

Door lock

The invention relates to a door lock with a bolt and a mechanism for moving the bolt between a protruding locking position and a retracted unlocking position.

One way of breaking open a locked door, is to press
5 the bolt inwardly of the edge of the door with sufficient force to move the bolt back into the lock. Another way is to enlarge the slot between the door and the door frame in the vicinity of the bolt to such an extent that the bolt can leave the bolt-receiving housing in the
10 door frame. This last-mentioned way of breaking open a door can only be successful if the bolt is in no way locked in its housing in the door frame, and is thus free to move relative thereto.

The present invention seeks to improve the security
15 of a door lock by providing the bolt with a mechanism which locks the bolt to the door frame but which works in the same way as a normal door lock, that is, when the door is locked, the bolt prevents the door from swinging into an open position. The invention provides, in
20 a door lock, a mechanism in the bolt which makes it much more difficult, and desirably impossible, to force the bolt out of the bolt housing in the door frame.

It has previously been known to use (so called)
hook bolts. They are used in sliding doors to lock the
25 bolt to the door frame in the sliding direction of the door. Such a design is shown in German Patent Publication 425 971. In this case the bolt itself, or a part thereof, must perform a vertical movement to effect the locking, and this considerably complicates the construction of
30 the bolt and the bolt mechanism.

It is also known to use ball elements as locking members. US Patent Specification 4 015 456 discloses

a design, where a cylindrical locking member and the member to be locked move in the same direction. The unlocking of this known lock is a complicated operation requiring a special tool, and hence, this design is not applicable to door locks.

In padlock design it is common to use ball elements as locking members, but a major problem in applying ball-locking or similar solutions to door locks, relates to the moving of the balls into their locking and/or releasing position(s) at exactly the right moment with regard to the movements of the lock bolt. For an effective door lock design, this should happen without applying special additional operations.

According to the invention there is provided a door lock comprising a bolt and a mechanism for moving the bolt between a protruding locking position and a withdrawn unlocked position, the bolt being provided, in its protruding part, with at least one auxiliary locking element movable in a transverse duct in the bolt between a first position, in which it partly extends outside the sides of the bolt, and a second more retracted position, and with an operating means movable within the bolt, which operating means is arranged, during normal operation of the lock, to move the or each auxiliary locking element into its first position, as the bolt approaches its protruding locking position, and is arranged to allow the or each auxiliary locking element to move out of said first position towards the second position as the bolt moves towards its withdrawn unlocked position.

The invention thus provides a lock in which efficient locking is obtained in two directions perpendicular to each other.

In a preferred embodiment of the invention, two auxiliary locking elements are used in the door lock bolt, for instance, balls, pins or the like, which move symmetrically in relation to a longitudinal plane of the lock bolt. Preferably, each auxiliary locking element is made to protrude from a vertical side of the bolt.

If the bolt is very thin, it may be necessary to arrange each auxiliary locking element so that it protrudes from the upper or lower side of the bolt. This is a less favourable solution, because in the vertical direction
5 a greater clearance is usually needed between the housing in the door frame and the bolt.

For moving the or each auxiliary locking element, an operating means is used which preferably moves in the longitudinal direction of the bolt. The operating
10 means may have an oblique surface for each auxiliary locking element giving the element an outward movement, when the operating means moves longitudinally. Adjacent to the oblique surface, the operating means may have a portion extending in the longitudinal direction of
15 the bolt, which portion keeps each auxiliary locking element locked in its first position. When an inner portion of each auxiliary locking element is supported by this longitudinally directed surface of the operating means, the auxiliary locking element(s) cannot be forced
20 inwards.

Normal operation of the lock is employed for moving the operating means. The auxiliary locking element(s) is desirably positively guided into its first position(s), when the bolt reaches its protruding
25 locking position. One embodiment of lock in accordance with the invention is based on the use of a lever, pivotally journaled in the bolt. When the bolt approaches its protruding locking position, the lever engages a stationary portion of a case of the lock or the door.
30 This causes turning of the lever and this movement is transmitted to the rest of the operating means, which, due to the action of the lever moves longitudinally and pushes the auxiliary locking element(s) outwards into its/their first position. The lever can be positively
35 guided by the lock case so that, when the bolt starts its return movement, the lever forces the operating means

to retract from the position keeping the auxiliary locking element(s) in its/their first position, thereby allowing it/them to withdraw into the transverse duct in the bolt. The retraction of the operating means can also be effected
5 or assisted by a spring.

In place of a lever for moving the operating means, other elements, for example, a pair of balls can be used. These balls can be located in a second transverse duct in the bolt and suitable guiding surfaces in the lock
10 case can act on the second pair of balls to move them relative to the bolt.

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

15 Figure 1 is a longitudinal section through a first embodiment of door lock according to the invention,

Figure 2 is a partially sectioned plan from above of the door lock of Figure 1, and

Figure 3 is a partially sectioned plan from above
20 of a second embodiment of door lock according to the invention.

In the drawings, 20 indicates a door provided with a door lock comprising a lock case 1 and a force transmission member, a so-called follower 2. The follower
25 2 has a central opening 3, to which a cylinder lock mechanism or a door handle (not shown) is connectable. A through-going bore 21 in the door 20 allows the cylinder lock mechanism or door handle assembly to be mounted on or in the door to cooperate with the follower 2.

30 The follower 2 is rotatably journalled in the lock

case 1 to turn about is central axis 3a, thereby operating a lock bolt 5 by means of a lever 4. The bolt 5 is shown in all three Figures in its fully protruding locking position. Its outer end is received by a bolt housing 7 in a stationary door frame 6. In Figure 1, the lever 4 has not quite reached its final bolt dead-locking position. To reach this position it has to be turned a few degrees more in an anti-clockwise direction.

As is evident from Figure 2, there are two auxiliary locking elements in the outer portion of the lock bolt 5, these taking the form of two balls 8. The balls 8 move in a horizontal through-going bore 9 in the bolt 5, the outer ends of this bore being reduced in cross-section somewhat, after the insertion of the balls 8, so that the balls 8 are then trapped within the bore 9 and cannot project outwardly more than as is shown in Figure 2. Each ball 8 thus protrudes from a vertical side of the bolt 5. When the lock bolt 5, under the influence of the lever 4, approaches its fully protruding locking position shown in the drawings, an operating member 10, slidably mounted in the bolt 5, engages the balls 8, so that they are pushed out into the protruding positions shown in Figure 2 where they are located in recesses 14 in the side surfaces of the housing 7. The movement of the operating member 10 is effected by a lever 11 pivotally mounted in the bolt 5. Because of the sliding movement of the bolt 5, the outer end of the lever 11 engages a stationary portion 12 of the lock case 1, which causes the lever 11 to turn, so that its inner end forces the operating member 10 forwardly into the position shown in Figure 2. In this position, the tapered end of the operating member 10 penetrates between the balls 8 beyond the line linking the centres of the balls 8. This means that the balls 8 each rest against the operating member, and are firmly locked in their protruding position preventing any significant relative

movement between the bolt 5 and the housing 7.

When the bolt 5 is subsequently retracted by means of the follower 2, the lever 11 is made to turn in the opposite direction, because its outer end became located in an opening 13 in the lock case 1 during the final stage of the locking operation. The rear edge of this opening 13 transmits a force to the lever 11, which effects a retraction of the operating member 10 from between the balls 8. This retraction of the member 10 occurs simultaneously with the retraction of the bolt 5 and thus requires there to be a sufficient clearance for the balls 8 in the ball-receiving recesses 14 to allow some withdrawal movement of the bolt 5 while the balls 8 are being fully released from engagement with the member 10. Retraction of the operating member 10 is assisted by a helical spring 22.

In the embodiment shown in Figure 3, the lever 11 is replaced by a pair of activating elements in the form of a second pair of balls 15, movable within a transverse bore 17. When the bolt 5 moves into its fully protruding locking position, the balls 15 are moved by oblique surfaces 16 of the lock case 1 towards each other and reach the position shown in Figure 3. Since the balls 15 are pressed against an oblique inner end surface 10a of the operating member 10, the operating member 10 is pushed to the left into a position which forces the balls 8 into the protruding position required to lock them in the recesses 14. This embodiment has a better and more reliable function than the one shown in Figures 1 and 2. Another advantage is that the clearance in the ball receiving recesses 14, which reduces the locking effect of the balls 8, can be made considerably smaller due to the fact that the lateral support keeping the balls 8 in their protruding position arises from engagement between the balls 15 and two parallel side surfaces 16a



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of the lock case 1. Hence, the locking balls 8 can move slightly towards each other almost immediately when the bolt 5 starts to move to the right back into the lock case 1 from the position shown in Figure 3.

- 5 The invention is not limited to the described embodiments, since several variations and modifications thereof are feasible within the scope of the following claims.



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CLAIMS

1. A door lock, comprising a bolt and a mechanism for moving the bolt between a protruding locking position and a withdrawn unlocked position, the bolt being provided, in its protruding part, with at least one auxiliary locking element movable in a transverse duct in the bolt between a first position, in which it partly extends outside the sides of the bolt, and a second more retracted position, and with an operating means movable within the bolt, which operating means is arranged, during normal operation of the lock, to move the or each auxiliary locking element into its first position, as the bolt approaches its protruding locking position, and is arranged to allow the or each auxiliary locking element to move out of said first position towards the second position as the bolt moves towards its withdrawn unlocked position.

2. A door lock according to claim 1, in which the operating means has a member moving in the longitudinal direction of the bolt.

3. A door lock according to claim 1 or claim 2, in which the bolt is provided with two auxiliary locking elements moving symmetrically with regard to a longitudinal plane of the bolt.

4. A door lock according to any preceding claim, in which the or each auxiliary locking element is arranged to protrude from a vertical side of the bolt.

5. A door lock according to any of the preceding claims, in which the operating means comprises a member provided with an oblique guiding surface giving the or each auxiliary locking element its movement, and with a portion extending in the longitudinal direction of the bolt, which portion acts to lock the or each auxiliary locking element in its first position.

6. A door lock according to any of the preceding claims, in which the bolt is provided with a pivoted lever, which, when the bolt approaches its protruding



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locking position, touches a stationary portion of a case of the lock or the door, so that it causes the pivoted lever to move, thereby pressing the operating means in the longitudinal direction of the bolt to bring the or
5 each auxiliary locking element into its first position.

7. A door lock according to claim 6, in which said lever is positively guided by a fixed portion of the lock case, so that it retracts the operating means, when the bolt starts moving back from its protruding locking
10 position towards its unlocked position, thereby allowing the or each auxiliary locking element to move into its second position.

8. A door lock according to any of claims 1-5, in which the bolt has a second transverse duct, in which
15 at least one activating element is arranged to move in relation to the operating means and to control the movements of the operating means.

9. A door lock according to claim 8, in which a case of the lock is provided with a guiding surface guiding the movements of the at least one activating element,
20 so that it forces said at least one activating element in a direction against said operating means when the bolt reaches its protruding locking position, and releases said at least one activating element to move away from
25 said operating means, when the bolt moves back from its protruding locking position.

10. A door lock according to claim 8 or 9, in which the or each said activating element has the form of a body of revolution.

30 11. A door lock according to claim 8, 9 or 10, in which the operating means has an oblique surface cooperating with the or each activating element for moving



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the operating member longitudinally.

12. A door lock according to any preceding claim, in which the or each auxiliary locking element is a ball.

13. A door lock substantially as hereinbefore
5 described with reference to, and as illustrated in, Figures 1 and 2 or Figure 3 of the accompanying drawings.
