

CARD OPERATED LOCK

This invention relates to a card operated lock, that is a lock in which the key is in the form of a card which carries a code for unlocking the lock. Such 'card keys' are typically semi-rigid, substantially flat and formed of cardboard, plastics and/or metal. The code may be in various forms and typically may comprise a pattern of holes which is detected electronically in the lock, or a pattern of magnetic poles such as described in US-A-4133194.

To assist handicapped persons, a lever operated lock is specified in many applications. A lever is used to unlatch the lock, but a separate key is still provided to unlock the lock. This is particularly suitable with a card operated lock where the card is inserted into the lockset to unlock the lock, the card being retained in the lock and the same hand being used to turn the lever to withdraw the latch and open the door, after which the card can be withdrawn and the lock returns to the locked mode. Such a lock is described in EP-A-0241323.

To assist handicapped persons, the elderly and children with the use of keys which comprise a stem and a bow (head) on the stem, the bow has been enlarged, or elongated to form a T or L shape, which thus offers better leverage and is easier to grasp, squeeze and rotate when unlocking the lock. The key is turned to throw a bolt or latch, or otherwise to unlock the lock. Thus in some locksets the key is turned to allow the bolt or latch to be withdrawn by turning a lever-type handle, and in others the turning of the key itself will withdraw a bolt or latch.

A lever-type lockset is often more expensive than the cylindrical type lockset, such as is described in US-A-4133194, in which the lever is replaced by a cylindrical knob which is turned to withdraw the latch. This is because a greater force can be applied to the lever to try and force the lock, and a strong spring-return mechanism must be provided to return and hold the lever in the horizontal position. Typically the lever will be of steel or brass, except in very light duty applications where it may be of aluminium, which is more easily damaged. The cylindrical lockset is, however, more difficult for the handicapped, elderly and very young to operate because of the combined grasping and turning motion which is required. It is

also known to modify a cylindrical lockset by attaching a lever to the knob. However, this is cumbersome, there is often a problem with the spring return on the knob not being sufficient to counter the weight of the lever, and also there is still a need for a key to unlock the lock.

A first aspect of the present invention provides a card operated magnetic lock comprising a lockset having a knob which is arranged to be turned to withdraw a locking member, a key in a form of a card carrying a pattern of magnetic poles which is inserted into a slot in the knob to unlock the lock, a free end of the card extending at least 1.5 cm out of the knob when the card is fully inserted in the knob to unlock the lock so as to form a lever for turning the knob to withdraw the locking member, and a key hold-in gripping mechanism to normally retain the key in the slot when fully inserted in the slot.

The free end of the card may be adapted by providing a card of increased length which protrudes sufficiently far out of the knob to be gripped or for the user to bear on the card end, similar to the operation of a lever. In another form, a T-bar or loop may be attached to the free end of the card, the user gripping or bearing on the T-bar or loop to pull on the end of the card to rotate the knob.

Very preferably the slot is arranged so that the card is inserted generally horizontally into the knob so that it extends out sideways from the knob for optimum leverage when a downwards force is applied to the end of the card. Preferably the slot will face away from the adjacent door jamb.

Other arrangements may be provided. For example the card may be L-shaped to facilitate application of a downwards force when the card is inserted vertically into a slot, although such an arrangement provides for a larger card key.

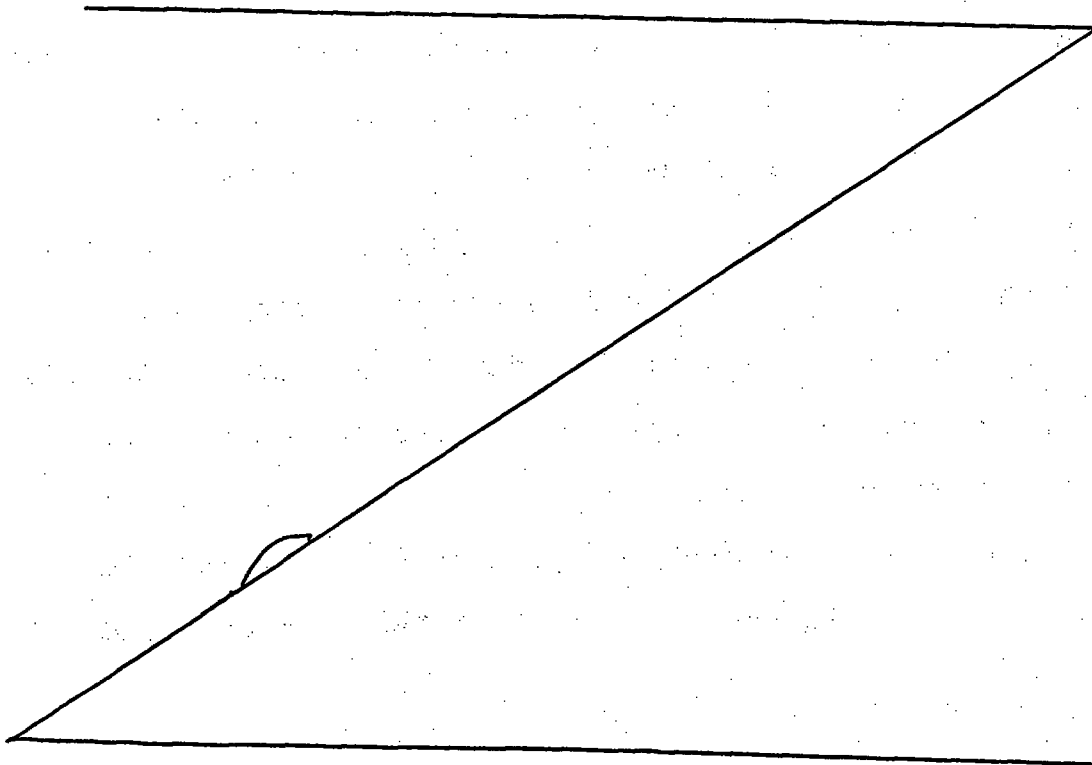
Another aspect of the invention provides a card operated lock comprising a lockset having a cylindrical knob which is arranged to withdraw a latch, and a key in the form of a card which is inserted into a slot in the knob to unlock the lock, wherein the slot is positioned sideways of the knob for the card to be inserted generally horizontally into the slot, and the knob is rotatable clockwise and anti-clockwise, rotation in either direction serving to withdraw the latch. In this way, the lockset is completely reversible on a door. The lockset may be positioned on the left or right of the door, with the slot always facing the hinged side of the door. As is usual, a bevelled latch is provided

which is reversible to suit the direction of opening of the door.

Typically a lockset will have a cylindrical, card operated lock on one end of the lockset spindle, and a cylinder or lever directly coupled to the other end of the spindle.

Where a second cylinder is used, it maybe provided with a slot to receive a card key for lever-type operation, although the lock mechanism per se is not needed (unless the opening of the door is to be controlled by a key from both sides).

In operation, a separate handle or lever operated latch is usually provided for moving the door open so that the end of the card key itself will not be pushed or pulled to open the door.



The aspects of the invention are especially suitable for use in magnetic key operated locks, such as described in, inter alia, EP-A-0024242 and US-A-4133194.

Other aspects, preferred features, and advantages of the invention will be apparent from the following description and the accompanying claims.

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

Figure 1 is a perspective view of a lockset forming an embodiment of the invention;

Figure 2 is an end view of the lockset of Figure 1;

Figure 3 is a view on line III-III of Figure 1; and

Figure 4 is a cross-sectional part view on line IV-IV of Figure 2.

Figure 1 is a perspective view of an entrance-type lockset 2 forming an embodiment of the invention. The lockset 2 comprises a card-operated cylindrical locking knob 4, and a rear locking knob 6 which has a turn-button (not shown) to lock and unlock a front spindle 12 (Figure 3) and in so doing also knob 4. The knobs 4, 6 are rotated to withdraw a locking member in the form of a latch 8.

The construction and working of the locking knob 4 is as described in EP-A-0024242, subject to modifications which will be described hereinafter in relation to Figures 3 and 4.

The lockset 2 functions as follows. When the turn-button (not shown) in the end of the knob 6 is pushed in, it locks the front spindle 12 (Fig. 3). A key 10 must be inserted into the knob 4 in order to unlock the lock, the key being retained in the lock in unlocked mode. This couples the knob 4 to a centre tailpiece driver 11 to be rotated to cause withdrawal of the latch 8. This operation will cause the push button in the knob 6 to pop-out and leave the lock in the unlocked mode until the push button on knob 6 is pushed in again. The front spindle 12 is thus free to rotate. In this situation the latch 8 can be retracted by rotating the rear casing 18 of the locking knob 4. The rear casing 18 is attached to a core 36 which is fixed to a spindle sleeve 9 which is coupled to the front spindle 12 to rotate it. Rotation of the rear casing 18 thus rotates the front spindle 12 to retract the latch 8. This requires grasping the rear casing 18.

If the button is pushed-in and rotated ninety degrees, it does not pop-out on turning of the knob 6 or by use

of a key to unlock the lock, and so continued keyed operation of the lock is required. This system of cylindrical lockset operation is well-known, and the operation of the knob 4 and rear casing 18 are particularly described in EP-A-0024242.

The knob 4 has a front cylindrical casing 12 which houses a magnetic key operated locking mechanism. In such a mechanism, a plurality of magnet pins are carried in a slide member which is moved by the key 10 to operate the lock. The magnet pins extend out of the slide member and project through holes in a lockplate which is fixed in the body of the knob 4. When the correct key is inserted the pins are repelled out of the holes in the lock plate, into the slide member, and so further insertion of the key moves the slide member to an unlocking position at which point the key is retained in the mechanism, allowing the key to be released by the user while the lock remains in the unlocked mode. In the embodiment described, the front outer casing 14 of knob 4 is then coupled to the centre tailpiece driver 11 so that the casing 14 can be turned to rotate the tailpiece 11 to withdraw the latch 8 with the same hand that inserted the key 10.

A mechanism to retain the key in the knob, holding the

lock in the unlocked mode while the knob is turned, is described in detail in EP-A-0241323 at Figures 5 and 6 and its application to the cylindrical knob of EP-A-0024242 is briefly described below by reference to Figure 4.

Referring to Figures 1 and 2, for the user to open the lock, i.e. withdraw the bolt 8, when the turn-button is pushed in (i.e. the lock is locked), the user inserts the magnetic card key 10 into a slot 16 which is positioned sideways of the outer casing 14, the key 10 being inserted in the horizontal direction. If the key has the correct code it unlocks the lock, retains the lock in the unlocked mode and so couples the casing 14 to the tailpiece 11. The outer free end 20 of the key 10 is then pushed or pulled laterally of the direction of insertion in the plane of rotation of the knob 4 to rotate the knob 4, (clockwise in Figure 2,) and so withdraw the latch 8. To facilitate the operation of pushing or pulling on the key end 20, the card 10 is made somewhat longer than usual, and/or is provided with a T-bow, hook, ring or other means which can be engaged by the user by a finger, prosthesis, etc, to apply a turning movement or downwards force to the key end 20.

In practice the key movement will usually be at right

angles to its long axis A-A, and so a rotational force is applied generally in the direction of arrow B (Figure 2).

The key is adapted to be operated on to rotate the knob 4 by, for example, being of increased length, of increased rigidity and/or by having a manually grippable member attached to the free end 20. Shown in Figures 1 to 3 is a T-bar 24 which is suspended from an eyelet 22 in the key end 20 by a ring 26. Ring 26 is dimensioned to clear the corners of the end 20 of the key 10. The T-bar may be a ring or other shape.

The key 10 is of increased length so that when inserted fully in the knob 4 to unlock the lock, the key end 20 extends further out than usual, by about 1.5cm to provide additional leverage for the T-bar 24. Where a T-bar or the like is not provided, an extra long key, of increased length about 4cm is provided so that the user can bear down directly on the free end 20 of the key, in the direction of arrow C (Fig. 2).

Thus, preferably the key 20 extends out of the casing 14 by from about 1.5 to 6cm, and particularly on the shorter key an additional means is provided for operating on the key.

In some other applications the front casing 14 of the knob 4 is arranged to be free-spinning when the key is

not inserted, so that the lock cannot be forced by turning the casing 14. The key of this invention can be used to operate such locks, in a similar manner to that described herein.

In the preferred embodiment, the knob 4 is sprung so that when released it returns to a position with the slot 16 facing sideways, in line with and away from the latch 8. The mechanism shown in Figure 3 provides two functions, one is to return knob 4 so that the slot 16 faces sideways, and the second is to limit the rotation of the casing 14 relative to the front spindle 12, so that the casing 14 can be freely turned ninety degrees, after which further turning will rotate the spindle 12 to withdraw the latch 8 when the lock is not locked, i.e. the turn-button is not pushed in.

Referring to Figure 3, the outer casing 14 which carries the lock mechanism (not shown) such as the slider and lock plate, has a fixed annular plate 30 which is fastened to the casing 46 by screws 32. A rotatable annular plate 34 is fixed to a core 36 which rotates in the annular plate 30 and is fixed to a cylindrical spindle sleeve 9. Core 36 is coupled to the rear casing part 18 (Fig. 1) by screws 38, and casing part 18 thus rotates with the core 36 and applies turning force to the spindle 12.

The rotatable plate 34 has two shoulders 40, 42 which are positioned to abut a tongue 44 extending in the axial direction out of the plane of the plate 30. Thus, when plate 30 rotates ninety degrees clockwise, tongue 44 abuts shoulder 40 and when rotated ninety degrees counter-clockwise, tongue 44 abuts shoulder 42. When the lock is unlocked, the outer casing part 14 can be rotated ninety degrees (in either direction) to bring tongue 44 against a shoulder 40 or 42, and further rotation then rotates the plate 34, and so spindle 12 will withdraw the latch 8. For the handicapped, this rotation can be effected by inserting a key 10 in the usual way in slot 16. The key does not need to be inserted fully into the slot 16 because the lock is not locked. However, where the mechanism includes means for holding the key in the slot 16 (as described below), it is preferred to insert the key fully as this helps hold the key in as the key is levered on. Also, this will couple the casing part 14 to the centre tailpiece driver 11, which will withdraw the latch 8 on rotation of the casing part through only ninety degrees.

It will be appreciated that when the lock is locked, the spindle 12 will not rotate and so movement of the casing 14 is limited by the tongue 44 abutting the shoulders 40, 42. To withdraw the latch 8, the key 10 is inserted

fully to unlock the lock and so couple the casing part 14 to the tailpiece driver 11. Rotation of the casing part 14, and hence tailpiece driver 11, through only ninety degrees then serves to withdraw the latch 8.

A coil spring 46 extends twice around the core 36, underneath tabs 48 on the rotatable plate 34, and its ends 50, 52 are hooked around tongue 44 and a similar tongue 54 on plate 34. Thus, when plate 30 is rotated clockwise as seen in Fig. 3 (by rotating casing 14) tab 44 pulls end 50 to tighten the spring, which will return the plate 30, and casing part 14 to its rest position (Figure 3) when the casing part 14 is released.

Similarly, counterclockwise rotation causes tab 44 to pull end 52 to tighten the spring. Thus, the spring 46 serves to orient the casing part 14 with the slot 16 facing sideways.

Figure 4 shows a cross-sectional detail of the knob 4 to illustrate the mechanism for holding the key in the lock in the unlocking position. The mechanism is similar to that seen in EP-A-0241323 at Figures 5 and 6, with minor adaption to suit the cylindrical lock of the type seen in EP-A-024282. As it is well known, a slide member 60 carries in blind bores (not shown) a plurality of magnet pins (not shown). The pins are attracted by a

steel plate 62 so as to project through holes (not shown) in a brass locking plate 64 and abut an intermediate plate 66. The locking plate 64 is fixed in position in the front casing part 14 and so the pins prevent movement of the slide member 60 relative to the locking plate, thus the lock is locked. To unlock the lock, the key 10 is inserted between the intermediate plate 66 and steel plate 62 which moves back against a plate spring 68. The key, having the correct code, repels the magnet pins to the bottom of the blind bores out of engagement in the holes in the locking plate 64. The key 10 abuts at its inner end (not shown) a toe on the slide member and so further movement of the key moves the slide member which effects an action of unlocking the lock. In the embodiment shown, movement of the slide member couples the front casing part 14 to the tailpiece 11.

The slide member 60 is moved against the urging force of a coil spring (not shown) which urges the slide member to the locking position. To facilitate operation of the lock with one hand, a key hold in mechanism holds the slide member in the unlocked position while the key is fully inserted in the lock. The key 10, as it is inserted, bears on a cam 70 which is pivotally mounted on a side of the slide member 60. As the slide member

is moved to the unlocked position, a claw 72 on the cam rides under a leg 74 of a leaf spring 76 which is fixed to a stationary plastics guide 78 in the front casing part 14. The claw 72 catches on a foot 80 of the leg 74 and so holds the slide member 60 in the unlocking position, against the urging force of a coil spring (not shown). The force of the coil spring, when the slide member 60 is held in the unlocking position, tends to create a pressing force urging the cam 70 against the key 10, thus tending to hold or maintain the key in place, enhancing the similar pressing force applied to the other side of the key by the plate spring 68. Of course, the key 10 can be readily withdrawn despite this surface pressure. When the key is removed from the lock, the cam 70 is free to pivot away from the leaf spring 76, and so the claw 72 can disengage from the foot 80 by passing under it, to allow the slide member to move back to the locking position.

The lockset is reversible, i. e. it can be used on either edge of a door, since casing 14 can be rotated in either direction to withdraw the latch 8 (which itself is reversible).

It will be noted that with the card key of the invention the key can be used to withdraw the locking member, even if the lock is not previously locked, the key acting as

a lever when it is inserted in the knob 4. Thus the user need not concern himself with whether or not the lockset is locked or to test it to determine if a key is required. A handicapped person would be instructed to always insert his key in the lock..

Various modifications will be made to suit the many different lock requirements. The locking knob 4 might not be sprung to return, when released, to its rest position, with the slot 16 sideways, when operating a bolt action where the position of the bolt is coupled to the rotational position of the knob 4. Some locks will require the knob 4 to be rotated through more than ninety degrees to withdraw a latch or bolt. Where greater rotation is required, a shorter key may be used to avoid hitting the door jamb, or to avoid hitting a nearby lever.

Where the key must be inserted with a particular face towards the user, a groove or peripheral rib 58, or other means such as an axially offset hole or a missing corner or embossed arrow is provided to identify the orientation of the key to a blind or partially sighted person, as well as a visible indicator such as a printed arrow. For magnetic lock systems, a metal or plastics key 10 may be used, the former being described in GB-A-1569017 and the latter in GB-A-1209934, the metal key being more suitable for longer length keys.

Generally the key will be of sufficient rigidity to enable it to be used as a lever. Where a cardboard key, in particular, is used it may be necessary to reinforce the key. Although the invention has been described with particular reference to a cylindrical lock, it can be used with other locking devices, such as rim locks, mortise locks, dead bolts, etc.

The knob slot 16 can be positioned at other locations than sideways. The plate 34 is coupled to the core 36 by four tangs 35 which engage in recesses 37 in the core 36. The tangs 35 and recesses 37 are spaced at ninety degree intervals and so the plate 34 may be relocated through ninety degree intervals relative to the core 36. This in turn will move the rest positions of the annular plate 30 and associated lock mechanism and casing 14 through ninety degrees.

Also it will be appreciated that the degree of free movement of the front casing part 14 relative to the rear casing part 18 (governed by the position of shoulders 40, 42) may be varied to provide greater or less free movement.

It may be preferable to locate the slot 16 facing downwards for an outside door lock. The key 10 can

still be inserted and pushed or pulled through ninety degrees to open the lock, and the downwardly facing position may be easier for a small child or someone in a wheelchair.

Various modifications may be made to the described embodiment and it is desired to include all such modifications as fall within the scope of the invention.



1. A card operated magnetic lock comprising a lockset having a knob which is arranged to be turned to withdraw a locking member, a key in a form of a card carrying a  
5 pattern of magnetic poles which is inserted into a slot in the knob to unlock the lock, a free end of the card extending at least 1.5 cm out of the knob when the card is fully inserted in the knob to unlock the lock so as to form a lever for turning the knob to withdraw the locking  
10 member, and a key hold-in gripping mechanism to normally retain the key in the slot when fully inserted in the slot.

2. A card operated magnetic lock as claimed in claim 1, wherein the card extends between 1.5 cm and 6 cm out of the slot.

15 3. A card operated magnetic lock as claimed in claim 1, wherein on insertion of the key to unlock the lock, a slide member is moved by the key from a locking to an unlocking position, and means is provided to hold the slide member in the unlocking position against the action of a biasing  
20 force urging the slide member to the locking position, while the key is substantially fully inserted.

4. A card operated magnetic lock comprising a lockset having a knob which is arranged to be turned to withdraw a locking member, a key in a form of a card carrying a  
25 pattern of magnetic poles which is inserted into a slot in



20.

the knob to unlock the lock, wherein the slot is positioned sideways of the knob for the card to be inserted generally horizontally into the slot, a free end of the card extending at least 1.5 cms out of the knob when the card is  
5 fully inserted in the knob to unlock the lock so as to form a lever for turning the knob to withdraw the locking member, and the knob is rotatable clockwise and anti-clockwise, rotation in either direction serving to withdraw the locking member, and a key hold-in gripping mechanism to  
10 normally retain the key in the slot when fully inserted in the slot.

5. A card operated magnetic lock comprising a lockset having a knob which is arranged to be turned to withdraw a locking member, a key in a form of a card carrying a  
15 pattern of magnetic poles which is inserted into a slot in the knob to unlock the lock, wherein the slot is positioned for the card to be inserted generally vertically upwards into the slot, a free end of the card extending at least 1.5 cms out of the knob when the card is fully inserted in  
20 the knob to unlock the lock so as to form a lever for turning the knob to withdraw the locking member, and the knob is rotatable clockwise and anti-clockwise, rotation in either direction serving to withdraw the locking member, and a key hold-in gripping mechanism to normally retain the  
25 key in the slot when fully inserted in the slot.



21.

6. A card operated magnetic lock according to any one of claims 1 to 5, in which the key carries a formation which can be felt to indicate the orientation of the key.

5 7. A card operated magnetic lock according to claim 6 in which the key has a ring or T-bar pivotably attached to its free end.

8. A card operated magnetic lock substantially as herein described with reference to the accompanying drawings.

---