

## KEY OVERRIDE MONITORING FACILITY FOR A LOCK ASSEMBLY

### Technical Field

5 This invention relates to locks of the kind including a bolt which is movable between lock and unlock conditions. Such locks are commonly used to secure doors and the like in a closed position. It will be convenient to hereinafter describe the invention with particular reference to door locks, but it is to be understood that the invention has other uses.

10 Broadly, the invention provides a key override monitoring facility for a lock assembly which assembly may include an arrangement for adjusting the hand of the assembly, may be electrically operable by a solenoid and readily convertible to provide either a fail-safe or fail-secure mode of operation.

### 15 Background

The "handing" of a lock assembly refers to the side or sides of a locked door from which a user will be unable to open the door. Such handing is usually defined relative to a direction across a door from the hinge side. Thus for a door having a "left handed" lock, the handle or knob (hereinafter the term  
20 handle is to be understood as including a knob) on the left side of this direction will not operate the lock assembly when it is in a locked condition whereas the right side handle will, and for a door having a "right handed" lock, the handle on the right side of the said direction will not operate the assembly when it is locked whereas the left side handle will. Usually the inoperable handle is on  
25 the "outside" of the door such that persons on the other side, for example persons inside a room, will be able to open the door. Alternatively a lock assembly may be "interconnected", which means that when the lock assembly is locked, both the left and right side handles are inoperative to move the bolt.

A lock assembly with which the present invention is useable may be a  
30 solenoid controlled lock of either the fail-safe or fail-secure kind. In the fail-safe kind, a solenoid driven component of the lock is arranged to adopt a lock release condition in the event of a power failure whereas in the fail-secure kind

of lock, a solenoid driven component is arranged to adopt a lock secure condition in the event of a power failure.

The solenoid driven component may be directly or indirectly connected with a detent so as to move the detent between active and inactive positions;  
5 that is the locking mechanism may include electrically operated drive means as exemplified by a solenoid.

In the parent application for the present divisional application, the claimed invention relates to a lock assembly which includes a carrier or detent which includes one or two locking heads for interacting with the actuating  
10 means of a lock. The locking head or heads is/are mounted on the carrier or detent so as to be readily adjustable linearly, relative to the length of the carrier or detent, between two positions relative thereto. That is, there is a single carrier or detent which responds to the locking mechanism and which carries one or two locking heads which is/are fixedly held thereon in a predetermined  
15 position, being one or the other of two adjustment positions.

Thus the invention of the parent application is a lock assembly including, a housing, a lock bolt mounted on the housing for relative movement between a locking position and an unlocking position, actuator means for moving said lock bolt and for receiving handle means, locking mechanism having a detent  
20 which is movable between active and inactive positions at which it prevents and does not prevent respectively movement of said lock bolt from the locking position to the unlocking position, wherein said detent includes a locking head for interacting with said actuator means and which is slidably adjustable for selectively rendering a handle means received in said actuator means  
25 operative or inoperative for said active position of said detent.

The lock assembly may include a cylinder lock, which is operable by a key, for influencing the locking mechanism, in particular for effecting retraction of the lock bolt. A key override monitoring facility in which the cylinder lock directly operates a microswitch is known from the Applicant's Australian Patent  
30 No. 657349 (22125/92). However this facility requires that the microswitch be accurately positioned relative to the cylinder lock to ensure it is properly operated. In particular, a problem arises from the "handing" of a microswitch

due to the positioning of its switching arm (sometimes termed its operating lever). This requires that a microswitch be matched to a cylinder lock, that is, either a left hand (anticlockwise) or right hand (clockwise) operable cylinder lock must be chosen depending on the handing of the microswitch with which it is to be associated.

### **Disclosure of The Invention**

An object of the present invention is to provide an improved key override monitoring facility for a lock assembly.

Accordingly the invention provides a key override monitoring facility for a lock assembly that includes a key operated cylinder lock, the monitoring facility including a housing, a switch for a monitoring circuit mounted in the housing, and means operably associated with the housing for operating the switch, wherein the housing is mountable within a lock assembly in proximity to said cylinder lock such that actuation of the cylinder lock actuates the switch via said means operably associated with the housing. The invention also provides a lock assembly that includes the key override monitoring facility associated with a cylinder lock, wherein the monitoring facility includes a microswitch or similar device which is actuatable by operation of the cylinder lock, said association of the monitoring facility and the cylinder lock including means arranged such that the microswitch is actuatable by a cylinder lock that is either left handed or right handed.

It will be convenient to hereinafter describe the invention by reference to a particular form of lock assembly including a linearly movable latch bolt facility. However the invention is applicable to other forms of lock assemblies.

### **Description of Drawings**

Embodiments of the invention are described in detail in the following passages of the specification which refer to the accompanying drawings. The drawings, however, are merely illustrative of how the invention might be put into effect, so that the specific form and arrangement of the various features as shown is not to be understood as limiting on the invention.

In the drawings;

Figure 1 is an illustration of a short backset latch assembly, to which the invention is applicable, with one side plate removed so that internal components are visible.

5        Figure 2 is a perspective illustration showing a detent and actuator.

Figure 3 shows a detent bar, which is a component in the Figure 1 latch assembly.

Figure 4 is an exploded perspective illustration of some of the components in the Figure 1 latch assembly arranged for fail-secure operation.

10       Figure 5 illustrates an assembly of components for fail-secure operation of the Figure 1 latch assembly.

Figure 6 is an exploded perspective illustration similar to Figure 4 but with the components arranged for fail-safe operation.

15       Figure 7 illustrates an assembly of components for fail-safe operation of the Figure 1 latch assembly.

Figure 8 illustrates another latch assembly to which the invention is applicable.

Figure 9 illustrates 2 hubs of a split hub actuator.

20       Figure 10 is an exploded perspective illustration of some of the components of the Figure 8 latch assembly.

Figure 11 shows an adaptor assembly for a key override monitoring facility according to the invention.

Figure 12 is a view of the adaptor assembly of Figure 11 along a central section XII-XII.

25       Figure 13 is an exploded view of some of the components within the adaptor assembly of Figures 11 and 12.

### **Best Mode for Carrying Out the Invention**

30       The latch assembly shown in Figure 1 is, in general terms, a typical latch assembly of the kind commonly used with swinging doors, and as previously stated is not the only form of assembly to which the invention is

applicable. The following description of the assembly assumes that the reader has a working knowledge of latch assemblies of the kind shown.

The latch assembly includes a latch bolt 1 mounted on a housing 2 so as to be movable longitudinally between a latch position (shown in Figure 1) and an unlatched position (not shown) at which a head 3 of the bolt 1 is at least substantially contained within the housing 2. A biasing spring 4 normally urges the bolt 1 towards the latched position. Retraction of bolt 1 is effected through a rotatable actuating means 5, which is a split hub assembly. Such split hub assembly comprises hubs 5a and 5b (in Figure 1, hub 5b lies behind hub 5a) each of which operatively interengages a hub lever 5L in known manner. Each hub 5a and 5b contains a square section bore 6 for receiving a stub shaft of a respective handle (not shown) whereby, as is well known for split hub actuating means, each handle is operable independently of the other to rotate its associated hub 5a or 5b to rotate its associated hub lever 5L to move a bolt 1 to its unlatched position.

Figure 9 illustrates the relative orientation of two hubs of a split hub actuator. It should be noted that although the hubs illustrated in Figure 9 are similar in form to those in the Figure 1 latch assembly, they are not exactly the same.

A locking mechanism for the latch assembly includes a detent in the form of a bar 7 which is operable in known manner by one or more locking means such as for example, a cylinder lock 8 or electrically driven solenoid 9.

Detent bar 7 is mounted in housing 2 for relative sliding movement on operation of a locking means such as cylinder lock 8 or solenoid 9 between an inactive position and an active position (shown in Figure 1). The detent includes two adjustable heads 10 and 11 for setting the hand of the latch assembly as will be described hereinbelow.

Each head 10 or 11 (see Figure 3) includes an end portion 12 containing a slot 13 for receiving a guiding tongue section 14 or 15 extending from an end of the detent 7. The remaining portion of each head 10 or 11 is recessed (as shown at 16 in Figure 3) to a depth corresponding to about the thickness of the detent bar and also includes a threaded hole (not shown) for

receiving a set screw 17 or 18. Detent 7 includes two slots 19 and 20 through which screws 17 and 18 pass. As will be evident from Figure 3, heads 10 and 11 are attached to detent 7 by means of screws 17 and 18 respectively and are also able to be moved, on loosening the screws, between an unextended position (shown by head 10 in Figure 3) and an extended position (shown by head 11 in Figure 3) relative to the detent 7 and as defined by the shape of the slots 19 and 20.

Thus, with reference to Figure 3, head 10 may be linearly moved between its unextended position and be fixed in its extended position by loosening screw 17, sliding the head away from the detent until it reaches its extended position (which is determined by the shaft of screw 17 bearing against the end of slot 19) and tightening screw 17. Head 11 is similarly linearly movable and fixable in either its extended position (shown in Figure 3) or its unextended position. Screws 17 and 18 may be held captive in known manner in each head, being unscrewable only sufficiently to allow the above described movement of the heads.

Although it is a feature of the invention claimed in the parent application that the heads 10 and 11 are linearly movable, the particular mounting and fixing arrangement illustrated in Figure 3 is given merely by way of example and alternative arrangements may be used. One such arrangement is that each head may include a rotatable cam for interacting with an appropriately shaped recess in the detent bar.

Hubs 5a and 5b (reference may be made to Figure 2 which illustrates the functional interaction between hubs 5a and 5b and detent 7, but with reference to hubs 5a' and 5b' which are of similar form to those in Figure 1 although not exactly the same) each contain an abutment surface 21a and 21b respectively. When detent 7 is in its inactive position and with heads 10 and 11 in either their extended or unextended position, each hub 5a and 5b is free to rotate to move its associated hub lever 5L and thus bolt 1 to an unlatched position. However if detent 7 is moved to its active position, then either hub 5a or 5b, or both, are rendered inoperative depending on the location of heads 10 and 11 on the detent. For example, as shown in Figure 2, for detent 7 in its

operative position, head 11, which is in its extended position on detent 7, will prevent any rotational movement of hub 5b' by virtue of the head 11 bearing against abutment surface 21b. Concomitantly hub 5a' is operable because head 10 is in its unextended position on detent 7 and thus remains clear of abutment surface 21a.

Thus the hand of a latch mechanism may be set by adjusting either head 10 or head 11 (depending on the particular handing that is required) to its extended position on detent 7. If both heads are set in their extended position on detent 7, the latch mechanism will be set in its interconnected position.

Figure 1 shows head 10 set in its extended position on a detent 7 with the detent in its active position. Actuator 5a is inoperable because head 10 is not clear of abutment surface 21a.

A rear wall of housing 2 may include access holes (as at 40 in Figure 1) to allow an operator easy access to the means, such as screws 17 and 18, for setting each head 10 and 11 in its unextended or extended position.

The locking mechanism in the latch illustrated in Figure 1, includes a fail-secure solenoid drive arrangement and Figure 4 illustrates how components are assembled for this arrangement. Detent 7, at its end opposite the end which carries heads 10 and 11, includes a lateral extension 50 containing two transversely spaced holes 51 and 52 as is illustrated in Figures 3, 4 and 6. The other components comprise solenoid 9, a lever 53 having recessed ends, connecting pin 54 and spring 59. A shaft 30 of solenoid 9 contains a slot 55 for receiving an end of lever 53, and a hole 56 for receiving pin 54 for locating the recessed end of lever 53 within the slot. Pin 54 assembles from the top (with reference to the orientation shown in Figure 4) through hole 51 in detent 7, then through hole 56 in shaft 30 of solenoid 9 so as to locate and hold the recessed end of lever 53 within slot 55. The assembly is located in the housing 2 (see Figure 5) with lever 53 pivotally located on a spigot 58 and includes a torsion coil spring 59 having one extended end 59a located beneath an abutment 60 of housing 2 and the other, oppositely extended end 59b located beneath pin 54 within slot 55 such that

the spring bias acts on solenoid shaft 30 to urge it in a direction opposite to the force exerted thereon by the mass of detent 7.

In the above described fail-secure arrangement pivoted lever 53 serves no functional purpose. However its presence enables the latch assembly to be  
5 readily changed to a fail-safe mode of operation by introducing a second connecting pin and changing the spring as will be described in more detail hereinbelow .

In the fail-secure arrangement, when electrical current flows through the coil of solenoid 9, shaft 30 is drawn into the coil and this moves detent 7 into its  
10 inactive position. The force of spring 59 is predetermined according to the mass of the detent 7 so that it substantially balances that mass whereby the power required for the solenoid 9 to operate the locking mechanism is minimised. That is, the force exerted by torsion spring 59 is not quite strong enough to lift the weight of the detent assembly 7 thus ensuring automatic  
15 locking when the power is off, but it assists the solenoid to lift the detent when power is on. Effectively, the force of spring 59 is employed to minimise the inertial mass force of the detent 7 on the drive means.

The assembly of components for a fail-safe mode will now be described with reference to Figure 6. As is mentioned hereinbefore, the assembly of  
20 components for fail-safe operation includes a second connecting pin 62, and a changed torsion coil spring 61, otherwise the components are the same as are illustrated in Figure 4 except that they are assembled differently. Thus, for a fail-safe assembly, connecting pin 54 assembles from the bottom (with reference to the orientation shown in Figure 6) through hole 55 in shaft 30 of  
25 solenoid 9 to retain the recessed end of lever 53 within slot 55. The second connecting pin 62 assembles from the top through hole 52 of detent 7 and locates the other recessed end of lever 53. The assembly is located within housing 2 (see Figure 7) with lever 53 pivotally located on a spigot 58 and includes a torsion coil spring 61 having one extended end 61a that bears on  
30 abutment 60 and the other oppositely extended end 61b located to bear on top of pin 54 such that the spring bias acts on solenoid shaft 30 to urge it in a direction opposite to the force exerted thereon by the mass of detent 7 acting

through pivoted lever 53, which is towards the off position of the solenoid. When electrical current flows through the coil of solenoid 9, shaft 30 is drawn into the coil thereby pivoting lever 53 and driving detent 7 into its active position. In the fail-safe arrangement if a power failure occurs and solenoid 9 is rendered inoperative, shaft 30 remains in its inoperative position wherein the locking mechanism remains in a lock released condition. Spring 61 re-sets the mechanism when the solenoid is switched from on to off, that is, it lifts the detent assembly 7 to the unlocked position when the power is off.

As is well known in the art, solenoid 9 of a latching mechanism may be arranged for remote operation.

Another embodiment is illustrated in Figure 8 which shows a standard backset mortice latch assembly. A back plate of a housing 102 of the Figure 6 latch assembly has been removed and some of the internal components are not illustrated for the sake of clarity. The latch assembly includes rotatable actuating means 105 for retracting a bolt. The rotatable actuating means is a split hub assembly comprising two hubs 105a and 105b (hub 105b in the Figure 8 illustration is directly behind hub 105a). Each hub 105a and 105b contains a square section bore 106 for receiving a stub shaft of a respective handle (not shown) whereby, as is well known for split hub actuating means, each handle is operable independently of the other to rotate its associated hub to effect movement of a bolt to its unlatched position via a hub lever 105L of each hub.

A locking mechanism for the latch assembly includes a detent 107 which is operable in known manner by one or more locking means such as, for example, a cylinder lock 108. Detent 107 is mounted in housing 102 for relative sliding movement on operation of a locking means such as cylinder lock 108 to move between an inactive position (wherein movement of the bolt is not prevented) and an active position (wherein movement of the bolt is prevented). The detent includes two adjustable heads 110 and 111 for setting the hand of the latch assembly. Each locking head is adjustable on detent 107 between two positions, one of which is shown by the position of head 110 relative to detent 107 in Figure 8 (which is an unextended position) and the

other of which is shown by the position of head 111 relative to detent 107 in Figure 8 (which is an extended position).

Each hub 105a and 105b includes an abutment surface 121 against which a corresponding head 110 or 111 may bear (depending on whether it is in its extended position and the detent is in its active position) and thus prevent rotation of its associated hub 105a or 105b. For example, as illustrated in Figure 8, head 110 will not prevent rotation of hub 105a, whereas head 111 will prevent rotation of hub 105b. Thus adjustment of the heads 110, 111 allows the handing of the latch assembly of Figure 8 to be set as may be required, as is more fully described hereinabove with reference to the Figure 1 embodiment. It will be clear that the Figures 1 and 8 embodiments are in principle the same in relation to setting the hand of the respective assemblies. The Figure 8 embodiment, however, includes an alternative arrangement in the form of a cam rather than a set screw for adjusting each head.

Figure 10 is an exploded perspective view of detent 107 with one of the heads 110 and a cam 112 for illustrating the structure of each of these components and their assembly. Thus, as is illustrated, detent 107 includes a recess 113 for containing heads 110 and 111 in a side by side relationship. Side walls 114 and 115 of detent 107 which define recess 113 each contain a slot 116, 117 within which is seated a shaft portion of a respective cam for adjusting a respective head. Thus, as illustrated in Figure 10, shaft portion 118 of cam 112 is received in slot 116. Head 110 (which is identical to head 111 which is not shown in Figure 10) includes a recess 119 for receiving cam 118. Recess 119 includes an extension 120 for retaining a V spring 121, one arm of which bears against the periphery of cam 112. When the two heads and their respective cams are assembled with detent 107, it will be clear that the positions of the heads are independently adjustable between an extended and an unextended position by rotation of their respective cams through 180°. Each cam is manually adjustable by insertion of a screw driver into an appropriately shaped slot (shown in Figure 8 but not in Figure 10) in the end face of the shaft portion thereof and for this purpose access holes are provided in the back plate and case side of the casing 102.

A lock assembly with which the present invention is useable may include microswitches or similar devices for use in providing certain functions. Thus, for example, in the latch assembly shown in Figure 1, a deadlatch monitoring function may utilise a microswitch as shown at 70, a hub monitoring function may utilize a microswitch as shown at 71 and a key override monitoring facility according to the invention may utilize a microswitch (not shown) associated with the cylinder lock 8. Figures 11, 12 and 13 illustrate a key override monitoring facility according to the invention that may be associated with cylinder lock 8.

10 The key override monitoring facility includes an assembly comprising a microswitch 201 and a 2-way di selection switch 202 mounted on a printed circuit board 203, which assembly is mounted within an adaptor 204. Adaptor 204 includes a ramp surface 205 having a lip 206 for guiding and retaining a switch actuating means in the form of a small diameter steel ball 207 (ball 207 is not shown in Figure 11).

The assembly 201, 202, 203, 204, 207 as shown in Figure 11, when mounted within a latch assembly as shown for example in Figure 1, is associated with the cylinder lock 8 such that a plug lever (not shown) that is attached to the barrel of lock 8 bears upon ball 207 which in turn holds switch lever 208 of microswitch 201 in a depressed position (this position of ball 207 is shown in full lines in Figure 12). When cylinder lock 8 is operated by a key, the plug lever is moved aside (in either a clockwise or anticlockwise direction depending on the handing of lock 8) thus freeing ball 207 and allowing it to be moved outwardly of adaptor 204 along ramp surface 205 by the bias force exerted on it by switch lever 208 (to the position shown in chain-dot outline in Figure 12). Aperture 209 is for passage of a bolt means for mounting the adaptor 204 and cylinder lock 8 assembly within a latch assembly.

With a key override monitoring facility according to the invention such as shown in Figs 11, 12 and 13, the positioning of the microswitch 201 relative to a cylinder lock 8 of a latch assembly is not as critical as it is when a plug lever of the cylinder lock operates directly upon the monitoring switch. Furthermore,

the one adaptor assembly may be supplied for either a left or right handed cylinder lock.

Microswitch 201 may be a normally closed or normally open switch that is part of a circuit which, upon actuation of cylinder lock 8, may have any  
5 desired result, such as for example, deactivation of an alarm system associated with the latch assembly and/or a door on which the assembly is mounted. Actuation of microswitch 201 may also be recorded permanently or temporarily at a control room or other remote station.

It is also within the scope of the invention to arrange for actuation of  
10 cylinder lock 8 to move ball 207 inwardly of adaptor 204 along ramp surface 205 to actuate switch lever 208 (rather than releasing the ball to allow it to be moved outwardly). In this alternative arrangement, the bias of switch lever 208 is such as to normally hold ball 207 in its outermost position relative to adaptor 204.

15 All the micro and other switches and electrical components within a latch assembly that are provided for monitoring, selection or alarm functions may be associated with a flexible circuit board that is housed within the casing of a latch assembly, which circuit board may provide for connection of all the internal monitoring, selection or alarm circuitry to an external wire loom and  
20 plug.

The invention described herein is susceptible to variations, modifications and/or additions other than those specifically described and it is to be understood that the invention includes all such variations, modifications and/or additions which fall within the spirit and scope of the following claims.



THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A key override monitoring facility for a lock assembly that includes a key operated cylinder lock, the monitoring facility including a housing, a switch for a monitoring circuit mounted in the housing, and means  
5 operably associated with the housing for operating the switch, wherein the housing is mountable within a lock assembly in proximity to said cylinder lock such that actuation of the cylinder lock actuates the switch via the said means operably associated with the housing.
2. A facility as claimed in claim 1, wherein the switch is a  
10 microswitch and the said means for operating the micro switch is actuable by either a left handed or a right handed cylinder lock.
3. A facility as claimed in claim 2, wherein the housing includes a ramp surface and the said means is a ball that is movable along the ramp surface.
- 15 4. A facility as claimed in claim 3, wherein the ball lies in contact with a switching arm of the microswitch and said switching arm when in its non-actuated position biases the ball to an outermost position along the ramp surface, and wherein said ball protrudes from said housing at said outermost position such that it is contactable by a lever associated with a cylinder lock,  
20 which lever on actuation of the cylinder lock, depresses said ball and thus actuates the microswitch.
5. A facility as claimed in claim 3, wherein the ball lies in contact with a switching arm of the microswitch and said switching arm normally biases said ball to an outermost position along the ramp surface, and wherein said  
25 ball is contactable by a lever associated with a cylinder lock such that said lever normally bears on said ball and holds it in an inner position along the ramp surface at which position the switch arm is depressed, and wherein on actuation of the cylinder lock the lever is moved aside allowing the ball to move to its outermost position for actuation of the microswitch.