

PATENT SPECIFICATION

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(54) IMPROVEMENTS RELATING TO KEY-OPERATED LOCKS

(71) We, CHUBB & SON'S LOCK AND SAFE COMPANY LIMITED, a British Company, of 14 Tottenham Street, London W1P 0AA do hereby declare the invention, for which we pray that a patent may be granted to us and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to key-operated locks and is particularly concerned with a construction of lock suitable for security purposes, e.g. for securing external doors in shops, offices, warehouses and private homes. With a normal construction of key-operated lock, if an incorrect key is used, the mechanism of the lock prevents this from turning and there is a natural temptation for the user of the key to apply excessive force. Generally speaking, therefore, the components of the lock have to be designed to absorb load or even break under excessive load to prevent undue force being transmitted to the naturally vulnerable key recognition members. The disadvantage of this is that at least some force is still transmitted to the key recognition members and damage is likely, if not necessary, in order to maintain security when an incorrect key is used.

A key-operated lock in accordance with the invention includes the normal components of a key-identification mechanism, a thrower turned by the key and a deadbolt which is operated by the use of a correct key, but contrary to the normal practice, the deadbolt is isolated from the thrower and the lock also includes means operable only by correct identification of the key for connecting the thrower to the deadbolt and also for removing a stop preventing retraction of the deadbolt from its extended position. This means that if an incorrect key is used, the deadbolt remains isolated from the thrower which is able to turn under the action of the key, but without otherwise affecting the operative components of the lock. Thus, not only does the deadbolt remain in the extended position, but the stop which prevents retraction of the deadbolt from this position and which is an

essential component of a security lock, continues to hold the deadbolt in this position. On the other hand, when a correct key is used, the identification of this by the key-identification mechanism of the lock operates the means for connecting the thrower to the deadbolt and also for removing the stop, so that turning of the key then operates the lock in the normal way. There is thus no need to design the components of the lock to absorb force applied by means of the key, nor is there the risk of forcing the locking mechanism.

The means for connecting the thrower to the deadbolt conveniently includes a pivoted lever formed with a locking projection capable of engagement with a complementary recess as a result of pivoting of the lever, which is prevented by a further member until the further member is allowed to move as the result of the identification of a correct key by the key-identification mechanism. Consequently, unless a correct key is used, the further member is prevented from movement and this, in its turn, prevents pivoting of the lever and thus prevents the completion of the connection between the thrower and the deadbolt.

Preferably the key-identification mechanism comprises detainers having slots which, when a correct key is employed, are lined up to allow the entry of a probe which then allows movement of the further member. This in its turn allows pivoting of the lever to complete the connection referred to above. Such a form of key-identification mechanism is by no means essential, however, and other forms of such mechanism such as a magnetically-operated mechanism may alternatively be used, the function of the mechanism being to allow the said further member to move only when a correct key is used and to prevent such movement when an incorrect key is used.

In one convenient construction, the pivoted lever is pivoted to the deadbolt and the further member is in the form of a pivoted arm which holds the pivoted lever in a position such that its locking projection is

clear of its recess until the pivoted arm is allowed to turn by the key-identification mechanism. The recess with which the locking projection on the pivoted lever co-operates is preferably formed in a runner driven along a path parallel with that of the bolt by co-operation with the thrower. Consequently, when the locking projection is in engagement with the recess in the runner, the deadbolt is locked to the runner and operation of the key to turn the thrower moves the runner and the deadbolt in unison. On the other hand, unless the deadbolt and the runner are locked together as the result of the use of a correct key, the two parts remain quite separate and although use of an incorrect key will cause the thrower to turn and hence the runner to move, the runner remains isolated from the deadbolt and the latter is not operated.

Instead of the recess being in a runner driven along a path parallel with that of the bolt, various alternatives are possible. For example, the recess may be formed in the thrower so that the pivoted lever locks the deadbolt directly to the thrower without the intermediary of the runner, as soon as identification of a correct key is complete. Yet again, the recess may be formed in an intermediate member other than the runner just described, e.g. in a rotary member or in a runner driven along a path perpendicular to that of the deadbolt and connected to the latter by means of a bell crank. This last mentioned form of construction is particularly useful in reducing the overall dimensions of a lock in a direction parallel with movement of the deadbolt.

When a key-identification mechanism comprising slotted retainers is used in conjunction with a pivoted arm for controlling movement of the pivoted lever, the thrower may be formed with a cam which holds the pivoted arm in a position such that the probe is clear of the retainers of the key identification mechanism until the thrower reaches an angular position in which the slots are lined up by the use of a correct key. When this angular position is reached, the pivoted arm is allowed to move so that the probe enters the lined-up slots in the retainers and the remainder of the operation proceeds as previously described.

As mentioned originally, one essential component of the lock is the stop for preventing retraction of the deadbolt from its extended position, this stop being removed upon correct identification of the key. Although a separate stop member may be used for this purpose, the mechanism as a whole can be simplified when using a locking lever pivoted to the bolt by means of a construction in which, as long as the locking projection on the lever is clear of its recess, another part of the lever is in engagement with a fixed

abutment so as positively to prevent movement of the deadbolt. As soon as the locking projection enters its recess, however, this part of the lever moves away from the abutment and thus removes the stop preventing retraction of the bolt.

A further desirable capability of a security lock is that when the deadbolt is retracted, it should be locked in the retracted position so that it cannot be moved to the extended position, either inadvertently, or by means of an incorrect key. Such a capability may be provided in a construction in accordance with the invention by means of a locking member operated by rotation of the thrower beyond the position corresponding to full retraction of the bolt. This locking member may conveniently be formed on the pivoted arm, the thrower being formed with a further cam which, when the thrower passes the angular position corresponding to full retraction of the bolt, causes the pivoted arm to move so that the locking member enters a recess in the bolt.

Figure 1 is an elevation with the cover removed showing the lock with the deadbolt extended;

Figure 2 is a similar view but with the deadbolt retracted, a small part of the mechanism being broken away for purposes of illustration; and

Figure 3 is a view corresponding to Figure 1 but illustrating attempted operation with an incorrect key.

The essential components of the lock are a key-identification mechanism comprising retainers 1, a thrower 6 turned by a key 3, against which the retainers are held by a spring 14, and a deadbolt 8 which is isolated from the thrower, but can be connected to it by way of a pivoted lever 7 and a runner 9 driven by the thrower 6 against the action of a spring 91 acting against a pin 92.

The lever 7 is pivoted to the bolt 8 at 17, being spring loaded clockwise, by means of a spring 71 and is formed with a locking projection 27. In the position illustrated in Figure 1, the end of the lever 7 remote from its pivot is in engagement with an abutment 11 to form a stop preventing retraction of the bolt 8. The lever 7 is held in the position shown by a droparm 12 pivoted to the frame of the lock at 112 and formed with a projection 212 which engages the lever 7 to hold it in the position shown.

The droparm 12 has a further projection 312 which engages with a cam surface 16 on the thrower 6. The greater part of this cam surface forms a circular arc about the axis of the thrower 6 so that, during the initial part of the rotation of the thrower 6, the droparm 12 continues to be held in the position shown. In this position, a probe 4 extending from the droparm 12 is held clear of the upper surface of the retainers 1. When

the thrower 6 is turned in a clockwise direction through approximately 90° from the position shown, the portion 312 of the drop-arm 12 reaches a step 26 in the cam surface of the thrower 6, thus allowing the probe 4 assisted by the spring 71 to move into contact with the surface of the detainers 1. By this stage, the positioning of the detainers 1 by the key 3 has been completed and provided the correct key has been used, the slots 2 are correctly aligned and the presence of the step 26 allows the probe 4 to enter the slots 2. This allows the droparm 12 to turn in an anti-clockwise direction about its pivot 112, thus allowing corresponding pivoting movement (in a clockwise direction) of the locking lever 7, thus bringing its projection 27 into engagement with a recess 19 in the runner 9 and, at the same time, allowing the right hand end of the lever 7 to move clear of the abutment 11.

Further rotation of the key 3 brings a peg 5 on the thrower 6 into engagement with a talon form 13 on the runner 9, driving the latter towards the right and causing corresponding movement of the bolt 8 by means of the connection just described between the projection 27 on the locking lever 7 and the recess 19 in the runner 9, the obstruction caused by the abutment 11 having previously been removed as also described.

Still further rotation of the key 3 in the same direction to the position of Figure 2 brings a step 36 on the cam surface of the thrower 6 into engagement with the portion 312 of the droparm 12, thus causing this to turn slightly in a clockwise direction and thereby lifting the projection 212 into engagement with a slot 10 in the bolt assembly and thereby to lock the bolt in the retracted position. The locking is merely the reverse of the operation just described.

Until the time of identification of a correct key, the bolt 8 is isolated from the runner 9 and hence from the thrower 6 by the fact that there is no connection between the pivoted locking lever 7 and the runner. It is only when a correct key is identified that the droparm 12 is allowed to fall, assisted by the spring 71, thus making the connection between the runner 9 and the bolt 8, thus allowing the movement of the runner 9 to be transmitted to the bolt 8 so as to retract it. If, however, an incorrect key is used, as illustrated in Figure 3, operation proceeds up to the point where the step 26 on the thrower cam allows the probe 4 to move into contact with the upper surfaces of the detainers 1. Owing to the fact that the key is incorrect, however, the slots 2 are not lined up and thus do not permit the probe 4 to enter, so that the droparm 12 is not allowed to fall and the locking lever 7 is not allowed to move into engagement with the runner 9 or indeed out of engagement with

the abutment 11. Further rotation of the key nevertheless causes the thrower peg to engage with the runner 9 so as to move it across as previously described, but since the runner 9 is not connected to the bolt 8, the latter remains in its extended or thrown position in which it is deadlocked by means of the engagement of the locking lever 7 with the abutment 11. Consequently, it is possible for the incorrect key to make a complete turn without meeting any obstruction so there is no risk of damage to the components of the lock or of forcing the lock.

When the key has made just over half a turn, (i.e. it reaches the position of Figure 3) the peg 5 leaves the talon form 13, thus freeing the runner 9 which returns to the left to the position illustrated under the influence of the spring 91. This permits the operation to be repeated and, in fact, the key may be turned any number of times without operating the lock and without damaging it in any way.

WHAT WE CLAIM IS:—

1. A key-operated security lock including key-identification mechanism, a thrower turned by the key, a deadbolt which is isolated from the thrower, and means operable only by correct identification of the key for connecting the thrower to the deadbolt and for removing a stop preventing retraction of the deadbolt from its extended position.

2. A security lock according to claim 1 in which the means includes a pivoted lever formed with a locking projection capable of engagement with a complementary recess to connect the thrower to the deadbolt as a result of pivoting of the lever, which is prevented by a further member until the further member is allowed to move as the result of the identification of a correct key by the key-identification mechanism.

3. A security lock according to claim 2 in which the key-identification mechanism comprises detainers having slots which, when a correct key is employed, are lined up to allow the entry of a probe which, in its turn, allows movement of the further member.

4. A security lock according to claim 2 or claim 3 in which the pivoted lever is pivoted to the deadbolt and the further member is in the form of a pivoted arm which holds the pivoted lever in a position such that its locking projection is clear of its recess until the pivoted arm is allowed to turn by the key-identification mechanism.

5. A security lock according to any one of claims 2 to 4 in which the locking projection on the pivoted lever co-operates with a recess in a runner driven along a path parallel with that of the bolt by co-operation with the thrower.

6. A security lock according to claim 3 together with claim 4 or claim 5 in which



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the thrower 6 is turned in a clockwise direction through approximately 90° from the position shown, the portion 312 of the drop-arm 12 reaches a step 26 in the cam surface of the thrower 6, thus allowing the probe 4 assisted by the spring 71 to move into contact with the surface of the detainers 1. By this stage, the positioning of the detainers 1 by the key 3 has been completed and provided the correct key has been used, the slots 2 are correctly aligned and the presence of the step 26 allows the probe 4 to enter the slots 2. This allows the droparm 12 to turn in an anti-clockwise direction about its pivot 112, thus allowing corresponding pivoting movement (in a clockwise direction) of the locking lever 7, thus bringing its projection 27 into engagement with a recess 19 in the runner 9 and, at the same time, allowing the right hand end of the lever 7 to move clear of the abutment 11.

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Still further rotation of the key 3 in the same direction to the position of Figure 2 brings a step 36 on the cam surface of the thrower 6 into engagement with the portion 312 of the droparm 12, thus causing this to turn slightly in a clockwise direction and thereby lifting the projection 212 into engagement with a slot 10 in the bolt assembly and thereby to lock the bolt in the retracted position. The locking is merely the reverse of the operation just described.

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WHAT WE CLAIM IS:—

1. A key-operated security lock including key-identification mechanism, a thrower turned by the key, a deadbolt which is isolated from the thrower, and means operable only by correct identification of the key for connecting the thrower to the deadbolt and for removing a stop preventing retraction of the deadbolt from its extended position.

2. A security lock according to claim 1 in which the means includes a pivoted lever formed with a locking projection capable of engagement with a complementary recess to connect the thrower to the deadbolt as a result of pivoting of the lever, which is prevented by a further member until the further member is allowed to move as the result of the identification of a correct key by the key-identification mechanism.

3. A security lock according to claim 2 in which the key-identification mechanism comprises detainers having slots which, when a correct key is employed, are lined up to allow the entry of a probe which, in its turn, allows movement of the further member.

4. A security lock according to claim 2 or claim 3 in which the pivoted lever is pivoted to the deadbolt and the further member is in the form of a pivoted arm which holds the pivoted lever in a position such that its locking projection is clear of its recess until the pivoted arm is allowed to turn by the key-identification mechanism.

5. A security lock according to any one of claims 2 to 4 in which the locking projection on the pivoted lever co-operates with a recess in a runner driven along a path parallel with that of the bolt by co-operation with the thrower.

6. A security lock according to claim 3 together with claim 4 or claim 5 in which

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5 the thrower is formed with a cam which holds the pivoted arm in a position such that the probe is clear of the detainers of the key-identification mechanism until the thrower reaches an angular position in which the slots are lined up by the use of a correct key.

10 7. A security lock according to any one of claims 4 to 6 in which pivoting movement of the lever to the position in which its locking projection enters its recess causes another part of the lever to move away from a fixed abutment so as to remove the stop preventing retraction of the bolt.

15 8. A security lock according to any one of the preceding claims and also including a locking member operated by rotation of the thrower beyond the position corresponding to full retraction of the bolt, for locking the

bolt in the retracted position.

20 9. A security lock according to claim 4 and claim 8 in which the locking member is formed on the pivoted arm and the thrower is formed with a further cam which, when the thrower passes an angular position corresponding to full retraction of the bolt, causes the pivoted arm to move so that the locking member enters a recess in the bolt. 25

10. A security lock substantially as described and as illustrated with reference to the accompanying drawings. 30

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