

DOOR LOCK

The invention relates to a door lock.

Door locks have to meet different requirements and objects in accordance with their place of employment, for instance a fire-door, staircase door or an office door, and the situation of operation, e.g. day-time operation or night-time operation. Thus, there can be a requirement for instance that from one side it is possible to open the lock only by key and from the other side either by key or alternatively by a handle or a turn knob. Another requirement can be that the lock should be provided with dead-locking possibility, whereby there are several options available as to how to set the lock into a dead-locked position and how to cancel the dead-locking.

15 Certain inconsistency is caused on one hand by the security requirements set for passage through a door and on the other hand by the needs for effortless passage as well as operation of the lock in certain places of employment especially in a day-time operation situation. Then there may be a desire that locking can be caused and withdrawn also through remote-control for different situations of operation, and additionally so that the bolt need not be separately removed by means of an actuating device or an operation device and, notwithstanding, the door could be opened, if desired, for instance simply through a pushing or drawing action. One solution for this kind of locking situation is offered by electrically controlled striking plate devices for locks in combination with a door lock provided with a latch bolt. According to these solutions a striking plate for the door lock, installed at the door frame, is provided with a stop member, which can be moved, under the control for instance of a solenoid, between a locked and a yielding position. In the yielding position of the stop member, the door can be pushed open although

the latch bolt is in its protruding position out from the lock body. When the door is closed, the bevelled surface of the latch bolt hits the striking plate in a normal way, which presses the latch bolt into its retracted position in the lock body. Then the door can be shut and the latch bolt resumes its protruding, locked position urged by spring means.

The electrically controlled striking plate arrangement is troublesome to install at certain places of employment and especially as a replacement installation. The arrangement is rather expensive as well, for in many places of employment, irrespective of providing an electrically controlled striking plate unit, a door lock provided with versatile options for operation, such as key operation and dead-locking possibility, needs to be installed to the door as well.

One aim of the invention is to create a novel and favorable arrangement, which is especially well adapted to the locking situation described above and from which the drawbacks in the prior art have been eliminated. A further aim of the invention is to create such a basic arrangement for a door lock, that can with advantage be adapted to several different places of employment and situations of operation and which is uncomplicated as to its construction and reliable to operate.

The aims of the invention are met with the door lock defined in the claim 1 and in the subclaims.

According to the present invention, there is provided a door lock comprising a lock body provided with a front end having a longitudinal axis and including a latch bolt, which is movable between a retracted position and a protruding position where it extends out from the lock body through an opening in the front end and which latch bolt is urged by spring means towards the protruding position.

latch bolt comprising a body member and a separate latch bolt member having an outer edge and being pivotally mounted on the body member remote from the outer edge so as to be turnable substantially about an axis parallel to the longitudinal axis of the front end and narrowing down in a wedge-like manner towards the outer edge, and dead locking means turnable from a passive position into a dead locking position, wherein the dead locking means are supported on the lock body so that in the dead locking position they prevent removal of the latch bolt from its protruding position into its retracted position, and, in the passive position, the latch bolt member is turnable about its pivotal mounting such that, in use, the latch bolt is movable from its protruding position to its retracted position using turning of the latch bolt member about its pivotal mounting if necessary to allow the door to be opened by movement in either direction.

Using the door lock of the present invention, the door can be opened simply by pushing in

either direction when the dead locking means are in their passive position. On the other hand unwanted passage through the door can be prevented by moving the dead locking means into the dead locking position.

5 The latch bolt member is favorably provided with guiding members extending substantially in the longitudinal direction of the latch bolt and being supported on opposite sides of the body member of the latch bolt in the direction of the turning axis of the latch body member. In practice
10 an arrangement with smooth operation has proved to be one wherein the latch bolt member comprises, in the direction of its turning axis, two separate parts independently turnable with respect to each other.

It is of advantage to provide said guiding members of
15 the latch bolt member with a protrusion, extending, in the direction of the turning axis of the latch bolt member, outwards from the latch bolt and including a stop surface arranged to cooperate with the front end for guiding the turning movement of the latch bolt member and for defining
20 the protruding length of the latch bolt out from the lock body. Thereby, when a spring urges the latch bolt outwards, said stop surface causes the latch bolt member or the parts thereof to turn into a certain basic position.

The body member of the latch bolt is favorably
25 designed such that it defines an inner space, which in the direction of the turning axis of the latch bolt member is open at the upper and lower ends thereof. Thus the lock can more easily be provided with additional functions, which may require that members on opposite sides of the
30 body member of the latch bolt in the direction of the said turning axis be operationally connected with respect to each other.

Both the body member of the latch bolt and the latch bolt member are with advantage provided with stop surfaces

arranged to co-operate with respect to each other so as to limit the turning range of the latch bolt member with respect to the body member of the latch bolt such that in the end positions of the turning range either one of the side surfaces of the bevelled latch bolt member is substantially parallel with the longitudinal axis of the latch bolt.

The dead locking means include favorably a dead locking member, for instance a lever, turnably supported in the lock body and co-operating, in its dead locking position, with said protrusion in the guiding member of the latch bolt member. The dead locking member can with advantage be urged by a spring towards its dead locking position, and the lock body can be provided with an operation device, for instance solenoid means, for moving the dead locking member against the force of said spring into its passive position and, thus, for freeing the latch bolt to be moved into its retracted position in the lock body. Thereby dead locking can with ease be set and withdrawn also under remote-control and the door lock itself be set for day-time or night-time operation.

For different places of employment it is of advantage to provide the door lock according to the invention with an operating axis, at which can be installed operation devices, for instance a key operated locking mechanism, a handle, a turn knob, or the like, and force transmission means, by means of which, by making use of an operation device installed at the operating axis, the dead locking member is movable away from its dead locking position. Said force transmission means can then favorably include a force transmission lever, which is turnably supported in the lock body, and is located partly in the inner space of the body member of the latch bolt, and is arranged in force-transmitting connection with the body member of the latch bolt for withdrawing the latch bolt and is simultaneously further arranged, through its turning movement,

to remove the dead locking member. Thus the door lock according to the invention can be used in a controlled way also when the dead locking means are activated, for instance when the lock has been set for night-time operation.

In practice it is of advantage to provide the door lock with an auxiliary bolt having a bevelled end, being reciprocatingly movable in a known way, and arranged to prevent, in its position protruding out from the lock body, the removal of the dead locking member into its dead locking position.

The invention will now be described in more detail with reference to the accompanying drawings, in which

Figure 1 shows an embodiment of a door lock according to the invention with the lock body opened and the dead locking means in a dead locking position,

Figure 2 shows the door lock of Figure 1 with the dead locking means in a passive position,

Figures 3a and 3b show an enlarged view of the latch bolt of the door lock according to Figures 1 and 2 viewed from one side and from above,

Figures 4a and 4b show another embodiment of a latch bolt for a door lock according to the invention viewed from one side and from above, and

Figures 5a and 5b show the latch bolt of Figures 3a, 3b in two operating positions.

In the drawings the reference numeral 1 indicates a lock body, which includes a front end 2 having a longitudinal axis, (shown dotted at A-A in Figure 1). The lock body is provided with a latch bolt 3, which is movable

between a protruding, locking position and a retracted position in the lock body through an opening 2a in the front end. The lock body includes guiding members 4 for guiding the movements of the latch bolt 3. Openings 37 and a supporting sleeve 38 are available to fix a lock cover 1a to the lock body 1. To provide dead locking operation for the latch bolt 3 the lock body comprises a dead locking lever 6 turnably journaled to a pivot pin 5, an auxiliary bolt 7, a spring 8 urging the auxiliary bolt out from the lock body, solenoid means 9, a setting member 10 connecting the solenoid means 9 to the dead locking lever 6, and a spring 11, which through the setting member 10 is adapted to press the dead locking lever 6 into its dead locking position. In the drawing remote controlled activation and deactivation of the solenoid means 9 is shown only schematically with a circuit 12 and a switch 13.

The lock body is also provided with an operating axis 14, at which can be installed on both sides of the lock body, depending on the place of operation, alternatively for instance a key operated lock mechanism, a handle, a turn knob, or the like (these are not shown in the drawings). From these operating devices the latch bolt 3 can be withdrawn from its protruding position into the lock body through means, which include a turnable force transmission member 15, a reciprocatingly movable force transmission plate 16 positioned in a transversal groove thereof and being provided with a force transmission pin 17, and, turnably journaled to a pivot pin 18, a force transmission lever 19 comprising a guiding groove 22 and including a force transmission pin 20 acting on the latch bolt 3. Guiding surfaces 21 in the groove of the force transmission member 15 transform the turning movement of the member 15 into a linear movement of the force transmission plate 16, and this linear movement is further transformed, through the pin 17 of the plate 16 and the guiding groove 22 of the force transmission lever 19, into a turning movement of the lever 19.

Thus the latch bolt 3 is withdrawn into the lock body by means of the force transmission pin 20. In addition to this also the returning of the latch bolt out from the lock body into the protruding position is accomplished through the force transmission pin 20. Therefore the lock body is provided with a spring 23, which acts on the force transmission pin 20 urging the force transmission lever 19 to turn in the clockwise direction in Figures 1 and 2.

The construction of the latch bolt 3 for a door lock according to the invention is more precisely disclosed in Figures 3a and 3b as well as 4a and 4b. The latch bolt comprises two basic parts: a body member 3a and a wedge-like latch bolt member 3b turnably supported thereto on a shaft 24 and extending out from the lock body when the latch bolt is in its locking position. The turning axis of the member 3b relative to the body member 3a lies parallel to the axis A-A. The body member 3a is formed such that it confines an inner space 25, which is open from the upper and from the lower side thereof and in which the force transmission lever 19 is partly arranged, as is apparent from Figures 1 and 2. In addition the body member 3a is provided with side openings 26 for the force transmission pin 20.

The latch bolt member 3b includes guiding members 27 and 28. These are provided with protrusions 29 and 30, which for their part include stop surfaces 31 and 32, which cooperate with the inner surface of the front end 2 of the lock. In addition the protrusion 30 of the guiding member 28 co-operates with the dead locking lever 6 for providing dead locking. As is apparent from Figures 4a and 4b, the latch bolt member 3b can alternatively comprise two mutually independently turnable parts 3'b and 3''b.

The latch bolt member 3b as well as the parts 3'b and 3''b are also provided with stop surfaces 41, 41' and 41''

respectively. These are arranged to co-operate with a stop surface 40 in the body member 3a for the purpose of limiting, possibly together with the side surfaces (not shown in the drawings) in the opening 2a of the front end 2, the turning range of the latch bolt member with regard to the body member of the latch bolt. Additionally these stop surfaces assist in pressing the latch bolt into the retracted position in the lock body when the door is turned and the latch bolt meets an obstacle, as is more clearly described below. Finally these stop surfaces make the arrangement according to the invention sturdy and able to resist efforts to break up the latch bolt by force.

The operation of the latch bolt and of the dead locking means of the door lock shown in the drawing is as follows. With reference to Figure 1, when the switch 13 is open and hence the circuit 12 is not connected, the solenoid means 9 is in a passive condition. Thereby the spring 11 presses, through the setting member 10, the dead locking lever 6 into its dead locking position, in which it co-operates with the protrusion 30 in the guiding member 28 of the latch bolt member 3b. In this event the latch bolt 3 can be withdrawn into the lock body only by means of operating devices installed at the operation axis 14. When this occurs, the force transmission lever 19 turns in the counter-clockwise direction according to Figure 1 and at the same time presses the dead locking lever 6 into a position in which it allows the latch bolt 3 to be removed into the lock body 1. Simultaneously the setting member 10 moves downwards in Figure 1 against the force of the spring 11. The spring 8 urges the auxiliary bolt 7 outwards from the lock body, but when the door is closed, a striking plate 39 in the door frame prevents outward movement of the auxiliary bolt. The movements of the auxiliary bolt 7 are guided by a guiding pin 35 and a guiding groove 36 formed in the lock body 1.

When latch bolt 3 is entirely withdrawn into the lock

body and the door has been pushed open past the striking plate 39, both the latch bolt 3 and the auxiliary bolt 7 move, urged by the springs 23 and 8 respectively, into the protruding position according to Figure 2. At the same time the pin 33 of the auxiliary bolt 7 engages a step 34 in the setting member 10 thereby preventing the spring 11 and the setting member 10 from moving the dead locking lever 6 into its dead locking position, because the latch bolt 3 being in its outer, protruding position the protrusion 30 and the force transmission lever 19 no longer prevent the dead locking lever 6 from entering into the dead locking position. Hence, when the door is being shut and the bevelled surface of the latch bolt 3 hits the striking plate 39 in the door frame, the latch bolt 3 is free to move, pressed by the striking plate 39, into the lock body 1 and the door can be closed. At the same time also the auxiliary bolt 7 is pressed into the lock body and the pin 33 of the auxiliary bolt, respectively, moves away from the step 34. Thus, the spring 23 again having removed the latch bolt 3 out from the lock body into the latch opening in the striking plate 39 and the solenoid means 9 still being in the non-connected state, the spring 11 moves the setting member 10 upwards in the Figure, whereby the locking lever 6, respectively, moves again into the dead locking position shown in Figure 1.

In Figure 2, on the other hand, the switch 13 is closed and, consequently, the circuit 12 is connected. Hence the solenoid means 9 is in the active condition and arranged to draw, with the assistance of the setting member 10, the dead locking lever 6 away from its dead locking position into the position of Figure 2, in which the dead locking lever 6 remains as long as the circuit 12 is connected. In this event the door can be pushed or drawn open and shut in whichever direction thanks to the turnable and wedge-like latch bolt member 3b of the latch bolt 3 and due to the fact that the dead locking lever 6 allows the latch bolt 3 to be pressed into the lock body.

Figures 5a and 5b illustrate more precisely the operation of the latch bolt member 3b of the latch bolt 3. This operation is independent of whether the latch bolt member comprises one part as is shown in Figures 3a and 3b or two parts as is shown in Figures 4a and 4b. With reference to Figure 5a the stop surface 31 is normally pressed against the inner surface of the front end 2 of the door lock and defines the basic position of the latch bolt member 3b. When the door is turned in the direction of the arrow, the position of the latch bolt member 3b does not change when the latch bolt 3 meets an obstacle, i.e. a counter surface in the striking plate 39 located in the door frame, but the result is that said counter surface presses the latch bolt 3 into the lock body. On the other hand when the door is turned in the direction of the arrow in Figure 5b and the latch bolt meets an obstacle, the latch bolt member 3b turns from the position of Figure 5a to the position of Figure 5b and the latch bolt 3 moves simultaneously somewhat inwards into the lock body. In case the door is pushed further in the same direction, the latch bolt moves again entirely into the lock body. When the latch bolt 3, urged by its spring, again is allowed to move out from the lock body into its protruding position, the edge of the stop surface 31 is first to hit on the inner surface of the front end 2. Urged by the spring 23 the latch bolt member 3b then turns back into the basic position of Figure 5a, in which the entire stop surface 31 is pressed against the front end 2. The guiding operation of the stop surfaces 31 and 32 is naturally fully analogous.

On the basis of what is described above it is clear that in the latch bolt arrangement of Figures 4a and 4b, each time the latch bolt 3 meets an obstacle, i.e. the striking plate 39 for the lock, one of the latch bolt members 3'b or 3''b is already in the basic position as described above and the other 3''b or 3'b turns respective-

ly. Thus the operation of the latch bolt 3 according to this embodiment is equally smooth in either turning direction of the door.

Naturally, the latch bolt member 3b can be journalled
5 to the body member 3a in many different ways. For instance a separate stub shaft can be used, or one of said members can be provided with fixed pivot pins etc. Also the dead locking means and the operation thereof can be provided in many different ways in practice. Depending on the place of
10 operation, a retracting or an extending solenoid or for instance a small electric motor can be used. In the same manner the selection of operating devices to be installed at the operating axis and the fact, whether said operating devices can only move the dead locking member away from the
15 dead locking position or can simultaneously also move the latch bolt into the lock body, as well as the necessity of the whole operating axis depend on the place of operation.

Thus the invention is not restricted to the embodiments shown since several modifications are feasible within
20 the scope of the following claims.

CLAIMS

1. A door lock comprising a lock body provided with a front end having a longitudinal axis and including a latch bolt, which is movable between a retracted position and a protruding position where it extends out from the lock body through an opening in the front end and which latch bolt is urged by spring means towards the protruding position, the latch bolt comprising a body member and a separate latch bolt member having an outer edge and being pivotally mounted on the body member remote from the outer edge so as to be turnable substantially about an axis parallel to the longitudinal axis of the front end and narrowing down in a wedge-like manner towards the outer edge, and dead locking means turnable from a passive position into a dead locking position, wherein the dead locking means are supported on the lock body so that in the dead locking position they prevent removal of the latch bolt from its protruding position into its retracted position, and, in the passive position, the latch bolt member is turnable about its pivotal mounting such that, in use, the latch bolt is movable from its protruding position to its retracted position using turning of the latch bolt member about its pivotal mounting if necessary to allow the door to be opened by movement in either direction.

2. A door lock according to claim 1, in which the latch bolt member comprises, in the direction of its turning axis, two separate parts independently turnable with respect to each other.

3. A door lock according to claim 1 or 2, in which the latch bolt member comprises guiding members extending substantially in the longitudinal direction of the latch bolt and being supported on opposite sides of the body member of the latch bolt in the direction of the turning



axis of the latch bolt member.

4. A door lock according to claim 3, in which the guiding members of the latch bolt member comprise a protrusion extending in the direction of the turning axis of the latch bolt member, outwards from the latch bolt and including a stop surface arranged to co-operate with the
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front end for guiding the turning movement of the latch bolt member and for defining the protruding length of the latch bolt out from the lock body.

5. A door lock according to any one of the preceding claims, in which the body member of the latch bolt is designed such that it defines an inner space, which space, in the direction of the turning axis of the latch body member, is open at the upper and lower ends thereof.

6. A door lock according to claim 4 or 5, in which said dead locking means includes a dead locking member turnably supported to the lock body and co-operating, in its dead locking position, with said protrusion in the guiding member of the latch bolt member.

7. A door lock according to claim 6, in which the dead locking member is urged by a spring towards its dead locking position, and the lock body is provided with an operation device for moving the dead locking member against the force of said spring into its passive position and, thus, for freeing the latch bolt to be moved into its retracted position in the lock body.

8. A door lock according to any one preceding claim dependent on claim 5, including an operating axis, at which can be installed operation devices, and force transmission means, by means of which, by making use of an operation device installed at the operating axis, the dead locking member is movable away from its dead locking position allowing the latch bolt to be withdrawn into the lock body, said force transmission means includes a force transmission lever, which is turnably supported in the lock body, and is located partly in the inner space of the body member of the latch bolt, and is arranged in force-transmitting connection with the body member of the latch bolt for withdrawing the latch bolt and is simultaneously further arranged, through its turning movement, to remove the dead locking



member into its passive position.

9. A door lock according to any one preceding claim, in which an auxiliary bolt having a bevelled end is mounted in the lock body to be reciprocatingly movable between retracted and protruding positions and arranged to prevent, in its protruding position, the movement of the dead locking member into its dead locking position.

10. A door lock according to any one preceding claim, in which both the body member of the latch bolt and the latch bolt member are provided with stop surfaces arranged to co-operate with respect to each other so as to limit the turning range of the latch bolt member with regard to the body member of the latch bolt such that in the end positions of the turning range either one of the side surfaces of the bevelled latch bolt member is substantially parallel with the longitudinal axis of the latch bolt.

11. A door lock according to claim 6 or any claim dependent thereon, in which the operation device is a solenoid.

12. A door lock substantially as hereinbefore described with reference to Figures 1, 2, 3a, 3b, 5a and 5b or with reference to Figures 1 and 2 as modified by Figures 4a and 4b of the accompanying drawings.
