



ELECTRICAL LOCK

BACKGROUND OF THE INVENTION

1. Field of the Invention

5 The present invention relates to an electrical lock, in which a dead bolt having been locked and therefore prevented from retracting from its extended locked position is capable of being released from its locked state by using electrical drive means.

2. Description of the Related Art

 In general, a conventional electrical lock comprises: unlock-code input means
10 for enabling a user to input an unlock code of the lock to the lock either by using a ten-key unit or by using a magnetic card key; a dead bolt which is extended outward from and retracted inward from an opening formed in a fore plate of a door either by a manual operation of manual means such as an interior-mounted thumb-turn or by manual insertion and rotation of a key in an externally accessed cylinder lock; and, a
15 latch bolt which is also extended outward from and retracted inward from another opening formed in the fore plate of the door by a manual turn of grip means such as a lever handle forming a door handle of the door. In a process for unlocking the lock; in a first step of the process, the dead bolt having been extended outward and locked is released from its locked position by using electrical drive means such as a solenoid, a
20 motor and like actuator which is controlled by the unlock-code input means; then, in a second step following the first step, the dead bolt is retracted from its locked position by using the above-mentioned manual means such as the thumb-turn and the like; and, lastly, in a third step following the second step, the latch bolt is retracted by using the above-mentioned grip means to permit the user to open the door.

25 In such a conventional electrical lock operated according to the above process, since the process for unlocking the conventional electrical lock comprises three process steps, the process is cumbersome in daily use of the lock. In other words, the conventional electrical lock is poor in operability. In order to improve the conventional electrical lock in operability, various types of attempts have, heretofore, been made in

the art. One of such attempts in the prior art is shown in Japanese Patent Publication No. Hei 6-43772, which discloses an electrical lock comprises: a dead bolt and a latch bolt both mounted in a lock box; a first working element, which is capable of being turned in forward and reverse directions by operation of an interior-mounted thumb-
5 turn so as to have the dead bolt extended and retracted, and is also capable of being turned in one direction by operation of an externally accessed cylinder lock so as to have the dead bolt extended; a plurality of links, through which the first working element is turned in forward and reverse directions; an elevating element, which permits grip means such as a lever handle and like door handle means to be rotated
10 so as to have the latch bolt retracted and further permits a second working element to be rotated in forward and reverse directions so as to have the elevating element moved up and down in a swinging manner; an interlocking unit, which is capable of swingably turning the elevating element in one direction on a pivot provided in an intermediate portion of the interlocking unit when a drive element incorporated in a
15 lock box is energized by a control signal issued from unlock-code input means which enables the user to input the unlock code to the lock; and, an engagement unit, which is brought into contact with both the elevating element and one of the links only when the elevating element is swingably moved in one direction.

In the conventional electrical lock having the above construction: when the
20 drive element is energized by the control signal or unlock code issued from the unlock-code input means, the elevating element is swingably moved by the interlocking unit so that the elevating element is engaged with one of the links through the engagement unit. Consequently, when the second working element is turned by using the door handle, the elevating element is moved up, so that the first working
25 element is swingably driven by the elevating element through the links to retract the dead bolt, whereby the conventional electrical lock is released from the door.

In this conventional electrical lock, since the latch bolt and the dead bolt are simultaneously retracted, this lock is considerably improved in operability but not improved in construction since the lock is still complicated in construction due to the

presence of its complicated interlocking mechanism, which increases the assembling cost of the conventional electrical lock in production. This is a problem inherent in the conventional electrical lock.

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SUMMARY OF THE INVENTION

Under such circumstances, the present invention was made to solve the problem inherent in the prior art.

Consequently, it is an object of the present invention to provide an electrical lock, which does not comprises any complicated interlocking mechanism and is
 10 capable of simultaneously retracting both a latch bolt and a dead bolt upon rotation of a door handle after the lock receives a control signal issued from unlock-code input means through which the user may input an unlock code of the lock to the lock. Therefore, the electrical lock of the present invention is capable of realizing a considerable cost reduction in assembling process of its components in production.

15 The above object of the present invention is accomplished by providing:

An electrical lock fixedly mounted on a door comprising, in combination:

a door handle (12) rotatably mounted in a main lock box (4) provided with unlock-code input means for inputting an unlock code;

20 a dead bolt (48) and a latch bolt (50) both mounted in a sub-lock box (34) disposed behind the main lock box (4);

a lock shaft (44) rotatably mounted in the sub-lock box (34) and disposed on an extension line of a handle shaft portion (14) of the door handle (12), wherein: the lock shaft (44) is provided with a drive hub portion (76) in its one side to permit the drive hub portion (76) to extend radially outwardly and a pivot hub portion (78) in it's
 25 the other side to permit the pivot hub portion (78) to extend radially outwardly; the drive hub portion (76) is engaged with an inner end portion of the dead bolt (48) to have the dead bolt (48) projected from and retracted from an opening (54) of a fore plate (35) of the door (46);

a first drive leg portion (18) and a second drive leg portion (20) both fixedly

mounted on a door handle shaft portion (14) of the door handle (12) to extend rearward from the main lock box (4) so as to be rotatably received in the sub-lock box (34) in an insertion manner, wherein each of the first drive leg portion (18) and the second drive leg portion (20) is disposed in each of opposite sides of the lock shaft (44);

5 a motor (10) fixedly mounted in the sub-lock box (34) to face the pivot hub portion (78) of the lock shaft (44), wherein the motor (10) is provided with an output shaft (82) to have the output shaft (82) connected with a rod screw (84), the motor (10) being energized by a control signal issued from unlock-code input means for inputting an unlock code;

10 a cam plate member (86) provided with a threaded hole (90) in its carrier portion (88), wherein: the carrier portion (88) is provided in a proximal end portion of the cam plate member (86); and, the cam plate member (86) is mounted inside the sub-lock box (34) in a manner such that the cam plate member (86) is linearly

15 movable and guided inside the sub-lock box (34);

a clutch lever (98) which is provided with a pressure arm portion (102) and pivotally connected with a front end portion of the pivot hub portion (78) of the lock shaft (44) through a pivot (100), wherein: when the cam plate member (86) is linearly moved forward and rearward by forward and reverse rotation of the rod screw (84),

20 the clutch lever (98) is swingably driven on the pivot pin (100) by the cam plate member (86) to have the pressure arm portion (102) of the clutch lever (98) separated from and brought into contact with a peripheral surface of the lock shaft (44);

a lever bias spring (106) for forcing the pressure arm portion (102) of the clutch lever (98) to be brought into contact with the peripheral surface of the lock shaft (44)

25 when the cam plate member (86) is in its rest position;

an interlocking lever (108) pivotally mounted inside the sub-lock box (34) through a pivot (110), wherein: the interlocking lever (108) is provided with a follower arm portion (109) and a pulling arm portion (112); and, the follower arm portion (109) and the pulling arm portion (112) are oppositely disposed from each other with

respect to the pivot (110) in a manner such that the follower arm portion (109) extends radially outwardly toward the lock shaft (44) and that the pulling arm portion (112) is engaged with an inner end portion of the latch bolt (50);

whereby a front end surface of the pressure arm portion (102) of the clutch lever (98), which abuts on the lock shaft (44), is pushed by the first drive leg portion (18), and the lower oblique surface of the follower arm portion (109) of the interlocking lever (108) is pushed upward by the second drive leg portion (20) when the door handle (12) is turned.

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BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects, advantages and features of the present invention will be more apparent from the following description taken in conjunction with the accompanying drawings in which:

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Fig. 1 is a front view of an electrical lock according to a first embodiment of the present invention;

Fig. 2 is a left side view of the electrical lock shown in Fig. 1;

Fig. 3 is a rear view of an essential part of the main lock box used in the electrical lock shown in Fig. 1;

Fig. 4 is a plan view of the main lock box shown in Fig. 3;

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Fig. 5 is a longitudinal sectional view of the electrical lock of the present invention, taken along the line A-A of Fig. 2;

Fig. 6 is a cross-sectional view of the electrical lock of the present invention, taken along the line B-B of Fig. 5;

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Fig. 7 is a cross-sectional view of the electrical lock of the present invention, taken along the line C-C of Fig. 5; and

Fig. 8 is a longitudinal sectional view of the electrical lock of the present invention, taken along the line D-D of Fig. 5.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The best modes for carrying out the present invention will be described in detail using embodiments of the present invention with reference to the accompanying drawings.

Figs. 1 to 8 show an embodiment of an electrical lock of the present invention. As is clear from Fig. 2, the embodiment of the electrical lock is fixedly mounted on a door 46 and comprises a door handle 12 constructed of a lever handle, which is rotatably mounted in a main lock box 4 provided with unlock-code input means for inputting an unlock code of the electrical lock. Now, hereinbelow, the remaining constituent elements of the electrical lock of the present invention will be described itemwise.

As shown in Fig. 2, a dead bolt 48 and a latch bolt 50 are movably mounted in a sub-lock box 34, which is disposed behind the main lock box 4. Rotatably mounted in the sub-lock box 34 is a lock shaft 44, which is disposed on an extension line of a handle shaft portion 14 of the door handle 12. As shown in Fig. 5, the lock shaft 44 is provided with: a drive hub portion 76 in one side of its peripheral surface to have the drive hub portion 76 extend radially outwardly; and, a pivot hub portion 78 in the other side of its peripheral surface to have the pivot hub portion 78 extend radially outwardly. The drive hub portion 76 of the lock shaft 44 is engaged with an inner end portion of the dead bolt 48 to have the dead bolt 48 projected from and retracted from an opening 54 of a fore plate 35 of the door 46.

As is clear from Fig. 4, a first drive leg portion 18 and a second drive leg portion 20 both fixedly mounted on the door handle shaft portion 14 of the door handle 12 to extend rearward from the main lock box 4 so as to be rotatably received in the sub-lock box 34 in an insertion manner, as shown in Fig. 2. Each of the first drive leg portion 18 and the second drive leg portion 20 is disposed in each of opposite sides of the lock shaft 44, as shown in Fig. 5.

A motor 10 shown in Fig. 5 is fixedly mounted in the sub-lock box 34 to face the pivot hub portion 78 of the lock shaft 44. The motor 10 is provided with an output shaft 82 to have the output shaft 82 connected with a rod screw 84, and is energized

on the basis of a control signal such as the unlock code issued from the unlock-code input means for inputting the unlock code of the electrical lock.

A cam plate member 86, which is shown in the bottom right-hand corner of Fig. 5, is provided with a threaded hole 90 in its carrier portion 88. The carrier portion 88 is provided in a proximal end portion of the cam plate member 86. The cam plate member 86 is mounted in the sub-lock box 34 in a manner such that the cam plate member 86 is linearly movable and guided in the sub-lock box 34.

A clutch lever 98, which is disposed adjacent to the cam plate member 86 in the same corner of Fig. 5, is provided with a pressure arm portion 102 and pivotally connected with a front end portion of the pivot hub portion 78 of the lock shaft 44 through a pivot pin 100. When the cam plate member 86 is linearly moved forward and rearward by forward and reverse rotation of the rod screw 84, the clutch lever 98 is swingably driven on the pivot pin 100 by the cam plate member 86 to have the pressure arm portion 102 of the clutch lever 98 separated from and brought into contact with a peripheral surface of the lock shaft 44.

A lever bias spring 106 is mounted on the pivot pin 100 to force the pressure arm portion 102 of the clutch lever 98 to be brought into contact with the peripheral surface of the lock shaft 44 when the cam plate member 86 is in its rest position.

An interlocking lever 108, which is disposed adjacent to the lock shaft 44 as shown in a substantially central area of Fig. 5, is pivotally mounted on the sub-lock box 34 through a pivot 110. The interlocking lever 108 is provided with a follower arm portion 109 and a pulling arm portion 112. The follower arm portion 109 and the pulling arm portion 112 are substantially oppositely disposed from each other with respect to the pivot 110 in a manner such that the follower arm portion 109 extends radially outwardly toward the lock shaft 44 and that the pulling arm portion 112 is engaged with an inner end portion of the latch bolt 50, as is clear from Fig. 5.

Since the electrical lock of the present invention has the above construction, a front end surface of the pressure arm portion 102 of the clutch lever 98 abuts on the lock shaft 44 and is pushed by the first drive leg portion 18. On the other hand, as

viewed in Fig. 5, a lower oblique surface of the follower arm portion 109 of the interlocking lever 108 is pushed upward by the second drive leg portion 20 of the door handle 12 when the door handle 12 is turned clockwise in Fig. 5.

As is clear from Figs. 1 and 2, the sub-lock box 34 is fixedly mounted in the interior space of the door 46 so as to be embedded therein or disposed adjacent to an inner wall of the fore plate 35 of the door 46. On the other hand, the main lock box 4 is fixedly mounted on a front surface of the door 46 in the vicinity of the fore plate 35. When the door 46 is locked to a stationary frame element 60 of the room, the dead bolt 48 and the latch bolt 50 extend outward, by a predetermined distance, from their corresponding openings 54 and 116, respectively. These bolts 48 and 50 are received in their corresponding receiver members 62 and 124 of the stationary frame element 60, respectively. In this locked condition, the cam plate member 86 stays in a position near the pivot hub portion 78 of the lock shaft 44 to have its first cam slope portion 92 brought into press-contact with the clutch lever 98. Due to this, in spite of the presence of a resilient biasing force exerted by the lever bias spring 106, the clutch lever 98 is capable of having its pressure arm portion 102 sufficiently separated from the peripheral surface of the lock shaft 44.

In a condition in which the pressure arm portion 102 of the clutch lever 98 is separated from the peripheral surface of the lock shaft 44, it is not possible for the first drive leg portion 18 of the door handle 12 to drive an upper end surface of the pressure arm portion 102 of the clutch lever 98. Due to this, it is not possible for the drive hub portion 76 of the lock shaft 44 to push back the dead bolt 48 into its rest position even when the door handle 12 is turned clockwise in Fig. 5.

Such clockwise rotation of the door handle 12 in Fig. 5 results in upward motion of the lower oblique surface of the follower arm portion 109 of the interlocking lever 108 through upward motion of the second drive leg portion 20 of the door handle 12. Although, at this time, there is a temporary and moment's retraction of the latch bolt 50 from its locked position, the door 46 remains locked since the dead bolt 48 keeps its locked condition. Consequently, even when an unauthorized person or

burglar grips the door handles 12 and tries to open the door 46 by turning the door handle 12, it is possible for the latch bolt 50 to return to its locked position under the influence of a resilient biasing force exerted by the bias spring 132 when the unauthorized person releases the door handle 12 from his hand grip.

5 In use, when an unlock signal is issued from the unlock-code input means such as the ten-key unit and a fingerprint identification unit, the motor 10 is energized in response to the unlock signal to rotate in one direction so that the rod screw 84 is rotatably driven by the output shaft 82 of the motor 10, whereby the cam plate member 86 is linearly driven in a direction away from the pivot hub portion 78 of the
10 lock shaft 44 by the motor 10 since the cam plate member 86 has the threaded hole 90 of its carrier portion 88 threadably engaged with the rod screw 84 driven by the output shaft 82 of the motor 10. Incidentally, the direction away from the pivot hub portion 78 of the lock shaft 44 to the right as viewed in Fig. 5 is a direction for unlocking the electrical lock of the present invention. Due to the above linear motion
15 of the cam plate member 86 in the direction away from the pivot hub portion 78 of the lock shaft 44 to the right-hand side of Fig. 5, the clutch lever 98 is rotatably driven counterclockwise under the influence of a resilient biasing force exerted by the lever bias spring 106. As a result, the pressure arm portion 102 of the clutch lever 98 reaches its rest position in which the pressure arm portion 102 abuts on the
20 peripheral surface of the lock shaft 44.

 In this rest position of the pressure arm portion 102 of the clutch lever 98, when the door handle 12 is rotated clockwise as viewed in Fig. 5, the first drive leg portion 18 of the door handle 12 abuts on the upper end surface of the pressure arm portion 102 of the clutch lever 98 to force the clutch lever 98 to rotate clockwise, so that the
25 lock shaft 44, which has its pivot hub portion 78 engaged with the clutch lever 98 through the pivot pin 100, is also rotated clockwise as viewed in Fig. 5, whereby both the dead bolt 48 and the latch bolt 50 are retracted from their corresponding openings 54 and 116 of the fore plate 35, respectively, to unlock the electrical lock of the present invention. More specifically, as for the dead bolt 48 in this unlocking operation,

the drive hub portion 76 of the lock shaft 44 is brought into press-contact with a second follower portion 70 of the dead bolt 48 due to clockwise rotation of the lock shaft 44 and forces the dead bolt 48 to be retracted from the opening 54. On the other hand, as for the latch bolt 50 in the unlocking operation, the lower oblique surface of the follower arm portion 109 of the interlocking lever 108 is brought into press-contact with the second drive leg portion 20 of the door handle 12 and forced to rotate counterclockwise on the pivot 110 as viewed in Fig. 5, so that the latch bolt 50, which has its rear end portion engaged with the pulling arm portion 112 of the interlocking lever 108 through the guide pin 122, is retracted from the opening 116. This enables an authorized person to open the door 46 by pulling the door handle 12 forward.

After the dead bolt 48 is retracted to reach its unlocked position, the motor 10 is energized again in response to another control signal issued from its control unit to rotate in a direction counter to the previous direction, so that the cam plate member 86 is linearly driven in a direction toward the pivot hub portion 78 of the lock shaft 44. In other words, the cam plate member 86 is moved to the left-hand side of Fig. 5. As a result of this leftward motion, the cam plate member 86 has its first cam slope portion 92 brought into press-contact with a cam projection 104 of the clutch lever 98 to rotate the clutch lever 98 on the pivot pin 100 clockwise as viewed in Fig. 5, so that the pressure arm portion 102 of the clutch lever 98 is moved away from the peripheral surface of the lock shaft 44 to reach its rest position.

In a closing operation of the door 46, there occurs a temporary and moment's retraction of the latch bolt 50 from its projected position at the end of the closing operation due to the presence of a wedged front surface in a projected end portion of the latch bolt 50. After completion of the closing operation of the door 46, the projected end portion of the latch bolt 50 is completely received in the latch receiver member 124 of the stationary frame element 60, as shown in Fig. 1. In a condition in which the door 46 is locked to the stationary frame element 60, when the door handle 12 is rotated counterclockwise as viewed in Fig. 5, the first drive leg portion 18 of the door handle 12 abuts on a root area of the drive hub portion 76 of the lock shaft 44 to

force the lock shaft 44 to rotate counterclockwise. This results in forward linear motion of the dead bolt 48. Such linear motion of the dead bolt 48 results in complete receipt of the projected end portion of the dead bolt 48 in the receiver members 62 of the stationary frame element 60, as shown in Fig. 1.

5 In the embodiment of the electrical lock of the present invention, the unlock-code input means is constructed of a ten-key unit 2. As is clear from Figs. 1 and 2, the ten-key unit 2 is fixedly mounted on an upper portion of the main lock box 4. On the other hand, a fingerprint identification unit 6 is fixedly mounted in an intermediate portion of the main lock box 4. When the authorized person is identified by means of
10 these units 2, 6, a confirmation signal is issued from these units to a control section 8 (shown in dotted lines in Fig. 1) of the main lock box 4. Upon receipt of such confirmation signal, the control section 8 of the main lock box 4 issues a control signal to a control unit (not shown) of the motor 10. Upon receipt of the control signal, the control unit of the motor 10 energizes the motor 10. As is clear from Fig. Fig. 1, the
15 door handle 12 constructed of the lever handle is rotatably mounted in a lower portion of the main lock box 4.

A U-shaped member 16, an intermediate portion of which is shown in dotted lines in Fig. 4, is fixedly mounted on an inner end portion of the door handle 12 by welding or any other fastening means such as screws and the like. As is clear from
20 Fig. 4, the U-shaped member 16 has a pair of its diametrically opposed leg portions formed into the first drive leg portion 18 and the second drive leg portion 20. As shown in Fig. 2, the door handle 12 is provided with the handle shaft portion 14. Axially formed in an inner end portion of this handle shaft portion 14 is a central axial hole 22. Rotatably received in the central axial hole 22 in an insertion manner is a
25 square shaft 24, which is provided with an annular groove 26 in its right-hand end portion as viewed in Fig. 2, wherein a stopper pin 28 is also shown in dotted lines. As is clear from Fig. 2, the stopper pin 28 has its upper end portion slidably received in the annular groove 26 of the square shaft 24 and its lower end portion press-fitted in a radial through-hole of a peripheral wall of a door handle mount. This door handle

mount is also shown in dotted lines in Fig. 2, assumes a cylindrical shape and fixedly mounted in the main lock box 4. Due to such provision of the stopper pin 28 in the door handle mount, the door handle 12 is prevented from being axially moved relative to door handle mount.

5 As is clear from Fig. 2, the square shaft 24 rotatably passes through a circular hole 32 (shown in Fig. 4) of a rear plate 30 of the main lock box 4 to extend rearward from the circular hole 32. Then, the square shaft 24 rotatably passes through a circular hole 38 of a front wall 36 of the sub-lock box 34 to rotatably enter the sub-lock box 34 and further rotatably enter a circular through-hole of a rear wall 72 of the sub-
10 lock box 34, as shown in Fig. 2. In this connection, as is clear from Fig. 3, a pair of diametrically opposing elongated arcuate through-holes 40, which are symmetric about a center of the circular hole 32, are formed in the rear plate 30 of the main lock box 4 together with the circular hole 32. The first drive leg portion 18 and the second drive leg portion 20 of the door handle 12 are loosely fitted in these elongated arcuate
15 through-holes 40 so as to be rotatable on the center of the circular hole 32 relative to the elongated arcuate through-holes 40. Similarly, as is clear from Fig. 5, a pair of diametrically opposing elongated arcuate through-holes 42, which are symmetric about a center of the circular hole 38, are formed in the front wall 36 of the sub-lock box 34 together with the circular hole 38. The first drive leg portion 18 and the second
20 drive leg portion 20 of the door handle 12 are loosely fitted in these elongated arcuate through-holes 42 so as to be rotatable on the center of the circular hole 38 relative to the elongated arcuate through-holes 42.

As shown in Figs. 1 and 2, the sub-lock box 34, which is fixedly mounted in the door 46, is disposed behind and adjacent to a lower half of the main lock box 4 in
25 parallel to the lower half in a manner such that the elongated arcuate through-holes 42 of the sub-lock box 34 are oppositely disposed from the corresponding elongated arcuate through-holes 40 of the main lock box 4 so as to be aligned in position therewith. The dead bolt 48 and the latch bolt 50 are disposed in parallel to each other and slidably received in the sub-lock box 34. As is clear from Fig. 6, the dead

bolt 48 is constructed of three pieces of metal plates, which are arranged in a multiplayer stack and combined with each other by means of a plurality of connecting pins 49. As shown in Fig. 2, the dead bolt 48 has its front-end locking portion 52 slidably inserted in the corresponding opening 54 of the fore plate 35 in the sub-lock box 34. As shown in Fig. 1, the dead bolt 48 is provided with a laterally elongated guide hole 56 in its intermediate portion. Loosely fitted in this guide hole 56 of the dead bolt 48 is a guide pin 58. This guide pin 58 is fixed to the sub-lock box 34 to permit the dead bolt 48 to slidably move back and forth relative to the sub-lock box 34. In locking and unlocking operations, the front-end locking portion 52 of the dead bolt 48 is engaged with and disengaged from the corresponding receiver members 62 of the stationary frame element 60, as shown in Fig. 1.

As is clear from Fig. 5, the dead bolt 48 is provided with a spring support pin 64. A toggle-joint spring 66 has each of its opposite end portions fitted on each of the spring support pin 64 of the dead bolt 48 and the guide pin 58 of the sub-lock box 34. Due to such arrangement of the toggle-joint spring 66, the dead bolt 48 is capable of steadily keeping its front-end locking portion 52 in each of its projected and therefore locked position and its retracted and therefore unlocked position under the influence of a resilient force exerted by the toggle-joint spring 66. As shown in Fig. 5, the first follower portion 68 and the second follower portion 70 both of the dead bolt 48 are formed in opposite inner walls of a concave portion formed in a lower surface of an inner end portion of the dead bolt 48. Another guide pin 138 is fixed to an inner end portion of the dead bolt 48, and slidably received in a laterally elongated guide hole 139 formed in the front wall 36 of the sub-lock box 34.

On the other hand, the lock shaft 44 is disposed on an extension line of the handle shaft portion 14 of the door handle 12, and rotatably supported between the front wall 36 and the rear wall 72 of the sub-lock box 34. These walls 36, 72 of the sub-lock box 34 are integrally combined with each other by means of a tubular fixing stud 37 and a screw 39. As shown in Fig. 5, the screw 39 is coaxially mounted in the stud 37, has its opposite threaded end portions pass through corresponding through-

holes (not shown) of both the walls 36, 72 of the sub-lock box 34 outward and threadably engaged with corresponding nuts (not shown) outside the walls 36, 72 of the sub-lock box 34. As is clear from Fig. 5, the lock shaft 44 is provided with a center through-hole 74, which extends in parallel with a longitudinal axis of the lock shaft 44.

5 Coaxially and Rotatably received in the center through-hole 74 of the lock shaft 44 is the square shaft 24. As is clear from Fig. 5, the lock shaft 44 is provided with: a central portion having the center through-hole 74; the drive hub portion 76; and, the pivot hub portion 78. Of these portions: the drive hub portion 76 obliquely extends radially outwardly from one side of the peripheral surface of the center portion of the

10 lock shaft 44, as shown in Fig. 5; and, the pivot hub portion 78 extends radially outwardly from the other side of the peripheral surface of the central portion of the lock shaft 44. In operation, the drive hub portion 76 of the lock shaft 44 abuts either on the first follower portion 68 of the dead bolt 48 or on the second follower portion 70 of the dead bolt 48 to push the dead bolt 48 in a manner such that the dead bolt 48 is

15 extended to the left-hand side (as viewed in Fig. 5) or retracted to the right-hand side (as viewed in Fig. 5) from the opening 54 of the fore plate 35 of the door 46.

The motor 10 is fixedly mounted inside the sub-lock box 34 by means of a fixing screw 80, a bracket 81 and a connecting screw 83, so as to be located in a position behind and under the pivot hub portion 78 of the lock shaft 44. As viewed in

20 Fig. 5, the motor 10 is provided with the output shaft 82. This shaft 82 horizontally extends rearward and coaxially connected with the rod screw 84 to rotate together with the rod screw 84 when the motor 10 is energized. The motor 10 is provided with its control unit (not shown). This control unit energizes the motor 10 upon receipt of the authorized person's confirmation signal issued from the unlock code input means

25 which enables the user to input the unlock code to the electrical lock of the present invention. On the other hand, the cam plate member 86 disposed over the motor 10 (as viewed in Fig. 5) is also mounted in the sub-lock box 34 and slidably and linearly guided therein so as to move back and forth relative to the motor 10. The cam plate member 86 has its carrier portion 88 bent at right angles so as to extend in a direction

perpendicular to a horizontal plain, as viewed in Fig. 5. Such carrier portion 88 of the cam plate member 86 thus bent at right angles is provided with the threaded hole 90 with which the rod screw 84 are threadably engaged. On the other hand, the cam plate member 86 is also provided with: the first cam slope portion 92 in its front end portion; and, the second cam slope portion 94 in its intermediate portion. In the cam plate member 86, its bent portion is disposed between the intermediate portion and the threaded hole 90 and formed into a cam shoulder portion 96, as shown in Fig. 5.

Pivotaly attached to a front end of the pivot hub portion 78 through the pivot pin 100 is the clutch lever 98. When the rod screw 84 is rotatably driven by the motor 10 in its forward or reverse direction to move the cam plate member 86 to the left or to the right as viewed in Fig. 5, the clutch lever 98 turns on the pivot pin 100 to have its pressure arm portion 102 brought into contact with or separated from the peripheral surface of the lock shaft 44. Formed in the proximal end portion of the clutch lever 98 is the cam projection 104, which extends downward as viewed in Fig. 5 and is pushed by the first cam slope portion 92 of the cam plate member 86 when the cam plate member 86 is moved forward to the left as viewed in Fig. 5.

Even when the cam plate member 86 reaches its rest position corresponding an unlocking position in which the cam plate member 86 is separated from the cam projection 104 of the clutch lever 98, the pressure arm portion 102 of the clutch lever 98 remains in press-contact with the peripheral surface of the lock shaft 44 under the influence of a resilient biasing force exerted by the lever bias spring 106. This bias spring 106 is preferably constructed of a torsion coil spring provided with a coil portion and opposite linear portions extending from opposite ends of the coil portion, where the coil portion is fitted to the pivot pin 100. One of the opposite linear portions of the lever bias spring 106 abuts on a peripheral surface of the lock shaft 44. On the other hand, the other of the opposite linear end portions of the lever bias spring 106 abuts on a root portion of the cam projection 104 of the clutch lever 98.

The interlocking lever 108 has opposite end portions of its pivot 110 fixedly mounted on the front wall 36 and the rear wall 72 of the sub-lock box 34, its follower

arm portion 109 horizontally disposed and its pulling arm portion 112 obliquely disposed as viewed in Fig. 5. The pulling arm portion 112 of the interlocking lever 108 has its front-side end portion curved. On the other hand, the latch bolt 50 permits its front-end latch portion 114 to be projected and retracted from the opening 116 of the sub-lock box 34. In the latch bolt 50, as shown in Fig. 5, its main body portion 118 is connected with its front-end latch portion 114 by means of a connecting screw 120 through a washer 121. The main body portion 118 of the latch bolt 50 is provided with the guide pin 122 in its inner end portion. As is clear from Figs. 5 and 7, opposite end portions of this guide pin 122 are mounted in opposite elongated guide slots 123 formed in opposite side surfaces of the sub-lock box 34 in a manner such that the guide pin 22 is horizontally sidable to the left and right in the elongated guide slots 123, as viewed in Fig. 5. In locking and unlocking operation, the front-end latch portion 114 of the latch bolt 50 is engaged with and disengaged from the latch receiver member 124 of the stationary frame element 60.

In construction, the pulling arm portion 112 of the interlocking lever 108 is engaged with a left-side peripheral surface of the guide pin 122. On the other hand, as shown in Figs. 5 and 7, a guide plate 126 is fixedly mounted in the sub-lock box 34, and received in a horizontally elongated slot 128 of the latch bolt 50 in an insertion manner. As is clear from Fig. 5, the horizontally elongated slot 128 has its left end portion formed into a spring receiving portion 130. Mounted between this spring receiving portion 130 and the guide plate 126 in the horizontally elongated slot 128 of the latch bolt 50 in an insertion manner is the latch bias spring 132, which is preferably constructed of a compression coil spring.

Mounted on a spring support pin 134 provided in an inner end portion of the dead bolt 48 is a hub bias spring 136, which is preferably constructed of a torsion coil spring. As shown in Fig. 5, the drive hub portion 76 of the lock shaft 44 is brought into press-contact with the first follower portion 68 of the dead bolt 48 under the influence of a resilient biasing force exerted by the hub bias spring 136. Fixedly mounted between the front wall 36 of the sub-lock box 34 and the rear wall of the same box 34

are both a stopper pin 140 for limiting rotation of the interlocking lever 108 and a stopper pin 142 for limiting rotation of the drive hub portion 76 of the lock shaft 44. Provided in the sub-lock box 34 are a first micro switch 144 and a second micro switch 146 both for detecting the cam plate member 86 in position.

5 The first micro switch 144 is provided with a first actuator lever 148, which is operated by the second cam slope portion 94 of the cam plate member 86. On the other hand, the second micro switch 146 is provided with a second actuator lever 150, which is operated by the cam shoulder portion 96 of the cam plate member 86. As shown in Fig. 7, the first actuator lever 148 and the second actuator lever 150 are
10 reversed in arrangement to each other. In operation, when the cam plate member 86 moves to the left as viewed in Fig. 5 to have the cam projection 104 of the clutch lever 98 pushed leftward by the first cam slope portion 92 of the cam plate member 86, the pressure arm portion 102 of the clutch lever 98 is separated from the peripheral surface of the lock shaft 44 to reach its rest position. When the pressure arm portion
15 102 of the clutch lever 98 reaches its rest position, the first actuator lever 148 of the first micro switch 144 is depressed to de-energize the motor 10.

On the other hand, when the cam plate member 86 is moved to the right as viewed in Fig. 5 to have the second actuator lever 150 of the second micro switch 146 depressed by the cam shoulder portion 96 of the cam plate member 86, the motor 10
20 is de-energized. As described above, an energizing period of time of the motor 10 in the electrical lock of the present invention is minimized. This contributes to a considerable reduction of noise in the electrical lock of the present invention. Consequently, the electrical lock of the present invention is excellent in quietness in operation.

25 As described above, in the electrical lock of the present invention: the drive hub portion 76 of the lock shaft 44 for driving the dead bolt 48 in a manner such that the dead bolt 48 is projected from and retracted from the opening 54 of the fore plate 35 is fixedly mounted on one side of the peripheral surface of the lock shaft 44 to extend radially outwardly; fixedly mounted on the other side of the peripheral surface

of the lock shaft 44 is the pivot hub portion 78 which extends radially outwardly; the handle shaft portion 14 of the door handle 12 is provided with the first drive leg portion 18 and the second drive leg portion 20 to have these leg portions 18, 20 disposed in opposite sides of the lock shaft 44, as shown in Fig. 5; the rod screw 84 is connected
 5 with the output shaft 82 of the motor 10, which is energized to rotate in forward and reverse directions on the basis of the control signal issued from the means for inputting the unlock code, so that the cam plate member 86 which has the threaded hole 90 of its carrier portion 88 threadably engaged with the rod screw 84 is linearly driven by the motor 10 to the left and right as viewed in Fig. 5; when the cam plate
 10 member 86 is in its rest position, the pressure arm portion 102 of the clutch lever 98 is brought into press-contact with the peripheral surface of the lock shaft 44 under the influence of the resilient biasing force exerted by the lever bias spring 106; and, when the lever handle 12 is turned by the user, the pressure arm portion 102 having been brought into press-contact with the peripheral surface of the lock shaft 44 is pushed
 15 by the first drive leg portion 18 of the door handle 12, and the follower arm portion 109 of the interlocking lever 108 is pushed by the second drive leg portion 20 of the door handle 12. Since the electrical lock of the present invention has the above construction, it is possible for the electrical lock of the present invention to operate both the latch bolt 50 and the dead bolt 48 simultaneously upon receipt of the unlock
 20 code issued from the means for inputting the unlock code. This makes it possible to unlock the electrical lock of the present invention through a single operation in an easy manner. Due to this, the electrical lock of the present invention is excellent in simplicity in operation, and therefore excellent in operability and in easiness in use.

In contrast with the conventional electrical lock employing a very complicated
 25 interlocking mechanism, the electrical lock of the present invention is simple in construction due to the lack of such complicated interlocking mechanism, and is therefore capable of considerably reducing its assembling cost in production.

Finally, the present application claims the Convention Priority based on Japanese Patent Application No. Hei 10-254298 filed on September 8, 1998, which is

herein incorporated by reference.

What is claimed is:

1. An electrical lock fixedly mounted on a door comprising, in combination:
 - a door handle (12) rotatably mounted in a main lock box (4) provided with means for inputting an unlock code;
 - 5 a dead bolt (48) and a latch bolt (50) both mounted in a sub-lock box (34) disposed behind said main lock box (4);
 - a lock shaft (44) rotatably mounted in said sub-lock box (34) and disposed on an extension line of a handle shaft portion (14) of said door handle (12), wherein: said lock shaft (44) is provided with a drive hub portion (76) in its one side to permit said
 - 10 drive hub portion (76) to extend radially outwardly and a pivot hub portion (78) in it's the other side to permit said pivot hub portion (78) to extend radially outwardly; said drive hub portion (76) is engaged with an inner end portion of said dead bolt (48) to have said dead bolt (48) projected and retracted from an opening (54) of a fore plate (35) of said door (46);
 - 15 a first drive leg portion (18) and a second drive leg portion (20) both fixedly mounted on said door handle shaft portion (14) to extend rearward from said main lock box (4) so as to be rotatably received in said sub-lock box (34) in an insertion manner, wherein each of said first drive leg portion (18) and said second drive leg portion (20) is disposed in each of opposite sides of said lock shaft (44);
 - 20 a motor (10) fixedly mounted in said sub-lock box (34) to face said pivot hub portion (78) of said lock shaft (44), wherein said motor (10) is provided with an output shaft (82) to have said output shaft (82) connected with a rod screw (84) and is energized on the basis of a control signal issued from means for inputting an unlock code;
 - 25 a cam plate member (86) provided with a threaded hole (90) in its carrier portion (88), wherein: said carrier portion (88) is provided in a proximal end portion of said cam plate member (86); and, said cam plate member (86) is mounted in said sub-lock box (34) in a manner such that said cam plate member (86) is linearly

movable and guided in said sub-lock box (34);

a clutch lever (98) which is provided with a pressure arm portion (102) and pivotally connected with a front end portion of said pivot hub portion (78) of said lock shaft (44) through a pivot (100), wherein: when said cam plate member (86) is linearly
 5 moved forward and rearward by forward and reverse rotation of said rod screw (84), said clutch lever (98) is swingably driven on said pivot pin (100) by said cam plate member (86) to have said pressure arm portion (102) of said clutch lever (98) separated from and brought into contact with a peripheral surface of said lock shaft (44);

10 a lever bias spring (106) for forcing said pressure arm portion (102) of said clutch lever (98) to be brought into contact with said peripheral surface of said lock shaft (44) when said cam plate member (86) is in its rest position;

an interlocking lever (108) pivotally mounted on said sub-lock box (34) through a pivot (110), wherein: said interlocking lever (108) is provided with a follower arm
 15 portion (109) and a pulling arm portion (112); and, said follower arm portion (109) and said pulling arm portion (112) are oppositely disposed from each other with respect to said pivot (110) in a manner such that said follower arm portion (109) extends radially outwardly toward said lock shaft (44) and that said pulling arm portion (112) is engaged with an inner end portion of said latch bolt (50);

20 whereby a front end surface of said pressure arm portion (102) of said clutch lever (98), which abuts on said lock shaft (44), is pushed by said first drive leg portion (18), and the lower oblique surface of said follower arm portion (109) of said interlocking lever (108) is pushed upward by said second drive leg portion (20) when said door handle (12) is turned.