

ELECTROMECHANICAL DOOR LOCK

The invention relates to an electromechanical door lock according to the preamble of claim 1.

A problem with electromechanical motor-operated door locks, which are also easily arrangeable for remote control, is to ensure the guiding and centralizing of the locking bolt into the opening in the striker plate located opposite to the bolt in the door jamb. For this purpose a lock body is additionally fitted with a latch urged by a spring to extend out from the lock body. The problem is then that the frictional forces from the lateral loading on the bolt and latch make it difficult to move these members back from their extended positions in the opening(s) of the striker plate into the lock body. Another aim, on the other hand, is to provide a lock body of such dimensions so as to fulfil norms set for the size of lock bodies, for example the German DIN norms. In that case in practice it is difficult to fit a sufficiently powerful electric motor into the lock body, which has the ability to simultaneously withdraw both the bolt and the latch inside the lock body. The suitability of the lock body for remote control is low in the case where the latch is always to be operated with separate manual operating means.

One solution to the problem mentioned above is presented in Finnish patent application No. 880953 (corresponding to EPA 87103206), according to which the bolt and latch of the lock are withdrawn into the lock body by means of an electric motor but at slightly different times, whereby the withdrawal phase of the bolt and of the latch respectively uses a different gear ratio in the mechanism between the electric motor and said lock parts. As a result this known arrangement has a complicated construction and, in addition, according to this solution the bolt has two different withdrawn positions within the lock body.

One aim of this invention is to eliminate the difficulties revealed by the known art and to resolve said problems in a new way. A further aim of the invention is at the same time to provide a lock body fitted with an electrically withdrawable bolt and which is well suited for remote control operation, has an uncomplicated construction, is reliable to operate and is also of compact dimensions so as to meet space requirements and norms for size.

The aims of the invention are achieved as described in the characterizing part of claim 1. In a construction according to the invention a known pivoted latch construction is employed in a new and advantageous way to solve the said problems. the exact construction and operating particulars of which are presented in British patent application 2203794A. By applying the known latch construction to an electrically operated door lock, a lock body is provided, in which the bolt is properly centralized by the latch, but in which the withdrawal of the latch does not require any separate operating means in the lock body. Specifically, if the bolt is first drawn into the lock body and the door is opened or shut with a push so that the latch presses against the striker plate, the striker plate at the same time presses the latch inwards into the lock body in the same way as a conventional latch bolt is forced to move into the lock body. The difference is however, that a conventional latch bolt can be pressed into the lock body in this way only when the door is shutting, whereas the bolt construction to be applied in the invention is additionally pressable in this way into the lock body when the door is opening.

A condition of the operation of the latch described above is naturally, that the dead-locking of the latch must first be freed. This can most advantageously be achieved by employing a force transmission unit moving at least substantially in the longitudinal direction of the lock body and which at the same time is arranged to release the

dead-locking of the bolt. In this way an uncomplicated construction is achieved for the lock body.

The force transmission unit can, in one extreme position, itself act advantageously as the means for dead-
5 locking the bolt. In that case the movement of the force transmission unit from the dead-locked position of the bolt to a second extreme position can be arranged simultaneously to achieve effectively the withdrawal of the bolt into the lock body.

10 The releasing of the latch from its dead-locked mode is most effectively arranged at the final stage of the withdrawal of the bolt into the lock body, preferably when the bolt is completely removed from the opening in the striker plate. In this way the frictional forces acting
15 on the sides of the bolt are advantageously eliminated.

To guard against non-operation due to possible electrical failure or to allow emergency operation, the lock body is preferably fitted with means defining operating axes for provision of key operation and for handle or
20 turning knob use. These means can be arranged to actuate the force transmission unit so that it moves the bolt into its unlocked position.

Both from the viewpoint of space requirements and production techniques an advantageous solution is achieved
25 when the force transmission unit comprises one functionally uniform, plate-like member. Depending on the requirements set for the dimensions of the lock body, the force transmission unit can in practice be one piece, but it can if necessary also be made of several parts, which are however
30 joined together so that they form one functional entity.

The invention will be further described, by way of example, with reference to the following annotated drawings, in which :-

Figure 1 is a side view of one embodiment of lock body according to the invention with the casing largely removed and in which the bolt and latch of the lock are shown in the locked position with the door closed. and

5 Figure 2 shows the lock body of Figure 1 with the bolt and latch in their corresponding positions when the door is open.

In the drawings the reference numeral 1 indicates a lock body, which is mounted in a door 36 and which has a front plate 2. In the lock body is a dead bolt 3, which is pressed by a spring 5 into its extended, locked position. and a latch 4, which a spring 6 presses out of the lock body. The latch 4 comprises a stop 35 and a body part 4c which are movable inside the lock body and to which an end part extending outside the lock body is pivoted so as to be turnable around an axis extending in the longitudinal direction of the lock body. The end part of the latch comprises, in the embodiment illustrated, two separate wedge-shaped outwardly tapering pieces 4a and 4b, but as well the end part could be formed from only one wedge shaped end member pivoted to the body part 4c as is presented in the previously mentioned British patent application 2203794A.

The lock body also includes an electric motor 7, which by means of force transmission means 8, 9 and 10 is arranged to act upon an arm 12 in a force transmission piece 11 movable in the longitudinal direction of the lock body. The force transmission piece 11 also includes a control slot 14, which is in cooperation with a control pin 13 of the bolt 3 for withdrawing the bolt. The control slot 14 is so shaped, that in the extreme position shown in Figure 1 it will at the same time dead-lock the bolt 3 by means of the control pin 13 when in the extended position (see Figure 1).

The lock body is also fitted with dead-locking means 15 for the latch 4 and a spring 16, which presses the dead-locking means 15 into the dead-locked position against a stop face 17 of the body part 4c of the latch.

5 The lock body is further fitted with an auxiliary bolt 19, which is urged by a spring 20 to project from the lock body. In the mode shown in Figure 1 the auxiliary bolt 19 is pressed in against a striker plate 18, which is positioned in a door jamb 37 or the like frame construction
10 arranged for the door and relative to which the door is turnable. The auxiliary bolt 19 is provided with a stop face 21, which when the bolt 3 is in the withdrawn position, coacts with a stop 22 of the force transmission piece 11 thus preventing the force transmission piece 11 from
15 moving downwards in Figure 2 and at the same time preventing the bolt 3 from moving outwards into its locked position.

In the situation shown in Figure 1, the bolt 3 and latch 4 are dead-locked in their extended locked positions,
20 when the door is locked. When the electric motor 7 has, with the aid of force transmission means 8, 9, 10, moved force transmission piece 11 to the position shown in Figure 2, the slot 14 in the force transmission piece has at the same time moved the bolt 3 into its withdrawn position by
25 means of the control pin 13. At the same time a guide surface 31 of force transmission piece 11 has moved the dead-locking means 15 for the latch 4 into the unlocked position. In that case the door can be opened with a push, as the end part of latch 4 presses against the edge of the
30 opening in the striker plate and, at the same time, it turns a little about its pivot axis, and as a consequence thereof, the latch is pressed against the force of spring 6 into the lock body. It is important to mention that only piece 4a turns in this case, as piece 4b is already in the
35 position in which it can be pressed inside the lock body as

a latch bolt.

When the door is pushed past the striker plate 18, the situation shown in Figure 2 arises. In this case the spring 6 pushes the latch 4 again into its position extending from the lock body and at the same time the end piece 4a turns under the influence of the spring 6 as the stop 35 moves back to its original position. In the same way, the auxiliary bolt 19 moves to its extended position under the influence of the spring 20 so that the stop face 21 of the auxiliary bolt 19 is situated below the stop 22 of the force transmission piece 11 thus preventing the force transmission piece 11 from moving downwards in Figure 2 and at the same time moving the bolt 3 into its locked position outside the lock body.

The motor 7 can, in a known manner, be programmed after a certain delay to move the force transmission means 8, 9, 10 back into its position shown in Figure 1. When the door is then pushed shut, the latch 4 and auxiliary bolt 19 strike against the edge of the striker plate 18, which pushes both of them into their withdrawn positions. It is important to point out that in this case only the end piece 4b turns because the piece 4a respectively is already in its yielding position. In that case the stop face 21 of the auxiliary bolt 19 moves away from under the stop 22 of the force transmission piece 11 thus freeing the force transmission piece 11 to move back into the position shown in Figure 1. As soon as the latch 4 is positioned opposite the opening in the striker plate, the spring 6 presses the latch 4 out of the lock body and the bolt 3 moves under pressure of the spring 5 to its extended position into its own opening in the striker plate 18. In its extended position the latch 4 at the same time centres the door in position relative to the striker plate 18. As is shown in Figure 1 the auxiliary bolt 19 is pressed against the striker plate 18, because there is no opening provided in the striker plate for the auxiliary bolt 19.

As a precaution against electrical failure, malfunction of the electric motor or for emergency operation, the lock body is fitted with means defining operating axes 23 and 27. At operating axis 23 there is a follower 24 arranged to be turnable against the force of a spring 26 by means of a handle, turning knob or similar on the inside of the door. With the aid of a control pin 25 of force transmission piece 11, the follower 24 can independently move the force transmission piece 11 upwards in the Figures to the opening mode of the bolt 3. In that case the door can always be opened by pressure from the inside. Particularly in cases when a handle is used as the operating means, the spring 26 will ensure that the handle will remain level when not in use.

Correspondingly operating axis 27 is surrounded by key operable means, for example a cylinder lock, the force transmission member of which is arranged to act on the force transmission piece 11 through a stop 32 thereof so as to push the bolt 3 in a corresponding way into its free position in the lock body.

The lock body is also fitted with micro switches 28 and 29, which are arranged to operate in cooperation with the control pins 33 and 34 of force transmission piece 11. Because the movements of force transmission piece 11 also affect the position of the bolt 3, in this way the state of the bolt and the lock can be detected unambiguously. This information can be fed to a control unit 30, which can be arranged to control the operation of the motor 7. In this way the lock can be easily arranged for remote control in a way known as such.

Control unit 30 can be situated either in the lock body itself or, by means of leads, outside the lock body as required. As is again illustrated in Figure 1 the lock body is also equipped for external power supply.

The invention is not limited to the embodiment described and illustrated. since several modifications thereof are feasible within the scope of the following claims.

CLAIMS

1. An electromechanical door lock, which comprises a lock body, in which is a dead bolt which can be dead locked in a position protruding from the lock body and electrical-
5 ly withdrawn into the lock body, a latch which is spring loaded to protrude from the lock body and which centralizes the dead bolt in an opening in a striker plate arranged for the door lock, and force transmission means for transmitting force from an electrical operating device to
10 the dead bolt, characterised in that said latch includes in a way known as such a body part movable inside the lock body and a wedge-shaped piece protruding at least partly from the lock body when the latch is in the protruding position and being connected to the body part in a manner
15 permitting pivotal movement of the wedge-shaped piece relative to the body part so that the latch can be pressed inside the lock body when a force acts on said wedge-shaped piece from either side of the lock body in the direction of the door opening or closing, that the lock body includes
20 separate dead-locking means for the latch, arranged to prevent the latch being moved inside the lock body, and that said force transmission means includes a force transmission unit movable at least substantially in the longitudinal direction of the lock body, the transmission
25 movement of which is arranged to release the dead-locking of both the dead bolt and the latch.

2. A door lock according to claim 1, characterized in that said force transmission unit is in one extreme position arranged to achieve the dead-locking of the bolt.

30 3. A door lock according to claim 2, characterized in that moving said force transmission unit from its position dead-locking the bolt into its other extreme position is at the same time arranged to withdraw the bolt into the lock body.



4. A door lock according to any preceding claim, characterized in that the releasing of the latch from the dead-locked mode is arranged to be achieved only at the last stage of the withdrawal of the bolt into the lock
5 body.

5. A door lock according to claim 4, characterized in that the releasing of the latch from the dead-locked mode occurs when the bolt is completely removed from the opening in the striker plate.

10 6. A door lock according to any preceding claim, characterized in that the lock body includes means located at an operating axis for provision of key operation so that the movement of said force transmission unit into the position releasing the bolt is achievable also by means of
15 a key.

7. A door lock according to any preceding claim, characterized in that the lock body includes a follower located at a further operating axis which follower is turnable by a knob, handle or the like for moving said
20 force transmission unit into the position releasing the dead bolt.

8. A door lock according to any preceding claim, characterized in that the bolt is spring loaded in a known way towards its outwardly extended, locked position, and
25 that the lock body is fitted with an auxiliary bolt, which in the withdrawn position of the bolt is arranged to prevent the bolt from moving to its locked position, by means of said force transmission unit.

9. A door lock according to any preceding claim,
30 characterized in that said force transmission unit comprises at least one plate-like member, which is fitted with force transmission and control means for said dead-locking



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operations. as well as means for separately achieving opening movement of the bolt by means of the electric operating device, by a key and/or a handle or turning knob.

10. An electromechanical door lock substantially as
5 hereinbefore described. with reference to and as illustrated in, the accompanying drawings.
