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A LOCK WITH A SMOKE ALARM INTERFACE

FIELD OF THE INVENTION

5 The present invention is directed to a lock (typically a door lock) where the lock mechanism can be controlled remotely and particularly in response to a signal (such as a signal produced by a smoke detector, fire alarm etc).

BACKGROUND ART

10 With the increased requirement of security, it is now known to provide quite sophisticated locksets which have improved security.

For instance, it is known to provide a door lock which can operate between several different types of modes. These modes can include a "secure mode", a "safety mode" and a "passage mode".

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In the secure mode, the inside handle and the outside handle are locked and therefore it is not possible to open the door from either the outside or the inside.

20 In the safety mode, the outside handle of the door is locked, but the inside handle is operable to enable the door to be opened from the inside.

In the passage mode, both the outside handle and the inside handle can be operated and the door can be opened from either side.

25 It is possible to have a key that can be inserted into a key barrel on the door lock to change the mode of the door at least between the secure mode and the safety mode. It is also known to have a snib or something similar on the inside of the door lock which can change the mode of the door between the safety mode and the passage mode.

30 Our Australian patent 2004200529 describes a particular type of "multiple mode" lock and the contents of that patent are incorporated herein by cross reference. However, unless the context requires otherwise, it is not considered that the present invention should be limited only to use with the lock described in our earlier patent application.

In houses, buildings and other structures or areas occupied by people, a dangerous situation can occur is if the lock on the entry/exit door is in the secure mode and there is a fire inside. In such a situation, a circumstance can occur where the door cannot be
5 opened from the inside, unless the key can be found.

Locking systems have been proposed to address this problem. Most of them contain locks which are converted from a secure mode to mode where the lock can be operated freely from either side of the door (i.e. passage mode) upon receipt of a
10 signal from a smoke alarm or the like. Therefore, these locks significantly reduce the risk of people becoming trapped in situations like the one described in the previous paragraph. However, systems like this also create additional security risks, particularly in the event of false alarms. With these locking systems, a false alarm will cause the lock to be converted from the secure mode to the passage mode in the
15 same way as a genuine alarm. Consequently, in a false alarm situation where there is actually no risk of danger from fire etc, the area secured by the lock is nevertheless rendered completely "unlocked" or unsecured thereby making it easy for thieves and the like to gain unauthorised entry. Furthermore, if the false alarm occurs when the building/area is unoccupied, it may remain in an insecure state (i.e. vulnerable to
20 vandals these etc) for some time until someone arrives to secure it.

It will be clearly understood that, if a prior art publication is referred to herein, this reference does not constitute an admission that the publication forms part of the common general knowledge in the art in Australia or in any other country.
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OBJECT OF THE INVENTION

It is an object of the invention to provide a lock or lock operating system that may overcome at least some of the above-mentioned disadvantages or provide a useful or commercial or safety choice.
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In one form, the invention resides in a lock operating system comprising a lock which has at least a secure mode and a safety mode and/or a passage mode, operating means to enable the lock to be moved from at least the secure mode to the safety mode or

passage mode, an alarm (which may be a smoke alarm), and an interface unit, the interface unit receiving a signal upon activation of the alarm, and sending a signal to the operating means to move the lock from the secure mode to the safety mode or the passage mode.

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In a broad form, the invention resides in a lock operating system comprising a lock which has at least a secure mode and a non secure mode, an alarm (which may be a smoke alarm) and means to operate the lock from the secure mode to the non secure mode upon activation of the alarm. In a variation or addition to this broad form of the invention, deactivation of the alarm may cause the lock to return to the secure mode.

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In this manner, should the smoke detector or fire alarm be activated, the door would immediately be changed from the secure mode to a non secure mode (for instance the safety mode or the passage mode) to enable people to quickly exit through the door without needing to look for a key etc.

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It is also envisaged that the arrangement enables the door lock to move back from the non secure mode to the secure mode by some remote means. For instance, when the smoke/fire alarm is switched off, the door lock may move back to the secure mode. Alternatively, the door lock may be moved back to the secure mode by a FOB, or by some other remote signaling means which may include a telephone code, a computer code and the like.

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The lock operating system can be used in any situation where this type of lock operating system would find the commercial or beneficial use. It is envisaged that a primary use of the lock operating system will be with a door. However, there may be circumstances with the lock operating system would find use with a window, or other type of "door" or "window" like member that benefits from being locked and unlocked using the lock operating system as described above. For instance, the lock operating system may find use with emergency exit, escape hatches, trap doors and the like.

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It is envisaged that the alarm which, when activated, causes the lock to move from the secure mode to a non secure mode will typically be a fire alarm or the like. However,

the invention might also operate with other forms of alarm, for example burglar alarms etc, for example to allow people to flee from the danger posed by an intruder.

5 The lock may comprise any suitable type of lock that can be provided with a secure mode and a non secure mode. The non secure mode may comprise a safety mode and/or a passage mode or any other type of mode that enables the lock to be operated from one side of the door without requiring a key or something similar to operate the lock.

10 In another broad form, the invention resides in a lock operating system comprising an alarm and a lock, the lock having a secure mode, a safety mode, a passage mode and operating means to enable the lock to be moved between the modes, wherein activation of the alarm causes a signal to be sent to the operating means whereupon, if the lock is in the secure mode, the lock is moved from the secure mode to the safety
15 mode, and wherein, if the lock is in the safety mode, the lock is moved to the passage mode if an internal handle of the lock is operated.

In this manner, if there is a false alarm and the lock is moved from the secure mode to the safety mode, nevertheless the external handle of the lock remains inoperable to
20 open the door in the safety mode, thus maintaining security. Alternatively, if there is a genuine fire alarm, the first person to exit will do so by operating the internal handle of the lock whereupon the lock will be converted to the passage mode (meaning the outside handle can also open the door), thus enabling firefighters etc to enter from the outside as well as allowing people to continue exiting.

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As mentioned previously, our earlier patent 2004200529 provides a lock that may be suitable with the present invention. That lock may be particularly suitable because of its "kickback" functionality. This functionality is described further in the earlier patent specification. In summary, the lock's internal mechanism is configured such
30 that when the lock is in the safety mode (called a "privacy mode" in the earlier specification) the outside handle of the door is locked, but the inside handle is operable to enable the door to be opened from the inside. However, in addition to this, operation of the inside handle to open the door (without any other interaction

with the lock by a key or in any other way) has the effect of moving the lock into the passage mode thus freeing the outside handle for operation is well. Because of this functionality, if the lock from our earlier patent is used with the present invention and there is a genuine fire alarm, the first person to exit by operating the internal handle
5 will cause a lock to be converted to the passage mode, thus enabling firefighters etc to enter from the outside as well as continuing to allow people to exit.

However, the invention need not be limited to the lock as described in our earlier patent application, and may include any other type of lock that provides at least a
10 secure mode and a safety mode. The lock may comprise a mechanical lock, or an electromechanical lock.

The lock may comprise any suitable mechanism (which may be mechanical, electronic or a combination) to enable the lock to be operated between the modes. It is
15 envisaged that the lock will normally comprise a mechanical mechanism in the lock body which can be operated by a small electric motor which may also be in the lock body and some form of sensor or something else that can operate the electric motor.

Operating means is provided to enable the lock to be operated between the required
20 modes. The operating means may be provided inside the lock body, or adjacent the lock body, or somewhere else. It is envisaged that the operating means will comprise a small electric motor in the lock body that can change the mode of the lock upon being energised. However, the operating means may also comprise something else. For instance, the operating means may comprise some form of link arrangement
25 which may be inside or outside of the lock body and operation of the link arrangement will cause the mode of the lock to be changed. In yet another alternative, the operating means may comprise some form of cable arrangement where operation of the cable can cause the mode of the lock to be changed.

30 It is however in envisaged that the operating means will most probably comprise a small electric motor positioned within or mainly within the lock body and operatively associated with parts of the lock mechanism to change the mode of the lock upon operation of the electric motor. The electric motor may be able to operate in either

direction.

The lock operating system may comprise an interface unit. The interface unit may comprise a separate component which may be positioned at any suitable place in the room/building/area etc. The interface unit is typically able to receive a signal that is produced when a smoke detector, fire or other sort of alarm goes off, or when a signal is produced by or from something else (e.g. a FOB, a computer, a telephone etc). The interface unit should then be able to send a signal to the lock, and particularly to the operating means.

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The interface unit (which may also be called an interface module) may receive a wireless signal from the smoke detector, fire alarm, or FOB etc. The wireless signal may comprise a radio-frequency signal (RF), or an infrared signal (IR), or possibly a laser signal, or any other suitable type of electromagnetic signal and the like. It is envisaged that in most circumstances, a radio-frequency signal will be most suitable and most versatile, as it does not require a "line of sight" type arrangement which may be necessary with other types of signals such as an infrared signal or a laser signal.

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Alternatively, the interface unit may receive a "wired" signal from the alarm or something else. In this variation, the interface unit may be "hardwired" to the alarm, or the computer, or a telephone or something else.

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Similarly, the signal sent from the interface unit to the lock may be a wireless signal or a "wired" signal as described above.

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The interface unit may need to be powered and this may be achieved by connecting the interface unit to a supply of mains power or a portable power pack such as batteries, solar energy, or something else. It is envisaged that the interface unit may be powered by mains power and also contains a backup battery pack in case of a power outage.

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As noted above, the signal that causes the lock to move from a non secure mode in the

present invention will normally be produced by a smoke detector or fire alarm. This may be a battery powered smoke detector, although, in many jurisdictions, there is now a requirement for the smoke alarm to be wired to mains power and therefore the smoke alarm may also comprise an alarm wired to mains power. The alarm however
5 may comprise a different type of alarm such as a heat sensing alarm, possibly an intruder sensing alarm and the like. If the alarm is an intruder sensing alarm, the system may alternatively operate to convert the mode of the lock to a secure mode to prevent an intruder from exiting through the door.

10 It is envisaged that the lock operating system may also comprise a number of locks (for instance a front door lock and a rear door lock) which are operatively associated with the interface unit such that if the smoke alarm operates, all the doors will be converted from a secure mode to the safety mode or passage mode. This will allow a quicker exiting of the risk area.

15 It is envisaged that the lock operating system may comprise more than one alarm. For instance, in many houses/offices/buildings etc, there are multiple smoke alarms positioned in strategic places. All these alarms may be operatively associated with the interface unit.

20 It is envisaged that the lock operating system may comprise a plurality of locks (e.g. a plurality of door locks), and a plurality of alarms and at least one interface unit which operates the nearest door to an alarm which is activated. With this variation of the invention, a situation need not occur where a remote area (containing a door) and
25 which is not under any threat, has the door converted to a non-secure mode upon operation of a smoke alarm somewhere distant from the remote area.

It is also envisaged that the lock operating system may comprise more than one interface unit with each interface unit being associated with one or more smoke alarms
30 and one or more lock.

It is also envisaged that the arrangement is such that when the lock is converted from the secure mode to the safety mode (e.g. via the smoke alarm), the lock will remain in

the safety mode until deliberately moved back to the secure mode. For instance, the lock can be deliberately moved back to the secure mode by some form of remote control means, or by a key and the like.

- 5 It is also envisaged that there may be some sort of automatic return from the safety mode to the secure mode if it turns out that the alarm is a "false alarm". For instance, it is envisaged that when the alarm sounds, the lock will be moved into the safety mode but if nobody exits the door after a certain period of time, the lock will reset itself or be reset automatically back to the secure mode. The lock may be provided
10 with some form of timing mechanism, or the interface unit may assist.

It is also envisaged that there may be some sort of "validating" means to validate that the alarm is a genuine alarm and not a false alarm. As an example, the validating means may comprise a second alarm and if both alarms are activated it is very
15 probable that there is a genuine hazard situation. If there is some sort of validating means, this may convert the lock into a passage mode which means that emergency personnel (e.g. firefighters) can enter through the front of the door. Alternatively, the lock can be initially converted from the secure mode to the safety mode and if nobody operates the door from the inside after a period of time, the lock is converted into the
20 passage mode. Other types of validating means are also envisaged. This may be advantageous if the alarm sounds (and it is genuine), and the building is empty and therefore nobody will operate the door from the inside to convert the lock from the safety mode to the passage mode.

25 BRIEF DESCRIPTION OF THE DRAWINGS

An embodiment of the invention will be described with reference to the following drawings in which:

Figure 1 illustrates parts of the internal mechanism of a "multiple mode" lock which is particularly suitable for use in the present invention. This lock is described
30 in our earlier patent 2004200529 and details of its operation (particularly its "kickback" functionality) can be read there.

Figure 2 illustrates schematically a smoke alarm sending a signal to an interface unit which, in turn, sends a radio-frequency signal to the lock fitted to a door.

Figure 3 illustrates schematically two possible versions of how the various components can communicate with each other.

Figure 4 illustrates schematically a smoke alarm sending a signal to the interface unit (interface module) and to the lock.

5 Figure 5 illustrates schematically various parts of the interface unit.

Figure 6 illustrates a multichannel remote control device (FOB).

Figure 7 illustrates how the multichannel remote control device of figures 6 can operate the various units.

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BEST MODE

In a particular embodiment of the invention, the interface unit (which is an electrical device with electronic circuit board and connectors) would be connected to a smoke alarm output (for instance a multiple station smoke alarm). When the smoke alarm is in the alarm mode, the or an output signal of the smoke alarm will trigger the interface
15 which in turn will send a radio-frequency signal command to the lock to make sure that the lock is converted into the safety mode (if it is in the secure mode). The safety mode will enable the inside handle to be operated to facilitate egress while the outside handle will remain locked for security in case of a false alarm. Once the inside handle has been operated, the outside locking "kicks off" (changes mode) to the passage
20 mode meaning that both the inside and the outside handle is unlocked. The door lock remains in the passage mode until it is either manually re-locked by a key or remotely operated by a fob or something else.

Referring to figure 1, there is illustrated a partial mechanism of a multiple mode door
25 lock 10 which is described in our earlier patent 2004200529. This door lock is able to be operated between three modes being a secure mode, a safety mode and a passage mode. The mechanism that enables the lock to be operated between these modes is better described in our earlier patent, but it should be appreciated that the present invention should not be limited only to the use of this particular lock. The secure
30 mode is where the outside and the inside handle is locked and it is not possible (without a key or something else) to enter or exit the door. The safety mode is where the outside handle is locked but the inside handle is unlocked which means that a person can open the door from the inside but not from the outside. The passage mode

is where both the inside and the outside handle are unlocked and the door can be opened from either direction.

Figure 2 illustrates a smoke alarm 11 connected to an interface unit 12 and, in this particular embodiment, the smoke alarm is hardwired to the interface unit. The interface unit contains componentry which includes a radio transmitter/receiver. When the smoke alarm is activated, a signal is sent to the interface unit from the smoke alarm. This, in turn, causes the interface unit to emit an RF signal 13 which is picked up by a receiver (not illustrated) in the lock 10 and which operates a small electric motor (not illustrated) in the lock 10, the electric motor moving the componentry within lock 10 such that the lock is in the safety mode. Thus, if the lock is in the secure mode, it will be moved to the safety mode. If the lock is already in the safety mode, nothing will happen.

An advantage of moving the lock from the secure mode to the safety mode is that people can quickly open the door from the inside without needing to look for a key or anything else. Another advantage is that the outside handle remains locked in case of a false alarm.

Referring to figure 3, there is illustrated two ways of operating the door lock other than by the smoke alarm. Thus, a remote control device (FOB) 14 (which may be handheld) can send a radio-frequency signal to the interface unit 12 which may be hardwired to a lock 10 or some other device to change the mode of the lock. Alternatively, a telephone 15 can be used to send a signal to the interface unit 12 to control the mode of lock 10.

Figure 4 illustrates dramatically operation of an embodiment of the invention.

Figure 5 illustrates the various inputs and outputs of an interface unit according to an embodiment of the invention.

Figure 6 illustrates a typical remote control device and illustrating that the remote control device can have multiple channels.

Figure 7 illustrates how a single remote control device can operate various units.

5 Interconnectivity can be achieved with interface units (modules) 12 which will act as a link with the door lock or other hardwired devices or controllers. The various interface units 12 can operate independently and need not be linked to a central controller.

10 The lock can remain in the non-secure mode until it is either manually relocked (for instance using a key) or locked remotely (for instance using a remote control device or a signal from a telephone, personal computer, PDA etc).

15 The interface unit 12 is able to receive a radio-frequency command from a remote control device etc and can relay this command to an electrical output. Likewise, the interface unit 12 is capable of receiving an electrical input and sending a radio-frequency command to the lock. This can enable interconnectivity (local integration) of the electrical devices with the lock and provides convenience of controlling multiple devices with one remote control. The other devices may comprise controllers such as lights, electric gates, electric strikes, roller doors, automatic garage doors, tilt doors, and the like.

25 Throughout the specification and the claims (if present), unless the context requires otherwise, the term "comprise", or variations such as "comprises" or "comprising", will be understood to apply the inclusion of the stated integer or group of integers but not the exclusion of any other integer or group of integers.

30 Throughout the specification and claims (if present), unless the context requires otherwise, the term "substantially" or "about" will be understood to not be limited to the value for the range qualified by the terms.

Any embodiment of the invention is meant to be illustrative only and is not meant to be limiting to the invention. Therefore, it should be appreciated that various other changes and modifications can be made to any embodiment described without

departing from the spirit and scope of the invention.

CLAIMS

1. A lock operating system comprising an alarm and a lock, the lock having a secure mode, a safety mode, a passage mode and operating means to enable the lock to be moved between the modes, wherein activation of the alarm causes a signal to be sent to the operating means whereupon, if the lock is in the secure mode, the lock is moved from the secure mode to the safety mode, and wherein, if the lock is in the safety mode, the lock is moved to the passage mode if an internal handle of the lock is operated.
2. A lock operating system as claimed in claim 1 wherein the alarm is a fire alarm.
3. A lock operating system as claimed in claim 1 or 2 wherein the lock comprises a mechanical lock or an electromechanical lock.
4. A lock operating system as claimed in any one of the preceding claims wherein the operating means is at least partially inside the lock body.
5. A lock operating system as claimed in any one of the preceding claims wherein the operating means is an electric motor which is operatively associated with parts of the lock mechanism to change the mode of the lock upon operation of the electric motor.
6. A lock operating system as claimed in claim 5 wherein the electric motor can operate in either direction.
7. A lock operating system as claimed in any one of the preceding claims having an interface unit.
8. A lock operating system as claimed in claim 7 wherein the interface unit can receive a signal that is produced when the alarm goes off and then send a signal to operate the operating means.

9. A lock operating system as claimed in claim 7 or 8 wherein the interface unit receives wireless signals from the alarm.
10. A lock operating system as claimed in any one of claims 7-9 wherein the signal sent from the interface unit to operate the operating means is wireless.
11. A lock operating system as claimed in claim 9 or 10 wherein the wireless signal comprises a radio-frequency signal.
12. A lock operating system as claimed in any one of claims 7-11 wherein the interface unit is powered by mains power and has a backup battery in case of power outage.
13. A lock operating system as claimed in any one of the preceding claims having means for automatically returning the lock from the safety mode and/or the passage mode to the secure mode.
14. A lock operating system as claimed in claim 13 wherein the lock is returned to the secure mode if the lock's internal handle is not operated within a predetermined time period.
15. A lock operating system having validating means to validate that the alarm is a genuine alarm.
16. A lock operating system comprising a lock which has at least a secure mode and a safety mode and/or a passage mode, operating means to enable the lock to be moved from at least the secure mode to the safety mode or passage mode, an alarm, and an interface unit, the interface unit receiving a signal upon activation of the alarm, and sending a signal to the operating means to move the lock from the secure mode to the safety mode or the passage mode.
17. A lock operating system comprising a lock which has at least a secure mode and a non secure mode, an alarm (which may be a smoke alarm) and means to operate the lock

from the secure mode to the non secure mode upon activation of the alarm.

18. A lock operating system substantially as hereinbefore described with reference to the accompanying drawings.