241 comprising connections to the various electrical elements of the lock system 200 like the first micro switch 213, the second micro switch 242 and the solenoid 230.

[0043] The lock system 200 further comprises a spring latch 262 as a second bolt that is biased in a locked position by means of a spring latch spring 266 that interacts with spring latch protrusion 264. The spring latch 262 can be operated by inserting a handle in the square spring latch operating hole 247. This enables the spring latch operating hole 247 to be swivelled, resulting in retracting the spring latch 262 in the lock casing 210, in an unlocked position. The spring latch operating hole 247 is fitted with a flange 246 that swivels with the spring latch operating hole 247 and is couplable to a spring latch swivel arm

248. If the flange 246 is coupled to the spring latch swivel arm 248, operation of a handle fitted in the spring latch operating hole 247 by turning the handle clockwise results in the spring latch swivel arm 248 moving to the right, thus retracting the spring latch 262 in the lock casing 210.

[0044] Coupling of the flange 246 and the spring latch swivel arm 248 is done by means of a coupling catch 254 fitted on a coupling tumbler 250. The coupling catch 254 fits in a recess in the flange 246 and the spring latch swivel arm 248. If the coupling catch 254 is fit in the recesses in the flange 246 and the spring latch swivel arm 248, the flange 246 and the spring latch swivel arm 248 are coupled and the spring bolt 262 can be operated by means of a handle fitted in the spring latch operating hole 247.

[0045] The coupling tumbler 250 further comprises a slot 256 fit around a coupling tumbler holding pin 258 connected to the lock casing 210. The coupling tumbler holding pin 258 hold the coupling tumbler 250 in place and with the slot 256 it allows the coupling tumbler to swivel with the flange 246.

[0046] The flange 246 and the spring latch swivel arm 248 can be decoupled by pulling the coupling catch 254 out of the recesses in the flange 246 and the spring latch swivel arm 248 by a coupling tumbler shaft 244. The coupling tumbler shaft 244 is coupled to the blocking tumbler shaft 220 and preferably moves in the same linear way as the blocking tumbler shaft moves in this embodiment.

[0047] If the blocking tumbler shaft 220 is in the blocked position, the coupling tumbler shaft 244 is in a lower position, lower than depicted on Figure 2, resulting in a coupling hook 245 to grip on a coupling pin 252 protruding from the coupling tumbler 250 and pulling back the coupling tumbler 250. This results in the coupling catch 254 to be pulled out from the recesses in the flange 246 and the spring latch swivel arm 248, preventing the spring bolt 262 to be operated by means of a handle fit in the spring latch operating hole 247.

[0048] If the blocking tumbler shaft 220 has moved back to the unblocked position, either by operation of a key or the solenoid 230, the coupling tumbler shaft 244, coupled to the blocking tumbler shaft 220, has moved upward as well, releasing the coupling pin 252 and allowing the flange 246 and the spring latch swivel arm 248 to be coupled again by inserting the coupling catch 254 back into the recesses in the flange 246 and the spring latch swivel arm 248.

[0049] This means that if the bolt 212 is in the locked position and the blocking tumbler shaft 220 is in the blocked position, the spring bolt 262 cannot be operated by means of a handle. Operating the handle would result in swivelling of the handle, without any further result. If the bolt 212 is in the unlocked position and the blocking tumbler shaft 220 is in the unblocked position, the spring bolt 262 can be operated by means of a handle. So if the lock system 200 has been unlocked in an emergency case the lock system 200 can be fully opened by opera-

tion of a handle to also open the spring bolt 262 manually.

[0050] It is stipulated that multiple variations on the embodiments described and discussed above are possible, without departing from the scope of the invention. Though thus far only solenoids have been presented as electromechanical actuators, also electromagnets directly attracting an actuating member or electromotors may be employed while implementing aspects of the invention, such electromotor either acting directly on mechanical elements of the lock system or by means of gears. However, solenoids are preferred over their speed. Additionally or alternative, other sensors than micro switches may be used. For example, other mechanical or optical, magnetic or other sensors may be used to monitor positions of bolts and blocking tumbler shafts. Additionally or alternatively, the springs thus far disclosed as leaf springs may be replaced or complemented by other biasing elements like coiled springs.

[0051] Figure 4 discloses a building locking system 400 fit in a building. The building locking system 400 comprises a plurality of locks systems 402 fit in the building. The lock systems 402 may be lock systems as discussed before or other embodiments of the lock system according with the invention. The building locking system 400 further comprises a lock control unit 410 comprising a sensor communication circuit 412, a lock actuating circuit 414, a control circuit 416 and a general communication unit 418. The control circuit 416 is operatively coupled to the sensor communication circuit 412, the lock actuating circuit 414 and the general communication unit 418. The sensors and in particular the micro switches of the lock systems 402 are coupled to the sensor communication unit 412 and the actuators like solenoids of the lock systems 402 are coupled to the lock actuating circuit 414.

[0052] By means of the sensor communication unit 412, the lock control unit is enabled to detect the positions of bolts and blocking tumbler shafts of the lock systems 402. By means of the lock actuating circuit 414, the solenoids of the lock systems 402 can be actuated. The general communication unit 418 allows the lock control unit 410 to be coupled to a fire detection system or another emergency detection system. Additionally or alternatively, the general communication unit 418 enables the control unit 410 to be coupled to other computer or control units, either dedicated to a special function or general purpose. The lock control unit 410 normally operates in a normal state, if there is no emergency situation. In this state, lock control unit 410 is in standby state and the lock systems 402 are not operated.

[0053] Upon detection and communication of an emergency like a fire, the lock control unit 410 switches to an emergency state in which the solenoids of the lock systems 402 are operated to unlock the lock systems 402. As discussed before, this is done by the solenoids acting on blocking tumbler shafts to allow bolts of the lock systems 402 to be retracted. Correct execution of this action is verified by reading out positions of various sensors and in particular micro switches in the lock systems 402 de-

tecting positions of bolts and/or positions of blocking tumbler shafts. This operation of the building lock system 400 is controlled by the control circuit 416 that can be a microcontroller, a microprocessor or a similar control unit.

[0054] Expressions such as "comprise", "include", "incorporate", "contain", "is" and "have" are to be construed in a non-exclusive manner when interpreting the description and its associated claims, namely construed to allow for other items or components which are not explicitly defined also to be present. Reference to the singular is also to be construed in be a reference to the plural and vice versa.

[0055] In the description above, it will be understood that when an element such as layer, region or substrate is referred to as being "on" or "onto" another element, or an element is connected to another element, the element is either directly on or directly connected to the other element, or intervening elements may also be present.

[0056] Furthermore, the invention may also be embodied with less components than provided in the embodiments described here, wherein one component carries out multiple functions. Just as well may the invention be embodied using more elements than depicted in Figure 1, Figure 2 or Figure 4, wherein functions carried out by one component in the embodiment provided are distributed over multiple components.

[0057] A person skilled in the art will readily appreciate that various parameters disclosed in the description may be modified and that various embodiments disclosed and/or claimed may be combined without departing from the scope of the invention, as defined by the appended claims.

[0058] It is stipulated that the reference signs in the claims do not limit the scope of the claims, but are merely inserted to enhance the legibility of the claims.

[0059] In summary, the invention relates to a lock comprising a bolt movable between a retracted and an expelled position, a biasing element for biasing the bolt towards the retracted position, a bolt blocking movable between a blocked position for blocking the bolt in the expelled position in a blocked position and an unblocked position allowing free movement of the bolt and an electromechanical actuator coupled to an actuating member which actuating member is arranged to engage with the bolt blocking member for moving the bolt blocking member from the blocked position to the unblocked position upon electrical activation of the electromechanical actuator. By activating the electromechanical actuator, the bolt blocking member is moved to the unblocked position by means of the actuating member, allowing the first to move freely. By virtue of the biasing element, the first bolt is subsequently moved to the unlocked position and the lock is opened.

Claims

1. Lock system comprising a mechanical lock compris-

ing:

- a) a lock casing (210);
- b) a first bolt (212) comprised by the lock casing (210), the first bolt (212) being movable between an unlocked position in which the first bolt (212) is substantially fully comprised by the lock casing (210) and a locked position in which the first bolt (212) is partially located outside the casing (210);
- c) a biasing element for biasing (216) the first bolt (212) towards the unlocked position; and
- d) a bolt blocking member (220) movable between a blocked position in which the blocking member (220) blocks the first bolt (212) if the first bolt (212) is in the locked position and an unblocked position in which movement of the first bolt (212) is not blocked by the bolt blocking member (220);

the lock system further comprising an electromechanical actuator (230) connected to an actuating member (236) arranged to engage with the bolt blocking member (220) for moving the bolt blocking member (220) from the blocked position to the unblocked position by the electromechanical actuator (230) moving the actuating member (236) from a first position to a second position;

characterised in that the lock casing (210) further comprises a second bolt (262) movable between an unlocked position in which the second bolt (262) is substantially fully comprised by the lock casing (210) and a locked position in which the second bolt (262) is partially located outside the casing (210), the second bolt (262) being movable by operating a spindle (246) if the second bolt (262) and the spindle (246) are connected, the second bolt (262) and the spindle (246) being connectable by a spindle connecting member (244) which is connected to and movable by the bolt blocking member (220) such that movement of the bolt blocking members (220) from the blocked position to the unblocked position causes the spindle connecting member (244) to connect the second bolt (262) and the spindle (246) and movement of the bolt blocking member (220) from the unblocked position to the blocked position causes the spindle connecting member (244) to disconnect the second bolt (262) and the spindle (246).

2. Lock system according to claim 1, wherein the first bolt (212) blocks in the unlocked position the bolt blocking member (220) from moving to the blocked position.
3. Lock system according to claim 1, wherein the electromechanical actuator (230) is further enabled to move the actuating member from the second position to the first position.

4. Lock system according to claim 3, wherein the electromechanical actuator (230) is enabled to move the first bolt locking member (220):

- a) from the unblocked position to the blocked position in response to receiving an electrical pulse of a first type; and
- b) from the blocked position to the unblocked position in response to receiving an electrical pulse of a second type.

5. Lock system according to claim 1, further comprising a further biasing element for biasing the first bolt (212) locking member to the blocked position enabling the first bolt to be blocked upon moving to the locked position.

6. Lock system according to claim 1, wherein the electromechanical actuator (230) is a bipolar solenoid comprising a plunger that is connected to the actuating member.

7. Lock system according to claim 1, wherein the bolt blocking member (220) is movable from the blocked position to the unblocked position and vice versa in a linear way.

8. Lock system according to claim 1, wherein the electromechanical actuator (230) is located outside of the lock casing and the actuating member protrudes the lock casing (210).

9. Lock system according to claim 1, wherein the first bolt (212) and the bolt blocking member (220) are movable in a substantially linear way and the directions of movement of the first bolt (212) and the bolt blocking member (220) are substantially perpendicular to one another.

10. Lock system according to claim 1, further comprising a sensor arranged to sense whether the actuating member is in the second position and the electromechanical actuator (230) and the sensor are couplable to a control unit that is arranged to control the electromechanical actuator (230) to move to the second position if the sensor senses that the actuating member is not in the second position.

11. Lock system according to claim 10, wherein the control unit can be set to a first state and to a second state and wherein the control unit only moves the electromechanical actuator (230) to the second position if the sensor senses that the actuating member is not in the second position in a case that the control unit is in the second state.

12. Building locking system comprising:

- a) at least one lock system according to claim 1; and
- b) a lock control unit couplable to the lock system and enabled to actuate the electromechanical actuator (230) of the lock system.

13. Building locking system according to claim 12, wherein:

- a) the lock system is a lock system according to claim 10; and
- b) the lock control unit is couplable to the electromechanical actuator (230) and the sensor of the lock system and the lock control unit is arranged to control the electromechanical actuator (230) to move the member to the second position if the sensor senses that the actuating member is not in the second position.

Patentansprüche

1. Schließsystem mit einem mechanischen Schloss mit:

- a) einem Schlossgehäuse (210),
- b) einem ersten Riegel (212), der von dem Schlossgehäuse (210) umfasst ist, wobei der erste Riegel (212) zwischen einer entriegelten Stellung, in der der erste Riegel (212) im Wesentlichen vollständig von dem Schlossgehäuse (210) umfasst ist, und einer verriegelten Stellung bewegbar ist, in der sich der erste Riegel (212) teilweise außerhalb des Gehäuses (210) befindet,
- c) einem Beaufschlagungselement zum Beaufschlagen (216) des ersten Riegels (212) zur entriegelten Stellung hin und
- d) einem Riegelsperrelement (220), das zwischen einer Sperrstellung, in der das Sperrelement (220) den ersten Riegel (212) sperrt, wenn der erste Riegel (212) in der verriegelten Stellung ist, und einer entsperrten Stellung bewegbar ist, in der die Bewegung des ersten Riegels (212) nicht von dem Riegelsperrelement (220) gesperrt ist,

wobei das Schließsystem ferner einen elektromechanischen Aktuator (230) umfasst, der mit einem Betätigungselement (236) verbunden ist, das so eingerichtet ist, dass es an dem Riegelsperrelement (220) angreift, um das Riegelsperrelement (220) aus der Sperrstellung in die entsperrte Stellung zu bewegen, indem der elektromechanische Aktuator (230) das Betätigungselement (236) aus einer ersten Stellung in eine zweite Stellung bewegt, **dadurch gekennzeichnet, dass** das Schlossgehäuse (210) ferner einen zweiten Riegel (262) um-

fasst, der zwischen einer entriegelten Stellung, in der der zweite Riegel (262) im Wesentlichen vollständig von dem Schlossgehäuse (210) umfasst ist, und einer verriegelten Stellung bewegbar ist, in der sich der zweite Riegel (262) teilweise außerhalb des Gehäuses (210) befindet, wobei der zweite Riegel (262) durch Betätigen einer Spindel (246) bewegbar ist, wenn der zweite Riegel (262) und die Spindel (246) verbunden sind, wobei der zweite Riegel (262) und die Spindel (246) durch ein Spindelverbindungselement (244) verbindbar sind, das mit dem Riegelsperrelement (220) verbunden und von diesem so bewegbar ist, dass die Bewegung des Riegelsperrelements (220) aus der Sperrstellung in die entsperrte Stellung bewirkt, dass das Spindelverbindungselement (244) den zweiten Riegel (262) und die Spindel (246) verbindet, und die Bewegung des Riegelsperrelements (220) aus der entsperrten Stellung in die Sperrstellung bewirkt, dass das Spindelverbindungselement (244) den zweiten Riegel (262) und die Spindel (246) trennt.

2. Schließsystem nach Anspruch 1, bei dem der erste Riegel (212) in der entriegelten Stellung das Riegelsperrelement (220) daran hindert, sich in die Sperrstellung zu bewegen.

3. Schließsystem nach Anspruch 1, bei dem es dem elektromechanischen Aktuator (230) ferner ermöglicht ist, das Betätigungselement aus der zweiten Stellung in die erste Stellung zu bewegen.

4. Schließsystem nach Anspruch 3, bei dem es dem elektromechanischen Aktuator (230) ermöglicht ist, das erste Riegelsperrelement (220)

- a) als Reaktion auf den Empfang eines elektrischen Impulses eines ersten Typs aus der entsperrten Stellung in die Sperrstellung zu bewegen und
- b) als Reaktion auf den Empfang eines elektrischen Impulses eines zweiten Typs aus der Sperrstellung in die entsperrte Stellung zu bewegen.

5. Schließsystem nach Anspruch 1, ferner mit einem weiteren Beaufschlagungselement zur Beaufschlagung des ersten Riegelsperrelements (212) in die Sperrstellung, die es dem ersten Riegel ermöglicht, bei Bewegung in die verriegelte Stellung gesperrt zu werden.

6. Schließsystem nach Anspruch 1, bei dem der elektromechanische Aktuator (230) ein zweipoliger Elektromagnet mit einem Stößel ist, der mit dem Betätigungselement verbunden ist.

7. Schließsystem nach Anspruch 1, bei dem das Rie-

gelsperrelement (220) linear aus der Sperrstellung in die entsperrte Stellung und umgekehrt bewegbar ist.

8. Schließsystem nach Anspruch 1, bei dem sich der elektromechanische Aktuator (230) außerhalb des Schlossgehäuses befindet und das Betätigungselement über das Schlossgehäuse (210) hinausragt. 5
9. Schließsystem nach Anspruch 1, bei dem der erste Riegel (212) und das Riegelsperrelement (220) im Wesentlichen linear bewegbar sind und die Bewegungsrichtungen des ersten Riegels (212) und des Riegelsperrelements (220) zueinander im Wesentlichen senkrecht sind. 10
10. Schließsystem nach Anspruch 1, ferner mit einem Sensor, der so eingerichtet ist, dass er erfasst, ob das Betätigungselement in der zweiten Stellung ist, und wobei der elektromechanische Aktuator (230) und der Sensor mit einer Steuereinheit koppelbar sind, die so eingerichtet ist, dass sie den elektromechanischen Aktuator (230) so steuert, dass er sich in die zweite Stellung bewegt, wenn der Sensor erfasst, dass das Betätigungselement nicht in der zweiten Stellung ist. 15
11. Schließsystem nach Anspruch 10, bei dem die Steuereinheit in einen ersten Zustand und in einen zweiten Zustand versetzt werden kann und bei dem die Steuereinheit den elektromechanischen Aktuator (230) nur in die zweite Stellung bewegt, wenn der Sensor erfasst, dass das Betätigungselement in dem Fall, dass die Steuereinheit im zweiten Zustand ist, nicht in der zweiten Stellung ist. 20
12. Gebäudeschließsystem mit: 25
 - a) wenigstens einem Schließsystem nach Anspruch 1 und 30
 - b) einer Schlosssteuereinheit, die mit dem Schließsystem koppelbar ist und den elektromechanischen Aktuator (230) des Schließsystems betätigen kann. 35
13. Gebäudeschließsystem nach Anspruch 12, bei dem: 40
 - a) das Schließsystem ein Schließsystem nach Anspruch 10 ist und 45
 - b) die Schlosssteuereinheit mit dem elektromechanischen Aktuator (230) und dem Sensor des Schließsystems koppelbar ist und die Schlosssteuereinheit so eingerichtet ist, dass sie den elektromechanischen Aktuator (230) so steuert, dass er das Element in die zweite Stellung bewegt, wenn der Sensor erfasst, dass das Betätigungselement nicht in der zweiten Stellung ist. 50

Revendications

1. Système de verrou comprenant un verrou mécanique comprenant :

- a) un coffre de verrou (210) ;
- b) un premier boulon (212) composé par le coffre de verrou (210), le premier boulon (212) étant mobile entre une position déverrouillée dans laquelle le premier boulon (212) est sensiblement totalement composé par le coffre de verrou (210) et une position verrouillée dans laquelle le premier boulon (212) est partiellement situé à l'extérieur du coffre (210) ;
- c) un élément de sollicitation permettant de solliciter (216) le premier boulon (212) vers la position déverrouillée ; et
- d) un organe de blocage de boulon (220) mobile entre une position bloquée dans laquelle l'organe de blocage (220) bloque le premier boulon (212) si le premier boulon (212) est dans la position verrouillée et une position débloquée dans laquelle un déplacement du premier boulon (212) n'est pas bloqué par l'organe de blocage de boulon (220) ;

le système de verrou comprenant en outre un actionneur électromécanique (230) connecté à un organe d'actionnement (236) agencé pour se mettre en prise avec l'organe de blocage de boulon (220) pour déplacer l'organe de blocage de boulon (220) de la position bloquée à la position débloquée par l'actionneur électromécanique (230) déplaçant l'organe d'actionnement (236) d'une première position à une seconde position ;

caractérisé en ce que le coffre de verrou (210) comprend en outre un second boulon (262) mobile entre une position déverrouillée dans laquelle le second boulon (262) est sensiblement totalement composé par le coffre de verrou (210) et une position verrouillée dans laquelle le second boulon (262) est partiellement situé à l'extérieur du coffre (210), le second boulon (262) étant mobile par actionnement d'une tige (246) si le second boulon (262) et la tige (246) sont connectés, le second boulon (262) et la tige (246) pouvant être connectés par un organe de connexion de tige (244) qui est connecté à et mobile par l'organe de blocage de boulon (220) de telle sorte qu'un déplacement de l'organe de blocage de boulon (220) de la position bloquée à la position débloquée amène l'organe de connexion de tige (244) à connecter le second boulon (262) et la tige (246) et un déplacement de l'organe de blocage de boulon (220) de la position débloquée à la position bloquée amène l'organe de connexion de tige (244) à déconnecter le second boulon (262) et la tige (246).

2. Système de verrou selon la revendication 1, dans

lequel le premier boulon (212) bloque dans la position déverrouillée l'organe de blocage de boulon (220) vis-à-vis d'un déplacement vers la position bloquée.

3. Système de verrou selon la revendication 1, dans lequel l'actionneur électromécanique (230) est en outre autorisé à déplacer l'organe d'actionnement de la seconde position à la première position.
4. Système de verrou selon la revendication 3, dans lequel l'actionneur électromécanique (230) est autorisé à déplacer le premier organe de verrouillage de boulon (220) :
 - a) de la position débloquée à la position bloquée en réponse à la réception d'une impulsion électrique d'un premier type ; et
 - b) de la position bloquée à la position débloquée en réponse à la réception d'une impulsion électrique d'un second type.
5. Système de verrou selon la revendication 1, comprenant en outre un élément de sollicitation supplémentaire permettant de solliciter l'organe de verrouillage du premier boulon (212) vers la position bloquée permettant le blocage du premier boulon lors du déplacement vers la position verrouillée.
6. Système de verrou selon la revendication 1, dans lequel l'actionneur électromécanique (230) est un solénoïde bipolaire comprenant un plongeur qui est connecté à l'organe d'actionnement.
7. Système de verrou selon la revendication 1, dans lequel l'organe de blocage de boulon (220) est mobile de la position bloquée à la position débloquée et vice versa de manière linéaire.
8. Système de verrou selon la revendication 1, dans lequel l'actionneur électromécanique (230) est situé à l'extérieur du coffre de verrou et l'organe d'actionnement dépasse du coffre de verrou (210).
9. Système de verrou selon la revendication 1, dans lequel le premier boulon (212) et l'organe de blocage de boulon (220) sont mobiles de manière sensiblement linéaire et les directions de déplacement du premier boulon (212) et de l'organe de blocage de boulon (220) sont sensiblement perpendiculaires l'une à l'autre.
10. Système de verrou selon la revendication 1, comprenant en outre un détecteur agencé pour détecter si l'organe d'actionnement est dans la seconde position et l'actionneur électromécanique (230) et le détecteur sont couplables à une unité de commande qui est agencée pour commander à l'actionneur

électromécanique (230) de se déplacer vers la seconde position si le détecteur détecte que l'organe d'actionnement n'est pas dans la seconde position.

11. Système de verrou selon la revendication 10, dans lequel l'unité de commande peut être fixée à un premier état et à un second état et dans lequel l'unité de commande ne déplace l'actionneur électromécanique (230) vers la seconde position que si le détecteur détecte que l'organe d'actionnement n'est pas dans la seconde position dans un cas où l'unité de commande est dans le second état.
12. Système de verrouillage de bâtiment comprenant :
 - a) au moins un système de verrou selon la revendication 1 ; et
 - b) une unité de commande de verrou couplable au système de verrou et autorisée à actionner l'actionneur électromécanique (230) du système de verrou.
13. Système de verrouillage de bâtiment selon la revendication 12, dans lequel :
 - a) le système de verrou est un système de verrou selon la revendication 10 ; et
 - b) l'unité de commande de verrou est couplable à l'actionneur électromécanique (230) et au détecteur du système de verrou, et l'unité de commande de verrou est agencée pour commander à l'actionneur électromécanique (230) de déplacer l'organe vers la seconde position si le détecteur détecte que l'organe d'actionnement n'est pas dans la seconde position.

100

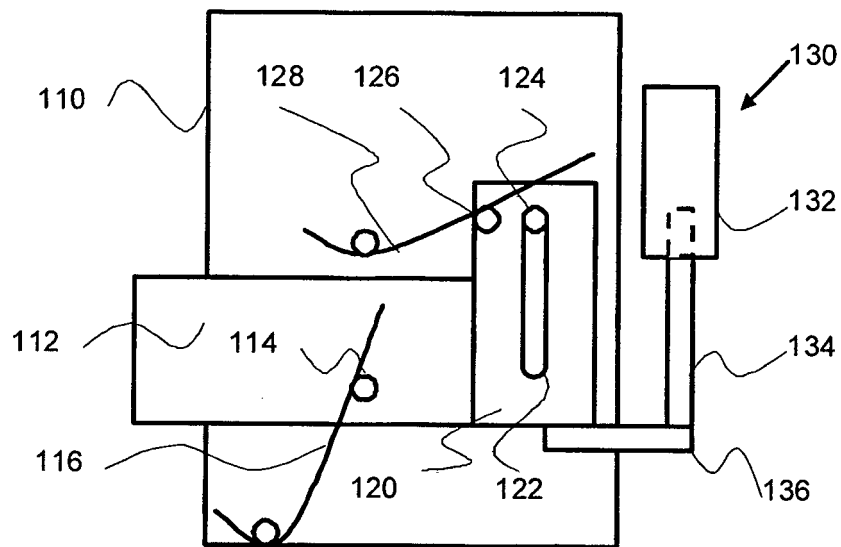


Fig. 1 A

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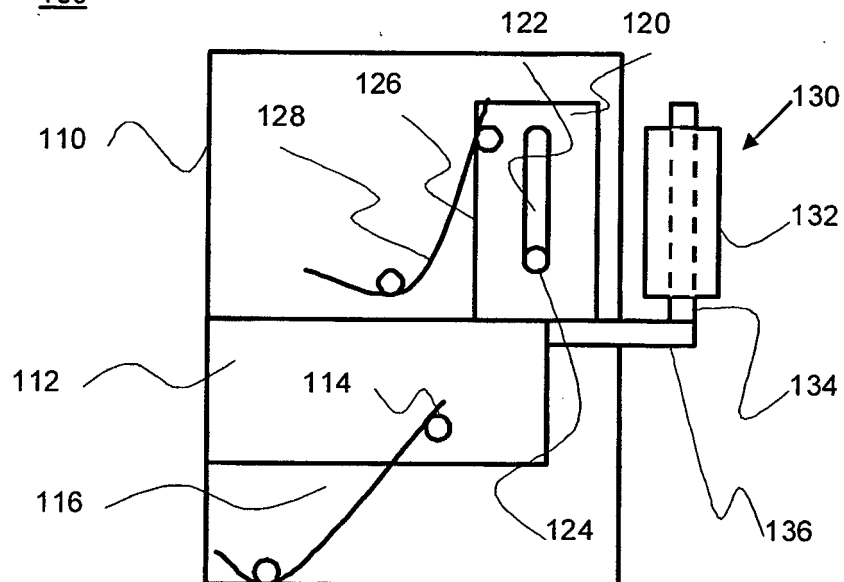


Fig. 1 B

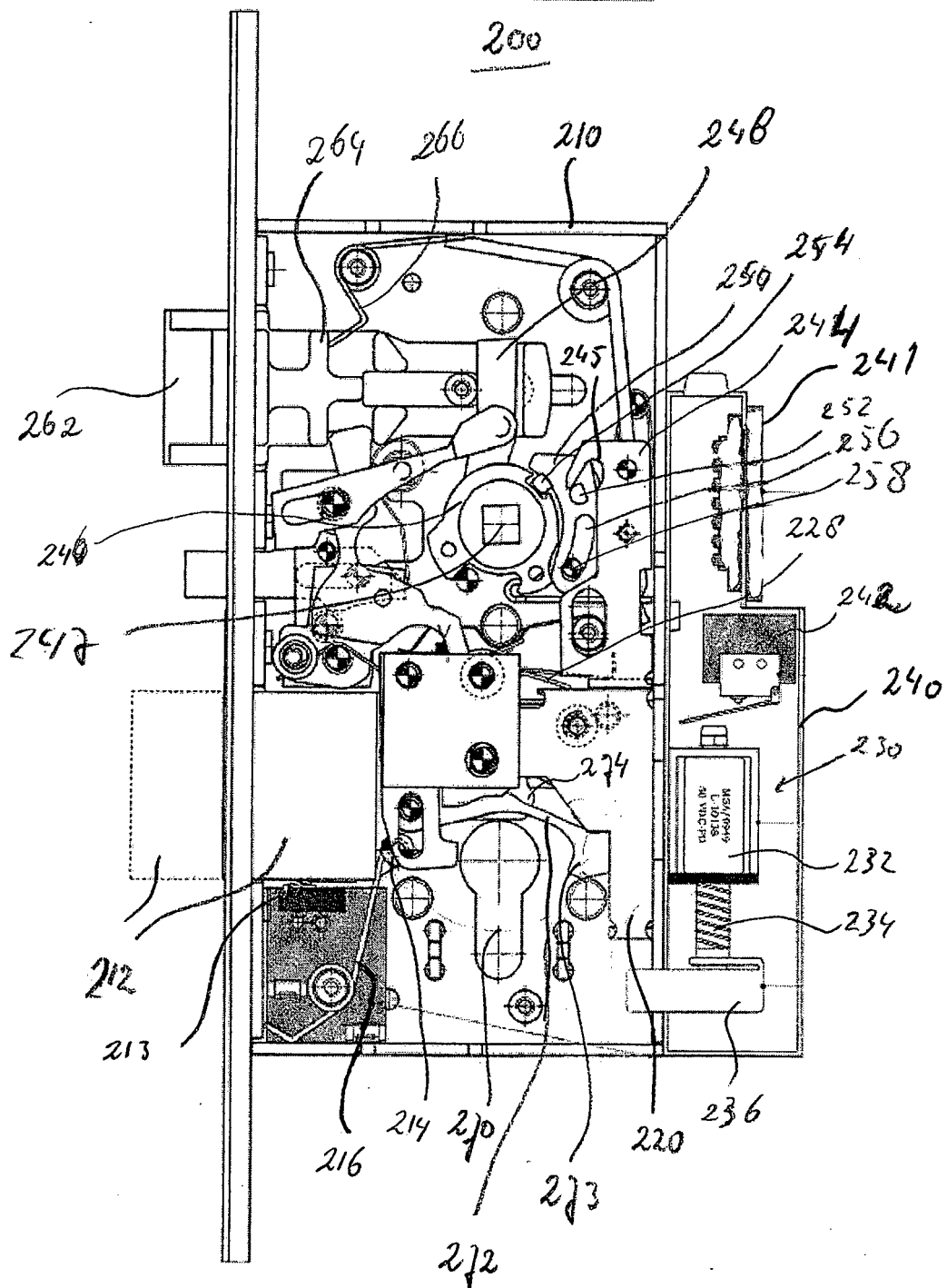


Fig. 2

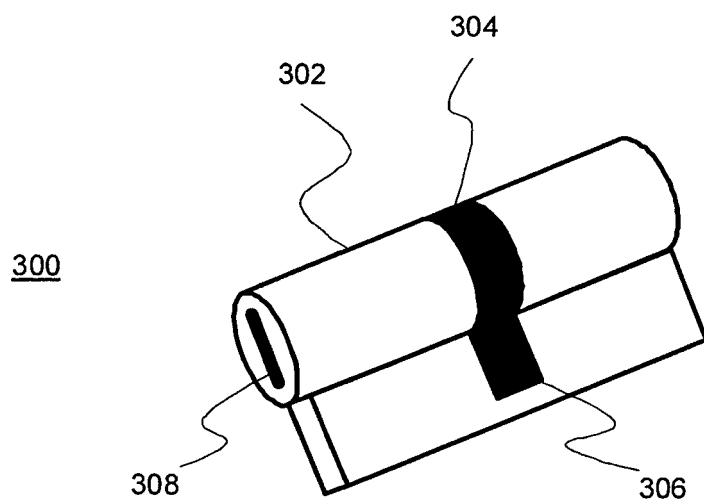


Fig. 3

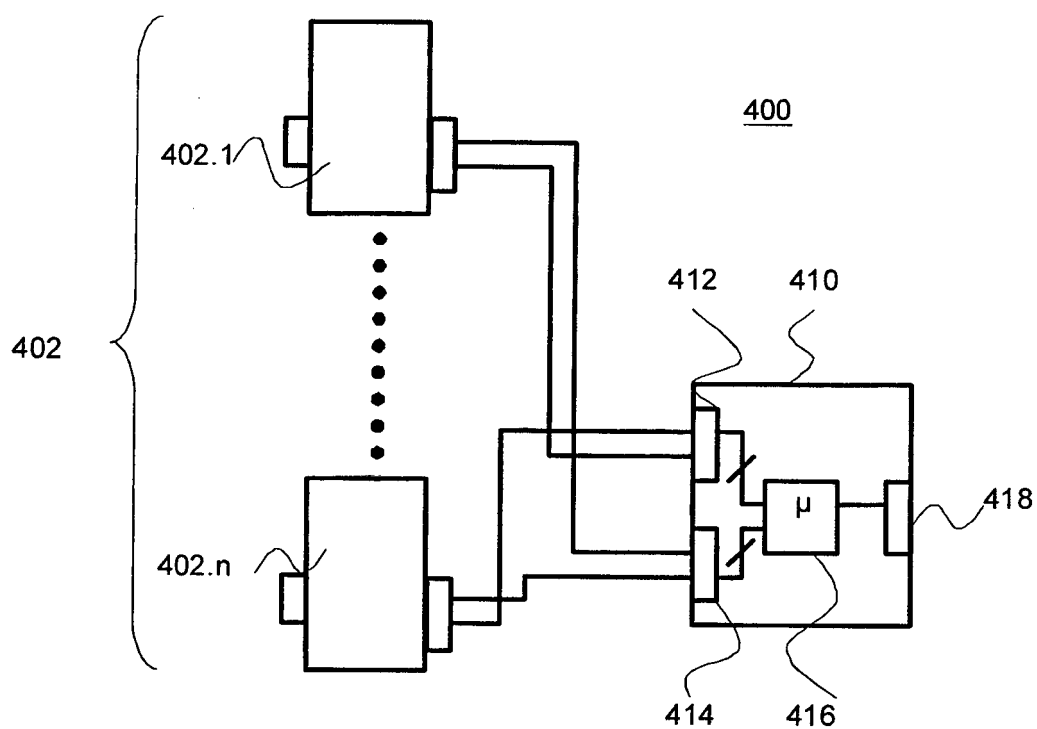


Fig. 4

REFERENCES CITED IN THE DESCRIPTION

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