

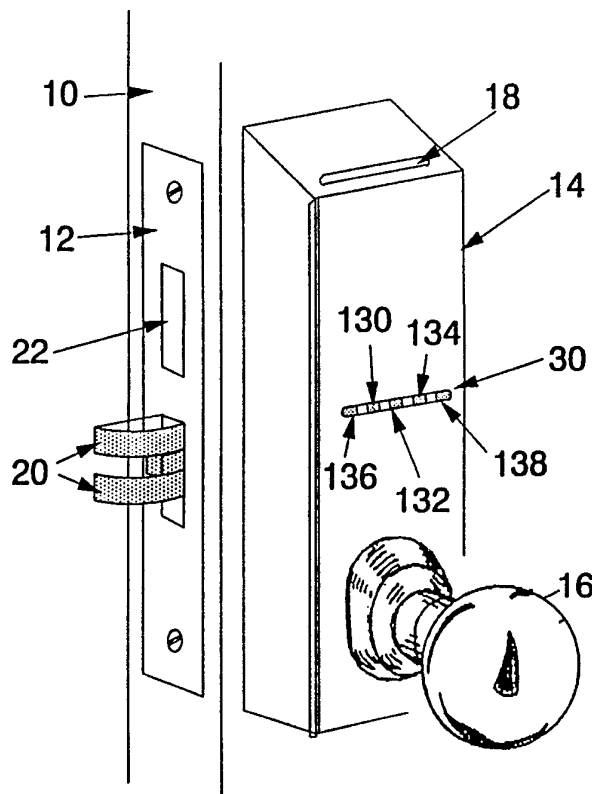


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(54) Title: IMPROVEMENTS IN AND RELATING TO LOCKS**(57) Abstract**

A card releasable mechanism for use in combination with a mortice lock associated with a door which lock is openable by rotating a drive shaft which extends therethrough. A second shaft separate from but aligned axially with the lock drive shaft, second shaft protrudes through a front plate on the outside of the door to enable a handle to be mounted thereon. Rotation of the handle will if authorised release the lock and allow the door to be opened. Clutch means transmits drive from one shaft to the other but when disengaged prevents rotation of the second shaft from being transmitted to the drive shaft. A card reader is adapted to derive information from coded data carried by a card inserted therein. Decoding circuit means and logic circuit means generates control signals if data received by the card reader satisfies pre-programmed conditions; and a clutch actuator comprising electrically powered drive means for operating said clutch in response to appropriately generated control signals enables the lock to be unlocked and the door to be opened after the insertion of an appropriate card into the card reader.



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Title: Improvements in and relating to Locks

Field of invention

This invention concerns locks particularly although not exclusively door locks for hotel rooms.

Background to the invention

Door locks for hotel rooms have to serve a number of requirements.

In the first place they must secure the room against unauthorised access.

Secondly they need to provide the occupant with the facility of bolting the door from within yet provide the occupant with the ability to open the door from inside quickly and easily without the need for a key to enable any occupants of the room to leave quickly in an emergency.

Thirdly each lock must be unique at least within each hotel, so that a room key for one room cannot be used to open another room door. On the other hand all locks should be capable of being opened by a single master key for use by cleaning staff or hotel management personnel.

In recent years conventional locks have been replaced or modified with card releasable locks enabling the hotel to

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issue each guest with a card instead of a key and additional facilities can be provided with such locking systems such as terminating the door opening capability of a card after a particular time period has elapsed from the issue of the card to the guest.

Problems have been experienced in practice with such systems and it is an object of the present invention to provide an improved card released lock and card operated locking system for hotels.

Although the invention will be described exclusively in relation to hotels, it is to be understood that the invention is equally applicable albeit with minor modifications to office blocks, factories, government buildings, prisons, secure hospitals, schools and the like, indeed any building to which people have access and which contain well defined areas which are to be made secure against unauthorised entry.

Summary of the invention

According to one aspect of the present invention a card releasable mechanism for use in combination with a mortice lock which itself is openable by rotating a drive shaft which extends therethrough, comprises a second shaft separate from but aligned axially with the lock drive shaft, which protrudes through a front plate on the outside of the door to enable a handle to be mounted thereon, rotation of which will if authorised release the lock and allow the door to be opened, wherein clutch means is provided which when engaged transmits drive between the said second shaft and the drive shaft but when disengaged prevents rotation of the second shaft from being

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transmitted to the drive shaft and in combination therewith a card reader, adapted to derive information from coded data carried by a card inserted therein, decoding circuit means and logic circuit means for generating control signals if data received by the card reader satisfies pre-programmed conditions and electrically powered drive means for operating the said clutch in response to appropriately generated signals to enable the door to be unlocked and opened after the insertion of an appropriate card into the card reader.

The clutch preferably provides a positive drive between the two shafts as by the engagement of a dog or other drive transmitting member so that when the clutch is engaged no slip can occur.

Preferably actuation of the drive transmitting member from the clutch actuating drive means includes at least one lost motion connection thereby to enable the clutch drive means to operate without damage occurring should the drive transmitting element be misaligned and prevented from entering into the drive transmitting position.

In one arrangement spring means may be provided to retract the drive transmitting element when the clutch drive means is deactivated.

Alternatively and preferably the clutch drive means is adapted to operate and move the drive transmitting element into the drive transmitting position in response to a short duration pulse of electrical energy and mechanical means is included which maintains the drive transmitting element in the drive transmitting position until a second until a second short duration pulse of electrical energy

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is applied to the clutch actuator means to enable the element to be retracted.

Preferably the period of time between the generation of the first pulse and the second pulse is controllable and may for example be determined by data contained on a card inserted into the card reader. Thus a door lock can be left enabled so that the door can be opened without the need to insert a card for an extended period of time, if desired.

Conveniently switch means is provided which is actuated only when the lock has been fully retracted to permit the door to be opened, which switch means causes a said second pulse to be generated to thereby enable the drive transmitting device to revert to its normal rest position to disengage the clutch so that when the door has been shut, the lock is once again incapable of being operated from outside the room.

If the drive transmitting element is moved into its drive transmitting position upon the insertion of an appropriate card, the door handle will be left in an operable mode until the said switch means is operated, which is only after the door handle has been rotated to open the door. Thus if a card is inserted and removed the door will have been effectively unlocked. To prevent a door being accidentally left in this condition, timing means may be included within the mechanism which generates the second pulse a short period of time after the first pulse has been generated in the event that the switch means has not been actuated. Typically the period of time is of the order of a few seconds, for example 5 to 8 seconds which is normally sufficient time for the person who has

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inserted the card to rotate the handle and open the door. However, should this not be the case, inserting the card once again will simply give the person wishing to gain access a further similar period of time within which to rotate the handle and open the door.

According to a preferred feature of the invention, the control means for generating the electrical signals for operating the clutch actuator is itself adapted not to so produce the clutch actuating signals until after the card has been removed from the card reader. In this way it is impossible for a person to insert the card and accidentally leave the latter in the lock on the outside of the door, enter the room and for the door to slam shut after them leaving the card on the outside and available to be stolen whilst the authorised user of the card is within the room.

According to a preferred feature of the invention the clutch actuating drive means comprises an electric motor adapted to rotate a cam from a first position to a second position, movement of the cam between the said two positions effecting axial movement of a pin means to engage in a slot and thereby transmit drive between the two shafts.

In order to obviate a problem which has been associated with other card released locking devices, the drive transmitting device is preferably formed from non-magnetic material so that it is not possible for the latter to be moved under the influence of a strong external magnetic field.

In a preferred embodiment of the invention, the clutch

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actuator comprises a cam driven by an electric motor and rotatable through approximately 180° so as to push, by camming action, a pin into a slot, so as to provide driving engagement between the shaft and the pin; and release of the clutch is achieved by simply continuing to rotate the cam so as to perform a complete revolution so that the pin is again free to retract.

Preferably spring means acts on the pin in a direction to maintain contact with the camming surface and a lost motion connection is provided so that the leading end of the pin can remain stationary if jammed and the lost motion connection can accommodate the whole of the movement attributable to the cam.

In a preferred version of the cam drive, a non-symmetrical cam may be employed sometimes referred to as a snail shell cam in which that part of the cam which produces the drive engaging movement of the pin corresponds to an inclined plane which subtends a small angle and that part which enables the pin to return to its rest and disengaged position corresponds to a very steeply inclined plane which subtends an angle approaching 90° . By utilising such a cam the time required to disengage the pin is much less than that required to engage the pin so that the disengagement i.e. effective locking of the door mechanism is achieved very quickly.

Preferably the drive for the cam is achieved using a worm and spur gear with the worm driven directly by the electric motor. Such a drive presents almost infinite resistance to any return torque so that there is little if any chance of movement of the cam after the motor is stopped and the combination of the spur wheel and worm

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gear acts effectively as a brake on the cam.

The cam is preferably mounted on the same shaft as is the spur wheel.

Additional cams may be provided on the same shaft for actuating micro switches when the clutch operating cam has been rotated to the most displaced position of the cam surface, and when it once again regains its rest position after 360° of rotation.

Full advantage of a non-symmetrical cam can be obtained if the cam surface is interrupted with a virtually radial step between the point of maximum radius to the point of minimum radius. In this event rotation through approximately 330° or even more may be provided for by the initial rotation of the motor requiring thereafter only some 30° of rotation to return the cam to its start position in which the pin means can retract fully.

This type of cam profile may be employed where the motor is a unidirectional motor or a reversing drive is employed. However, in the latter event the time taken to return the cam to its rest position will be substantially the same as that required to drive the pin into its engaging position.

The use of a rotary drive together with a worm and spur gear has the particular advantage that once the motor has driven the spur gear to a particular desired position in which the clutch is engaged, there is no need to maintain the supply of current to the motor to maintain the clutch engaged condition which thereby saves energy.

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According to a preferred feature of the invention, electric current for the motor and for the control circuits and the card reader is derived from one or more batteries carried within the lock controlling mechanism or the lock or the door. However, it is to be understood that the invention is not limited to battery operated systems and is equally applicable to a card operated door lock release mechanism which is powered from an external source of power such as a battery or power supply or the electricity supply mains or any combination thereof. Thus electrical power for the release mechanism may be conveyed thereto by cabling which extends between the door and the door jam on the hinge side of the door, sufficient cable being provided to accommodate the distance between the door and the door jam even when the door is fully opened.

In accordance with a further aspect of the invention, the release mechanism may include a display containing for example differently coloured light emitting diodes and the control circuit means is adapted to generate further control signals which cause the light emitting diodes to be illuminated depending on the circumstances. Thus for example after a card has been inserted and read and removed if the lock is released as a consequence (i.e. the card has been authorised to open the door) then typically a green light emitting diode may be caused to flash for a short time or until such time as the door has been opened.

A further signal may be generated if for example the door has not been opened within a prescribed period of for example 5 to 8 seconds after the card has been removed and in this event a red light emitting diode may be caused to flash.

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According to a further preferred feature of the invention, the illuminated display may be duplicated on the interior of the door and may be visible through a window in the back plate mounted on the rear of the door.

Typically the light emitting diodes are simply connected in parallel so that whatever light condition occurs on the outside is mimicked inside the room. However, the invention is not limited to such an arrangement and separate wiring and separate or the same control signals may be applied to the different light emitting diodes so that in some circumstances different display information will appear inside the room as from that appearing outside and vice a versa.

According to a particular feature of the invention the control circuit means which is supplied with signals from the card reader is programmed so as to distinguish between a plurality of different cards and following the insertion (and recordal) of one type of card is adapted to cause a green light emitting diode to flash at least on the inside of the door but to inhibit at that time the generation of a signal for engaging the clutch, the card reader also generates a clutch engaging signal after the same card has been inserted and removed a second time. Such a card may for example be given to hotel staff or in the case of an office building non-management personnel, and the recipients are instructed to insert and remove their card and await clearance (from within the room) before inserting and removing the card a second time to gain entry. Such an arrangement enables the occupant of the room to either deny access to the extent of even bolting the door from within or to grant access depending on

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circumstances and desire.

Instead of or in addition to the illumination of a green light emitting diode visible from within the room, a buzzer or other warning device may be activated by the same signal so the occupant of the room can be alerted to the fact that somebody wishes to gain entry but is awaiting their instructions.

In the event that the door is provided with a so-called dead bolt and electrically powered drive means is available for advancing and retracting the said dead bolt, the signal which causes the green light emitting diode to flash may also be used to enable the drive to the dead bolt so as to cause the latter to engage and thereby secure the door against unauthorised entry even if the person wishing to gain access inserts their card a second time.

Where the dead bolt is capable of being driven in this way, a further card may be provided the data on which is adapted to override all locking functions and cause signals to be transmitted both to the clutch and to the dead bolt drive so as to withdrawn the dead bolt and enable the door to be opened for emergency purposes.

Where the deadbolt cannot be driven, but a further clutch is provided between the external handle and the deadbolt operating shaft, which when actuated enables the deadbolt to be retracted as well as the door lock on rotation of the handle, the said further card may alternatively enable actuation of the said further clutch to enable a locked and bolted door to be opened in an emergency.

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According to a further aspect of the present invention there may be provided in or associated with the display means, infrared or opto electric transmitters and receivers, to enable data to be transmitted to and received from data storage means located within the lock release mechanism. To this end the latter preferably includes digital storage means such as random access memories, and circuit means for entering data into the memory means and reading out data stored therein.

According to a further preferred feature of the invention, a pulse generator circuit may be incorporated adapted to produce timing pulses at one second intervals or multiples thereof to serve as timing pulses, and counter and register means are provided into which date and time can be stored in digital form and updated as appropriate by the pulses from the pulse generator circuit. The latter may for example be crystal controlled.

In order to set and reset the clock means, data may be entered via the data ports (infrared or opto electric) or by means of a card which has previously been programmed. Where the card is itself inactive but merely bears static data, the card can be used to enter the approximate time into a number of locks but where a so-called smart card is employed which itself contains in solid state micro circuits its own time clock, real time data may be entered into the memory of the lock release mechanism for comparison with and calibrating the time clock generator means therewithin.

According to a further preferred feature of the invention, data transmitting and receiving means such as infrared or opto electric detectors and transmitters may be provided

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on the inside of the door as well as on the outside, to enable appropriately aligned data transmitters and receivers located within the room to transmit or receive information to and from the door. In this way for example information about temperature and light level within a room can be checked without opening the door and temperature controls and lighting and/or other electrical appliances within the room can be activated remotely by transmitting data to the data receiver on the outside of the door and relaying via the control circuit means the data to the data transmitter device on the inside of the door, which when transmitted is received by a data receiver at a remote position in the room which upon being decoded by receiving and decoding circuits associated therewith can be converted into control signals for either turning on or turning off or up or down the room heating, the room lighting etc.

According to a further preferred feature of the invention, data may be fed into or out of a lock release mechanism as aforesaid using a portable transmitter receiver device which itself includes infrared or opto electrical devices, as appropriate, positioned similarly to those at least on the outside of the door, so that merely pointing the hand held device at the lock release mechanism and pressing appropriate switches, so data can be transmitted to the receiver on the door, or received from the transmitter on the door.

According to a particularly preferred aspect of the invention, memory means is provided within the control circuit means into which data is entered every time a card is inserted into the card reader. Essentially data identifying both the time and some unique identifying

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number or code on the card is entered together with an indication as to whether or not the door is opened before the reset signal is generated. In this way a record of all card authorised entries into a room is retained and the hand held unit is adapted to recover this data and either display this data on a screen or produce a print-out using a suitable printer. By providing a so-called first in first out memory, so a string of such card entries can be recorded which depending on the size of the memory can extend over a period of hours or days or weeks and which will enable a person containing authority to do so, to interrogate the listing and determine what cards have been used, and when, to gain access to the room.

Where the device is battery operated, it is essential that low battery state should be indicated at the earliest opportunity. To this end an audible alarm device is included within the mechanism which responds to low battery state and produces an audible low battery alarm upon insertion of a card once the low battery state has been detected. The device may be made selective so as to distinguish between a guest card and for example a maid's card so that only the latter causes the audible alarm to sound.

Typically the battery or batteries are located under the back plate on the room side of the door, which is adapted to be removable using appropriate tools to give access for battery removal.

It is envisaged that using standard lithium cells a battery life of up to three years may be achieved in view of the low current drain on the battery by the device as proposed.

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Card verification may be achieved by incorporating an opto sensor in the card reader and by providing a unique printed patch on the card so that when a card is inserted in the card reader it is first checked and verified before may be adapted to enter time data into the mechanism. This enables real time to be entered via a keyboard on the hand held device for immediate entry into the lock release mechanism, so that the time "on board" is as near true real time as possible.

The provision of an intelligent hand held communication unit associated with a locking system as aforesaid enables further features to be incorporated in the system. In particular by providing a card reader as part of the hand held communication unit, the latter can be programmed to verify cards entered therein. Such a device can be used to check whether a person holding a particular card is entitled to access a particular part of a hotel or other building, and is of particular use in secure installations, such as defence establishments, prisons, etc.

Although the hand held communication unit described so far has been limited to one in which communication is by an infrared receiver-transmitter path, it is to be understood that direct connection by plug and socket means may be used in the alternative, although this is less desirable.

The invention also lies in a security system comprising a plurality of secure areas such as rooms or zones access to each of which can be gained through one or more doors each of which is controlled by a card releasable lock as aforesaid, card dispenser means and card encoding means associated with a central accessible point within the

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building to which guests or visitors or users have access, whereby cards can be issued to appropriate persons suitably encoded to allow them access to one or more of the secured areas either indefinitely or for a restricted period of time. Preferably each of the card releaseable locks includes a card reader adapted to receive one of the cards to read the data stored thereon and each of the said locks is releaseable after the card has been removed provided the data on the card satisfies criteria stored within with the particular lock release mechanism.

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

Figure 1 is a perspective view of part of a door on which a card operated lock release mechanism is mounted.

Figure 2 is a rear view of the same door showing the room side of the said card operated lock release mechanism.

Figure 3 illustrates an exploded view of the front plate mechanism of Figure 1.

Figure 4 contains plan and side views and scrap sections of the lock clutch device,

Figure 5 is a rear view of the front plate assembly.

Figure 6 is a illustrates a hand held communication device for use with the lock,

Figure 7 is a front view of the device shown in Figure 6,

Figure 8 illustrates an encoding device and computer for encoding cards,

Figure 9 is a block circuit diagram of the control system within the lock of Figures 1 to 5,

Figure 10 is a block circuit diagram of the communication shown in Figures 6 and 7, and

Figure 11 is a block circuit diagram of the encoder of Figure 8.

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In Figure 1 a door 10 has fitted therein a conventional hotel lock 12. On the front of the door is mounted a card operated lock release mechanism 14 having a rotatable handle 16 and a card entry slot 18. In known manner, entry of an appropriate card into slot 18 enables the lock 12 to be operated by the handle 16 to retract the locking fingers 20 and thereby open the door provided the dead bolt 22 is in its retracted condition.

As shown in Figure 2, the inside of the door is fitted with a similar assembly 24 having a handle 26 and dead bolt operating button 28. Unlike the handle 16, the handle 26 will always operate the lock and retract the fingers 20 to allow an occupant of the room to leave.

In known manner rotation of the button 28 in one direction will cause the dead bolt 22 to protrude from the lock. Rotation in the opposite sense withdraws the dead bolt.

Both assemblies 14 and 24 also include a window slit 30 in the case of the front plate and 32 in the case of the rear plate, through which lights can be seen and IR signals received and transmitted as will be described later.

In Figure 3 some of the parts making up the front plate assembly of Figure 1 are shown in exploded view. The operation of the lock by the external handle 16 is achieved by ensuring that drive is transmitted from the handle 16 via the intermediate member 34 (shown in greater detail and to an enlarged scale in Figure 3a) to the lock operating shaft 36 which protrudes through the square hole in the lock assembly 12, so that rotation of 36 will cause the lock mechanism to be operated and the finger 20

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retracted.

The shafts 34 and 36 are axially aligned when assembled but are not interconnected. Rotation of the intermediate shaft assembly 34 does not therefore transmit drive to shaft 36 directly. Instead shaft 36 is keyed by means of its square end 38 to a housing 40. Rotation of the housing will also produce rotation of the shaft 36.

The cross section of the inner end 42 of the intermediate assembly 34 which engages the housing 40 is of generally circular cross section (albeit formed with a groove 44). The outboard end of the member 34 is also formed with a square cross section shaft 46 on which the handle 16 can be secured so that rotation of the handle 16 always produces rotation of the intermediate assembly 34. However, because of the circular section of the inner end 42, the latter will simply rotate i.e. slip within the circular aperture 48 within the housing 40, and the latter will simply remain stationary.

If a pin, attached to the housing 40, is introduced into the groove 44, clearly the situation is changed. Rotation of the handle 16 will now cause the housing 40 also to rotate and with it the shaft 36 thereby operating the lock. The manner in which this is achieved will be described in relation to Figure 4.

Turning to the remaining items shown in Figure 3, the housing 40 is sandwiched between two plates 50 and 52 when assembled. Spacers such as 54, 56 and 58 keep the two plates 50 and 52 separated by a distance just greater than the thickness of the housing 40 so that the latter is free to rotate about the axis of the aligned shafts 34 and 36

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between the two plates. Both plates are apertured as at 60 and 62 respectively to allow the passage of the intermediate shaft section 34 and the shaft 36.

The plates 50 and 52 are themselves mounted securely within the front plate housing 14 as by screws such as 64 and 66.

The assembly shown is one in which opening of the lock is achieved by rotating the handle 16 in a generally clockwise manner. To this end a stop to arrest anticlockwise movement of the handle 16 is provided by of engagement of a radially protruding pin 68 with an undercut 70 in the front face 72 of the housing 40.

A return spring 78 for automatically rotating the handle in an anticlockwise sense is provided on the plate 50. One end 74 is secured to the plate 50 and the other end 76 is secured to the intermediate shaft assembly 34. The spring 78 is tensioned with clockwise rotation of the handle 16 so as to provide a restoring force when the handle is released.

Figures 4a and 4b show the internal detail of the housing 40. Where appropriate the same reference numerals have been used to denote the parts common to Figures 3 and 4. Thus the circular section shaft 42 having the groove 44 is shown entering the housing 40 from the left in Figure 4b whilst the end 38 of the main lock drive shaft 36 is shown entering at the right into a square sectioned aperture in the end plate 41.

The pin 68 can also be seen engaging the underside of the rebate 70 shown in dotted outline in Figures 4a and 4b.

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Drive is transmitted between shaft 42 and shaft 38 by engaging a pin 80 in the groove 44. Since the pin is attached to the housing 40 (as will be described later) the engagement of the pin 80 in the groove 44 will cause the housing 40 to rotate with the shaft 42. As a consequence rotation of the latter will produce rotation of the shaft end 38 and operate the lock.

The pin 80 is formed with a hollow interior as best seen in Figure 4a into which the lower end of an upper pin 82 is a sliding fit. Both pins have enlarged heads 84 and 86 respectively which slide in and are guided by a cylindrical sleeve 88. The pin 80 is in turn guided in a circular aperture 90 in the lower end wall 92 of the sleeve 88 and the two pins are therefore guided for sliding movement within the sleeve and therefore the housing 40. A first spring 94 is located between the end wall 92 and the head of the pin 80 whilst a second spring 96 is located between the pin head 84 and the underside of the pin head 86. The springs are selected to give the desired characteristic but typically the upper spring will be stiffer than the lower spring.

The head 86 is engaged by a cam 98 which is mounted on a shaft 100 to rotate therewith. The latter has mounted thereon a toothed spur wheel 102 so that rotation of the wheel produces rotation of the cam. Spur wheel 102 meshes with a worm gear 104 which is mounted on the output shaft of an electric motor 106 which itself is also mounted within the housing 40.

Also on the shaft 100 are mounted two further cams 108 and 110 which serve to operate micro switches 112 and 114

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respectively, to denote that the cam is in its maximum and minimum displaced positions relative to the head 86.

The two part pin assembly 80/82 is provided so as to ensure that should the shaft 42 be misaligned, so that the pin 80 cannot enter the groove 44, movement of the cam 98 is not prevented. Instead the cam merely pushes the pin 82 further into the interior of pin 80, the lost motion connection formed thereby accommodating full displacement of the cam 98. Whilst the rotation of the cam in this situation will not allow the door to be opened, the mechanism is nevertheless protected and by arranging that the motor will drive the cam into its rest position (as shown in Figure 4a) after a short period of time, the door has been opened, the mechanism will have a chance of being reset so that the groove 44 is in fact aligned and ready to receive the pin 80. (It will be seen for example that if the handle 16 has been rotated by even a small amount by a person trying to gain access, before the pin 80 is advanced into the groove 44 subsequent, movement of the pin will of course be inhibited and the door will not be able to be unlocked. It is therefore essential that the handle 16 is left in its fully retracted position (under the influence of the restoring spring 78) whilst the card is inserted into and removed from the card receiving slot 18 to enable the mechanism to operate the pin 80 and move it into the groove 44 before any attempt is made to turn the handle 16).

Although the shaft 42 is described as having a groove 44 formed therein, it will be seen that a cut-away shaft section as at 4c or at 4d would achieve the same result. The shaft section of Figure 4c would "feel" the same as the shaft section of Figure 4a whereas that of Figure 4d

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might introduce an element of lost motion in the feel of the handle as the semi-circular section is rotated until it engages the side of the pin 80 thereafter causing rotation of the housing 40. It will be seen that if the shaft section is as shown in Figure 4d, a certain amount of rotation of the handle 16 could be accommodated before the pin 80 is fully protruding and would therefore make the mechanism less sensitive to imprecise operation of the handle during the lock releasing phase.

Figure 5 shows the rear view of the front plate 14 with the various internal components mounted therein. Thus the housing 40 can be seen mounted behind the plate 52 which itself is secured in position by screws such as 64 and 66. Visible in Figure 5 is a square section aperture 116 into which the square section end 38 of the main lock drive shaft 36 fits. To permit rotation of the latter relative to the plate 52, the square section hole 116 is formed in the centre of a round boss 118 which itself protrudes through the circular aperture 62 in the end plate 52.

In the upper half of the housing 40 is mounted a printed circuit board 122 which carries a card reader (not shown) adapted to read and write data from and to cards such as 124 which are entered into the card reader via the slot 18. The printed circuit board also carries logic circuits and control circuits, memories, interfaces and all other circuit connections for deriving the motor receiving signals from the micro switches such as 112 and 114, and receiving power from a battery (not shown) typically housed below the cover 24 on the inside of the door.

As previously mentioned the cover 14 includes a window 30 through which three light emitting diodes are visible and

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which also enables infrared radiation to be projected into and received from infrared detectors and transmitters located in line with the light emitting diodes aligned with the slit 30. A similar array is situated behind the slit 32 in the plate 24 on the rear of the door. The printed circuit board provides control signals for the light emitting diodes and circuit connections for conveying signals to and from the infrared transmitters and detectors and a multiway cable 126 with socket connector 128 extends from the circuit board through an aperture in the door for connection to an appropriate edge connector or the like on a printed circuit board (not shown) within the cover 24 on the rear of the door. In this way signals can be conveyed to the light emitting diodes and to and from the infrared detectors and transmitters on the other side of the door.

The three light emitting diodes are seen at 130, 132 and 134 through slit 30 in Figure 1 and an infrared transmitting device is shown at 136 and receiving device at 138. A similar array will be seen through the slit 32.

Communication with the logic and memory circuits on the printed circuit board 122 may be effected by means of a hand held unit 140 shown in Figure 6. This device includes a card receiving slot 142 for receiving a card such as 144, a viewing window 146 through which an LED or liquid crystal display can be seen, a keyboard generally designated 148 for entering digital data and at its front end (as shown in Figure 7) a window containing infrared transmitter 150 and receiver 152.

The device is adapted to generate digital signals for

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modulating infrared transmissions from the unit (and to decode infrared transmissions received by the unit) to (and from) the infrared devices 136 and 138 in the door release mechanism. Thus for example real time can be entered using the 24 hour clock notation via the keyboard 148 and using for example the bottom left-hand key 154, the data transmitted, so as to enter the accurate time into memory means within the housing 14.

Perhaps most importantly, the memory means within the housing 14 can be interrogated by the unit 140 and a list of details obtained relating to the card(s) which have been used and times at which access has been gained to the room. The unit 140 may include a printer for printing data out, or the data can be scrolled on the screen behind the window 146 or the data can be simply stored in a memory within the device for transmission to a printer or display at a central location to allow the data to be printed or scrolled out as a list.

The hand held unit can also be used to interrogate sensors within a room to determine temperature, whether lighting is on or off, and can also be used to transmit data via the external infrared link and via the infrared transmitter device on the inside of the door, to infrared sensing devices within the room, to for example, turn off or on heating, turn off or on lighting and the like.

A security system as described is completed by means of an encoding device 156 as shown in Figure 8 which may incorporate or be adapted to operate in conjunction with a computing device 158.

The encoder 156 includes a slot 160 into which a card such

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as 162 can be inserted and further includes a display 164 typically a liquid crystal display or the like to enable data to be displayed to the user prior to its being written to the card for verification. The computer 158 is programmed to interface with and drive the encoder unit 156 to enable room data, guest data, date and time of arrival and departure and authorised zones to be entered in digital format on the card and typically this is done by writing to a magnetic stripe on the card and storing therein data as a magnetic pattern all in known manner. However, it is to be understood that the invention is not limited to the use of magnetic stripe cards but punched cards and printed cards which can be read by optical character recognition may also be employed. However, it is believed that magnetic cards represent the most secure form since they are least able to be reproduced for unauthorised use.

Various modifications and extensions to the system are envisaged. Thus for example a microswitch may be associated with the dead bolt operating mechanism to close the switch when the dead bolt is operated and thereby create a logic condition which the processing and logic circuit means within the housing 14 can detect and act on. Thus for example when the dead bolt is across, the insertion of a card for example by a maid might cause two light emitting diodes to flash in the display panel 30 (for example both a red and an amber light emitting diode).

In addition drive means may be provided between the shaft 36 and the dead bolt operating mechanism which is operated by a square shaft 37 visible in Figure 3. By providing a clutch which is electrically operable from a disengaged to

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an engaged mode so operation of the handle 16 will not only rotate the shaft 36 but also the shaft 37 to thereby retract both the fingers 20 and the dead bolt. Since the cards can be programmed by the encoding device 156 in any convenient manner, one card may be programmed for emergency use so as to be capable of not only operating the motor 106 (after it has been inserted and withdrawn) but also a clutch (not shown) associated with the drive between the shaft 36 and the shaft 37, so that subsequent rotation of the handle 16 will gain access to the room even if the door had previously been dead bolted. Such a card would clearly only be available for emergency use where for example a hotel guest has retired to his room, dead bolted the door and then been taken ill.

Since the mechanism within the housing 14 is possibly required to not only receive data but also transmit data and also interpret different cards, simple logic circuits may not be sufficient and a microprocessor together with associated support circuits, memories and the like is preferably included on the printed circuit board 122 to enable the many functions required to be performed. Typically each card will include numerical data identifying the person to whom it has been issued (e.g. a guest, a maid, an engineer, manager etc.) digital data indicating the time and date of issue, digital data indicating the time and date when the card will cease to be authorised for use, digital data indicating which of a plurality of different zones the card can be accepted to give access and further digital data which when encoded enables the processor and or memories on the printed circuit board 122 to be accessed for either entering information or receiving information from a subsequently introduced card, or transmitting from the hand held unit

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such as shown in Figure 6. Where it is possible to operate the dead lock using the handle 16 through a further clutch, further digital data must be included which when decoded enables the second clutch, so that both the ordinary lock and the dead bolt can be withdrawn by rotation of the handle 16.

Although the LED and IR transmitter and receiver array in the lock shown in the drawings is indicated as being viewable through an elongate slit or window, more preferably the LED's and IR devices are located in separate compartments viewable through individual ports or apertures in the face plate of the lock housing. Not only does this ensure no cross talk between LED's and the IR sensor, but it also prevents someone thinking the slit as shown in the drawings comprises the card viewing aperture.

According to another preferred feature the viewing ports may be angled upwards at approximately 45° to make them easier to see.

The essential parts of the control system of the lock of Figures 1 to 5 are shown in Figure 9.

The heart of the system is a microprocessor 166. A preferred device is a Hitachi Series H8 device, typically Type 320. The device is powered by a battery 168 via a power switch 170 and power conditioner 172 which regulates the supply voltage as seen by the processor 166 and monitors the voltage and generates a warning signal either directly or via the processor when the battery voltage falls to a predetermined value.

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The power switch can be operated to allow power to the processor 166 by operation of one of four microswitches 174 located in the lock but not all shown in the drawings.

Microswitch A is closed by the insertion of a card.

Microswitch B is closed by rotating the handle 16 on the outside of the door (see Figure 1).

Microswitch C is closed by rotating the handle 26 in the inside of the door.

Microswitch D is closed by operation of the deadbolt 28 on the inside of the door.

The procesor 166 receives data or input signals from various circuit elements.

Machine readable data stored on a card such as 124 (see Figure 5) typically in a magnetic stripe on the card, is converted into electrical pulses in response to relative movement of the card as it is inserted in or removed from (or both), a card reader 176. The electrical pulses are amplified and shaped by an amplifier 178 before being supplied to a data input, typically a serial input, 180 of the CPU 166.

Date and time data from a crystal controlled real time clock 182 is supplied to another data input 184 of CPU 166. Although not shown, a permanent connection is provided between the clock 182 and the battery 168 (or a separate battery (not shown) is provided) for powering the clock 182, so that the clock continues to operate even in

- 29 -

sleep mode, and a real time signal can be obtained from the clock at all times. Control of the clock data can be gained by appropriate signals from the CPU 166, to enable the date and time data stored in the clock to be changed, for setting the clock on installation, or changing the time (for example at the beginning and ending of British Summer Time), or merely to allow the local clock time to be synchronised to an external time source.

Electrical pulses obtained from the infra red sensor 138 (see Figure 1) provide a third input to the processor at 186, whereby data from the infra red transmitting element 150 of the hand held transceiver 140 (Figure 6) can be transmitted to the processor 166.

Electrical pulses generated by the LED infra red transmitter 136 (see Figure 1) in response to control signals from the processor 166 and LED driver 188 can be received by the infra red receiver 152 of the hand held unit 140 (Figure 6).

The LED driver 188 can additionally provide power for light emitting LED's 130, 132 and 134 (Figure 1) on the lock, which when actuated reveal the condition of the lock circuit, as hitherto described.

Data can be written to or read from an EPROM 190 by the processor via data path 192. Thus for example date, time and card identity data may be linked and stored to enable a history of access to the room.

Lastly the condition of microswitches 112, 114 (see Figure 4b) associated with the cams 108, 110 on the shaft 100, and driven in response to rotation of the motor 106 as

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hitherto describe, is conveyed to the CPU 166 via signal path 194.

Except when a card is inserted or the handle on the inside of the door is turned, the bulk of the circuit of Figure 9 is powered down into a so-called "sleep mode". Inserting a card 124 or turning the handle 26 activates CPU 166 via 170, 172. If the battery voltage is below a given threshold, power conditioner 172 generates an audible signal to warn the user that the battery should be replaced. The processor 166 may be programmed to only enable the audible alarm signal if a certain type of card is inserted (eg a maid's card) and not if a guest card has been inserted.

Insertion and removal of a card causes data on the card to be read by the card reader 176. This is decrypted by the CPU 166 and compared with data stored (typically during installation) in the EPROM 190, and with data and time data from the clock 182. If the CPU is able to validate the data from the card (eg the card is a guest card which has been encoded for use on the day and at the time concerned), the motor 106 is powered by a signal from CPU 166 along line 198 until switch 114 has been actuated by cam 110, indicating that cam 98 has been rotated to a position causing maximum downward displacement of pin section 82. As previously described with reference to Figures 4a and 4b, provided the outer handle 16 occupies its rest position so that shaft 42 occupies the position shown in Figure 4a, the lower pin 80 will thereby have entered the groove 44 in the shaft 42, so that subsequent rotation of handle 16 in an appropriate manner will rotate the housing 40 and therefore shaft 36 thereby withdrawing fingers 20 and allowing the door to be opened.

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A microswitch (not shown) responsive to rotation of the outside door handle 16 and shaft 46 provides a further logic input from the CPU 166, causing power once again to be supplied to the motor 106 to continue to rotate the cams 108, 110 until microswitch 112 is actuated by cam 98, denoting a complete 360° of rotation of cam 102 from its initial position when the card was first inserted. The pin 82 follows the surface of cam 98 and rises, leaving the way open for pin 80 to rise to its original position, in which it is disengaged from the groove 44 in the shaft 42, thereby disabling the outside handle and enabling the fingers 20 to spring out and cause the door to latch when it is closed.

If the data read from the card 124 cannot be validated (eg the date and/or time encoded on the card does not include the present date/time as read by the CPU 166 from the clock 182) then no power is supplied to the motor 106 and the pin 80 is not moved by cam 98 into driving engagement with the groove 44 in shaft 42, so that rotation of the handle 16 and shaft 42 is not transmitted to shaft 36 to thereby unlock 12. The door therefore remains locked.

Validation data causes CPU 166 to generate signals for 188 to activate the Green LED 130 to indicate that the door can be opened.

Deriving timing pulses from an on board clock or from the clock 182, CPU 166 also generates a second signal on line 198 (to simulate closing of microswitch 112) after a given period of time has elapsed from the actuation of the Green LED 130. The generation of the second signal by the CPU 166 also causes LED driver 188 to turn off the Green LED

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130 and turn on Red LED 134, indicating that the door is once again locked and cannot be opened merely by rotating the handle 16. Typically the time out is of the order of a few seconds.

If the deadbolt has been engaged and the associated microswitch activated by rotating deadbolt knob 28 on the inside of the door, insertion of a card containing valid data will produce a different set of control signals from the CPU 166, so as to cause the Green LED 130 and the Red LED 134 to flash, thereby indicating that the deadbolt is across and the occupant(s) do not wish to be disturbed.

A second motor (not shown) or a solenoid (not shown) may be provided for releasing the deadbolt (not shown). In this event CPU 166 is programmed to generate a further control signal in the event that a further card (an emergency card) is subsequently inserted after the first, validated card, has been withdrawn. The purpose and function of the further control signal is such as to activate the deadbolt withdrawal motor/solenoid (not shown), to permit access to be gained to the room even though the occupant(s) had secured the door by means of the deadbolt.

A second set of LED's behind window 32 mimic the states of the LED's visible through window 30 on the front of the door.

The CPU 166 actuates the Red LED 134 as soon as it is powered up, indicating that access is desired. As soon as data is validated following insertion and removal of a card, the Red LED is extinguished and a second LED signal is generated by CPU 166 and driver 188 to power the Green

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LED 184. This is extinguished after satisfactory operation of the lock. If time out occurs, the Green LED is extinguished and the Red is illuminated.

In order to conserve power, the LED's are powered by intermittent signals generated by the CPU 166 (or the driver 188) so that the LED's are caused to flash.

When a communicator, such as hand held unit 140 (Figure 6) is employed, data from the unit can be transmitted to or received from the CPU 166, and in particular control signals may be generated by the CPU 166 so as to power an infra red (IR) transmitter or an IR receiver on the inside of the door. By providing an IR sensor or IR transmitter at an appropriate position within the room to which the door gives access, the IR transmitter can transmit data to the IR detector on the inside of the door and thereby via the processor 166 to an IR transmitter on the outside of the door, to permit the signal to be transmitted "through the door" to a hand held unit, and vice versa. Thus lighting and temperature in the room and data relating thereto or controls affecting them be monitored and/or controlled, without opening the door, as previously described.

Figure 10 shows the essential circuit elements of the hand held communicator 140 (Figure 6) by which inter alia data can be inserted into the EPROM 190 (Figure 9) and/or the memory of processor 166, and by which data stored in the EPROM and/or processor can be retrieved.

As with the lock control system of Figure 9, the heart of the system is a microprocessor 198 and again a preferred type is a Hitachi Series H8 device, Type 320. Power is

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derived from an on-board battery 200 which may be a rechargeable type. Battery condition is monitored and supply voltage is regulated by conditioner 202 which supplies power to the CPU 198. A real-time clock 204 (which includes date and time and is similar to 182 in Figure 9) provides clock pulses and date and time data for the CPU 198.

The CPU 198 and the related circuitry is normally maintained in a powered-down or sleep mode. An on-off switch (not shown) may be provided to convert to operational mode, but more preferably the sleep mode is exited either as soon as a card is inserted into the slot 142 of a card reader 206 in the unit 140 (so actuating a microswitch 208), or whenever any one of the keys of the keypad 148 is depressed.

As with the card reader 176 (Figure 9) when a card is inserted and removed, the card data is read and decrypted by the CPU 198 and can be displayed in the LCD (or similar) display 146 (Figure 6) by entering appropriate instructions via the keypad 148 (shown diagrammatically in Figure 10).

The CPU 198 provides control signals for a display driver 210 for driving the LCD display 146 and additionally receives pulses from an infra red detector 152 and provides transmit pulses to the infra red transmitting device 150 (shown in Figure 7).

An EPROM memory 212 supplements any memory on the CPU 198.

By pointing the unit 140 towards a door lock such as shown

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in Figure 1, so that infra red light pulses transmitted by the transmitter 136 on the lock can be received by the detector/receiver 152 on the unit 140, so communication can be established between the unit and the lock. In this way the date and time information generated by the clock 182 in the lock system can be updated using the date and time data produced by the clock 204 on the unit 140. Likewise, data stored in the EPROM 190 can be read out and inserted on the EPROM 212 (or retained in the memory on board the CPU 198) of the unit 140.

When the encoder 156 (Figure 8) includes an infra red communication channel (as by an IR receiver and transmitter means on its front panel) the unit 140 can also communicate with the encoder 156, and thereby with the computer 158 associated therewith. Thus for example the clock 204 of unit 140 can itself be synchronised from a master clock in the encoder/computer 156/158, before being used to correct the date and time data of a lock system clock such as 182. Likewise data transferred from an EPROM in a lock (such as 190) to the EPROM 212 of the unit 140 can be transferred to the encoder 156 and/or computer 158 to enable a permanent record of a room access listing to be obtained as by printing out using a printer (not shown) linked to the computer 158.

The essential parts of the electrical circuits of the encoder unit 156 are shown in Figure 11. As with the lock system of Figure 9, the heart of the encoder is a microprocessor 214 and again a Hitachi Series H8 device Type 320 is preferred. A crystal controlled real-time clock 216 provides date and time data for CPU 214. This clock can serve as the master clock for the whole system since its date and time can be accessed by a hand held

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device 140 (as previously described) and the synchronised clock 204 on the hand held unit can be used to synchronise the clocks such as 182 in the locks.

Power for the encoder is typically derived from the electricity supply mains via an ON/OFF switch and filter 218. The alternating current is converted to an appropriate regulated DC supply by a PSU 220.

As well as supplying power to the CPU 214, PSU 220 also supplies power to a motor driven card reader/writer 222 the entrance slot to which is shown at 160 in Figure 8.

An EPROM memory 224 retains inter alia encrypting ciphers for encrypting data to be written to each card such as 162 (Figure 8) inserted into the slot 160. It may also retain data to provide screen prompts to the user for display on the screen of the computer 158, if not stored within the computer 158.

Data communication between the CPU 214 and the computer 158 is by way of a serial RS232 link 226.

Data communication with a hand held unit 140 is achieved by an IR link by means of an IR transmitter unit 228 and IR receiver 130 connected to the CPU 214 via path 132. Signals for driving the IR LED in the transmitter 228 are obtained from an LED driver 234 which derives its control signals from the CPU 214 and also serves to power status indicating LED's 236, 238, on the front panel of the encoder but not shown in Figure 8. LED 236 indicates when power is ON and LED 238 when a card is being coded.

Card data to be written to a card is most conveniently

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stored and/or generated within the host computer 158 (Figure 8) and transmitted to the CPU 214 via the RS232 link 226. The data from 226 is encrypted by CPU 214 using data from EPROM 224. The encrypted data may be buffered by the CPU memory before being transmitted to the card writer 222.

Data received from a hand held unit 140 relating for example to the access listing of one or more locks in a system, may be transferred via CPU 214 to the computer 158 for display on the computer screen or printing out by a printer (not shown).

CLAIMS

1. A card releasable mechanism for use in combination with a mortice lock associated with a door which lock is openable by rotating a drive shaft which extends therethrough, characterised by a second shaft separate from but aligned axially with the lock drive shaft, which second shaft protrudes through a front plate on the outside of the door to enable a handle to be mounted thereon, rotation of which will if authorised release the lock and allow the door to be opened; clutch means which when engaged transmits drive between the said second shaft and the drive shaft but when disengaged prevents rotation of the second shaft from being transmitted to the drive shaft; a card reader, adapted to derive information from coded data carried by a card inserted therein; decoding circuit means and logic circuit means for generating control signals if data received by the card reader satisfies pre-programmed conditions; and a clutch actuator comprising electrically powered drive means for operating the said clutch in response to appropriately generated control signals to enable the lock to be unlocked and the door opened after the insertion of an appropriate card into the card reader.

2. A mechanism as claimed in claim 1, wherein the clutch provides a positive drive between the two shafts so that when the clutch is engaged no slip can occur.

3. A mechanism as claimed in claim 1 or 2, wherein the drive transmitting member from the clutch actuating drive means includes at least one lost motion connection thereby

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to enable the clutch drive means to operate without damage occurring should the drive transmitting element be misaligned and prevented from entering into the drive transmitting position.

4. A mechanism as claimed in claim 3, wherein spring means is provided to retract the drive transmitting element when the clutch drive means is deactivated.

5. A mechanism as claimed in claim 3, wherein the clutch drive means is adapted to operate and move the drive transmitting element into the drive transmitting position in response to a short duration pulse of electrical energy and mechanical means is included which maintains the drive transmitting element in the drive transmitting position until a second short duration pulse of electrical energy is applied to the clutch actuator means to enable the element to be retracted.

6. A mechanism as claimed in claim 5, wherein the period of time between the generation of the first pulse and the second pulse is controllable.

7. A mechanism as claimed in claim 6, wherein the control is effected by means of data contained on a card inserted into the card reader, whereby a door lock can be left enabled so that the door can be opened without the need to insert a card for a period of time.

8. A mechanism as claimed in any of claims 5 to 7, wherein switch means is provided which is actuated only when the lock has been fully retracted to permit the door to be opened, which switch means causes a said second pulse to be generated to thereby enable the drive

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transmitting device to revert to its normal rest position to disengage the clutch so that when the door has been shut, the lock is once again incapable of being operated from outside the room.

9. A mechanism as claimed in claim 8, wherein timing means is included which generates a second pulse a short period of time after the first pulse has been generated in the event that the said switch means has not been actuated.

10. A mechanism as claimed in claim 9, wherein the said short period of time is chosen as being the period of time which will normally be required to turn the handle and open the door.

11. A mechanism as claimed in claim 1, wherein the circuit means for generating the electrical signals for operating the clutch actuator is adapted not to so produce the clutch actuating signals until after the card has been removed from the card reader.

12. A mechanism as claimed in any of claims 1 to 11, wherein the clutch actuating drive means comprises an electric motor adapted to rotate a cam from a first position to a second position, movement of the cam between the said two positions effecting axial movement of a pin means to engage in a slot and thereby transmit drive between the two shafts.

13. A mechanism as claimed in any of claims 1 to 12, wherein the drive transmitting device is formed from non-magnetic material so that it is not possible for the latter to be moved under the influence of an external

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magnetic field.

14. A mechanism as claimed in any of claims 1 to 13, wherein the clutch actuator comprises a cam driven by an electric motor and rotatable through approximately 180° so as to push, by camming action, a pin into a slot, so as to provide driving engagement between the shaft and the pin; and release of the clutch is achieved by continuing to rotate the cam so as to perform a complete revolution so that the pin is again free to retract.

15. A mechanism as claimed in claim 14, wherein spring means acts on the pin in a direction to maintain contact with the camming surface and a lost motion connection is provided so that the leading end of the pin can remain stationary if jammed and the lost motion connection can accommodate the whole of the movement attributable to the cam.

16. A mechanism as claimed in claim 14, wherein a non-symmetrical cam is employed in which that part of the cam which produces the drive engaging movement of the pin corresponds to an inclined plane which subtends a small angle and that part which enables the pin to return to its rest and disengaged position corresponds to a very steeply inclined plane which subtends an angle approaching 90° , whereby the time required to disengage the pin is much less than that required to engage the pin so that the disengagement and locking of the door mechanism is achieved very quickly.

17. A mechanism as claimed in any of claims 14 to 16, wherein the drive for the cam is achieved using a worm and spur gear with the worm driven directly by the electric

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motor so as to exclude movement of the cam after the motor is stopped, the combination of the spur wheel and worm gear acting as a brake on the cam.

18. A mechanism as claimed in claim 17, wherein the cam is mounted on the same shaft as is the spur wheel.

19. A mechanism as claimed in claim 18, wherein additional cams are provided on the same shaft for actuating a micro switch when the clutch operating cam has been rotated to the most displaced position of the cam surface, and actuating another micro switch when it once again regains its rest position after 360° of rotation.

20. A mechanism as claimed in claim 14, wherein a non-symmetrical cam is employed in which the cam surface is interrupted with a virtually radial step between the point of maximum radius to the point of minimum radius, so that rotation through approximately 330° or even more by the initial rotation of the motor to the point of maximum radius requires thereafter only some 30° of rotation to return the cam to its start position in which the pin means can retract fully.

21. A mechanism as claimed in any of claims 1 to 20, wherein electric current for the motor, the control circuits and the card reader is derived from one or more batteries carried within any or all of the lock controlling mechanism, the lock and the door.

22. A mechanism as claimed in any of claims 1 to 20, wherein the lock release mechanism is powered from an external source of power, current from which is conveyed to the release mechanism by cabling which extends between

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the door and the door jam on the hinge side of the door, sufficient free cable being provided to accommodate the distance between the door and the door jam, even when the door is fully opened.

23. A mechanism as claimed in any of claims 1 to 22, wherein the release mechanism includes a display containing differently coloured lamps such as light emitting diodes and the control circuit means is adapted to generate further control signals which cause the lamps to be illuminated depending on the circumstances.

24. A mechanism as claimed in claim 23, wherein after a card has been inserted and read and removed and the lock is released then a green lamp is caused to flash either for a short time or until such time as the door has been opened.

25. A mechanism as claimed in claim 24, wherein a further signal is generated if the door has not been opened within a prescribed period of time after the card has been removed and in this event a red lamp is caused to flash.

26. A mechanism as claimed in any of claims 23 to 25, wherein the illuminted display is also visible from the reverse side of the door through a window in a back plate mounted on the rear of the door.

27. A mechanism as claimed in any of claims 23 to 25, wherein a second similar display to the first is mounted for viewing from the reverse side of the door.

28. A mechanism as claimed in claim 27, wherein the lamps are connected in parallel so that whatever light condition

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occurs on one side of the door is mimicked on the other.

29. A mechanism as claimed in claim 27, wherein separate wiring and separate or the same control signals are applied to the different light emitting diodes so that in some circumstances different display information can appear on one side of the door from that appearing on the other.

30. A mechanism as claimed in any of claims 23 to 29, wherein the control circuit means which is supplied with signals from the card reader is programmed so as to distinguish between a plurality of different cards and following the insertion (and recordal) of one type of card is adapted to cause a green light emitting diode to flash at least on the inside of the door but to inhibit at that time the generation of a signal for engaging the clutch, and the card reader is programmed to generate a clutch engaging signal after the same card has been inserted and removed a second time.

31. A mechanism as claimed in any of claims 23 to 30, wherein a buzzer or other warning device is activated by the said further control signals so the occupant of the room can be alerted to the fact that somebody wishes to gain entry but is awaiting their instructions.

32. A mechanism as claimed in claim 30 or 31 as applied to a door which is provided with a dead bolt and electrically powered drive means for advancing and retracting the said dead bolt, the signal which causes the green lamp to flash is also used to enable the drive to the dead bolt so as to cause the latter to engage and thereby secure the door against entry.

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33. A mechanism as claimed in claim 32, wherein the dead bolt is capable of being driven in this way, and a further card is provided the data on which is adapted to override all locking functions and cause signals to be transmitted both to the clutch and to the dead bolt drive so as to withdrawn the dead bolt and enable the door to be opened for emergency purposes.

34. A mechanism as claimed in claims 32 and 33, wherein a further clutch is provided between the external handle and the deadbolt operating shaft, which when actuated enables the deadbolt to be retracted as well as the door lock on rotation of the handle, the said further card enabling actuation of the said further clutch to enable a locked and bolted door to be opened in an emergency.

35. A mechanism as claimed in any of claims 1 to 34, wherein there is provided in or associated therewith infrared or opto electric transmitters and receivers, to enable data to be transmitted to and received from data storage means located within the lock release mechanism.

36. A mechanism as claimed in claim 35, which includes digital storage means such as random access memories, and circuit means for entering data into the memory means and reading out data stored therein.

37. A mechanism as claimed in claim 35 or 36, further comprising a pulse generator circuit adapted to produce timing pulses at one second intervals or multiples thereof to serve as timing pulses, and counter and register means are provided into which date and time can be stored in digital form and updated as appropriate by the pulses from

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the pulse generator circuit.

38. A mechanism as claimed in claim 37, wherein data is entered via the data ports or by means of a card.

39. A mechanism as claimed in any of claims 1 to 38, wherein data transmitting and receiving means is provided on the inside of the door as well as on the outside, to enable appropriately aligned data transmitters and receivers located within the room to transmit or receive information to and from the door.

40. A mechanism as claimed in any of claims 35 to 39, wherein data may be fed into or out of a lock release mechanism as aforesaid using a portable transmitter receiver device which itself includes infrared or optical electrical devices, as appropriate, positioned similarly to those at least on the outside of the door, so that merely pointing the hand held device at the lock release mechanism and pressing appropriate switches, so data can be transmitted to the receiver on the door, or received from the transmitter on the door.

41. A mechanism as claimed in any of claims 1 to 40 wherein memory means is provided within the control circuit means into which data is entered every time a card is inserted into the card reader.

42. A mechanism as claimed in claim 41, wherein data identifying both the time and some unique identifying number or code on the card is entered together with an indication as to whether or not the door is opened before the reset signal is generated, so that a record of all card authorised entries into a room is retained, and the

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hand held unit is adapted to recover this data and either display this data on a screen or produce a print-out using a suitable printer.

43. A mechanism as claimed in claim 42, wherein the memory means is a "first in first out" memory, so that a string of such card entries can be recorded which depending on the size of the memory can extend over a period of hours or days or weeks and which will enable a person having authority to do so, to interrogate the listing and determine what cards have been used, and when, to gain access to the room.

44. A mechanism as claimed in any of claims 1 to 42, which is battery operated, and includes means for indicating low battery state comprising an audible alarm device within the mechanism which responds to low battery state and produces an audible low battery alarm upon insertion of a card once the low battery state has been detected.

45. A mechanism as claimed in claim 44, wherein the device is selective so as to distinguish between one card and another so that only particular cards cause the audible alarm to sound.

46. A mechanism as claimed in claim 44 or 45, wherein a battery or batteries are located under the back plate on the room side of the door, which back plate is adapted to be removable, using appropriate tools, to give access for battery removal.

47. A mechanism as claimed in any of claims 1 to 46, wherein card verification is achieved by incorporating an opto sensor in the card reader and by providing a unique

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printed patch on the card so that when a card is inserted in the card reader it is first checked and verified by the logic circuit means therein.

48. A mechanism as claimed in any of the preceding claims in combination with an intelligent hand held communication unit which includes a card reader which is adapted to verify cards entered therein so that such a device can be used to check whether a person holding a particular card is entitled to access a particular part of a building or site such as a hotel.

49. A mechanism as claimed in any of claims 1 to 48 wherein the hand held communication unit is adapted to be connected thereto by plug and socket means.

50. A security system comprising a plurality of secure areas such as rooms or zones access to each of which can be gained through one or more doors each of which is controlled by a card releasable lock mechanism as claimed in any one of claims 1 to 49 together with card dispenser means and card encoding means associated with a central location within the building to which guests or visitors or users have access, whereby cards can be issued to appropriate persons suitably encoded to allow them access to one or more of the secured areas either indefinitely or for a restricted period of time.

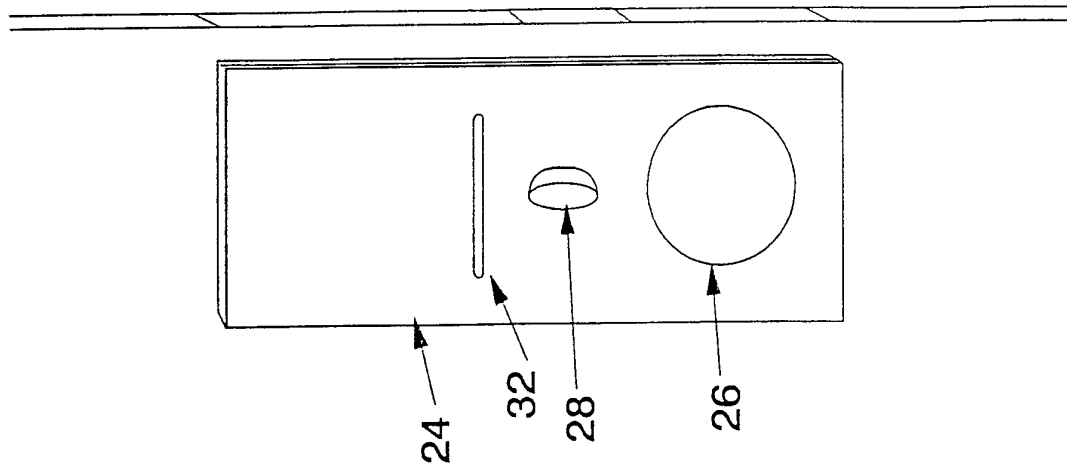


Figure 2

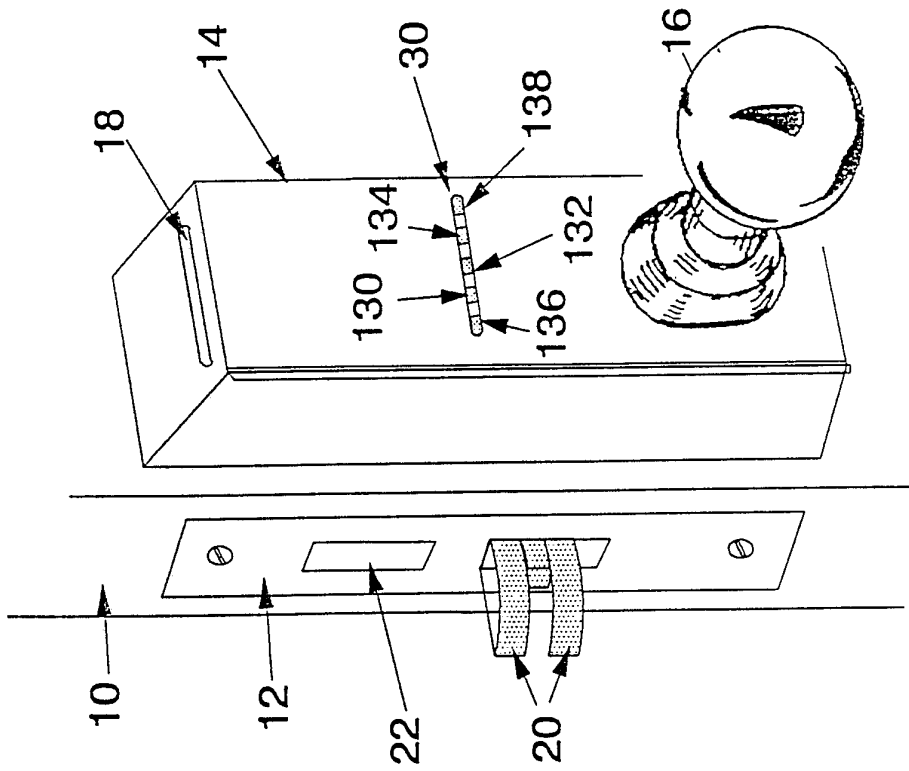


Figure 1

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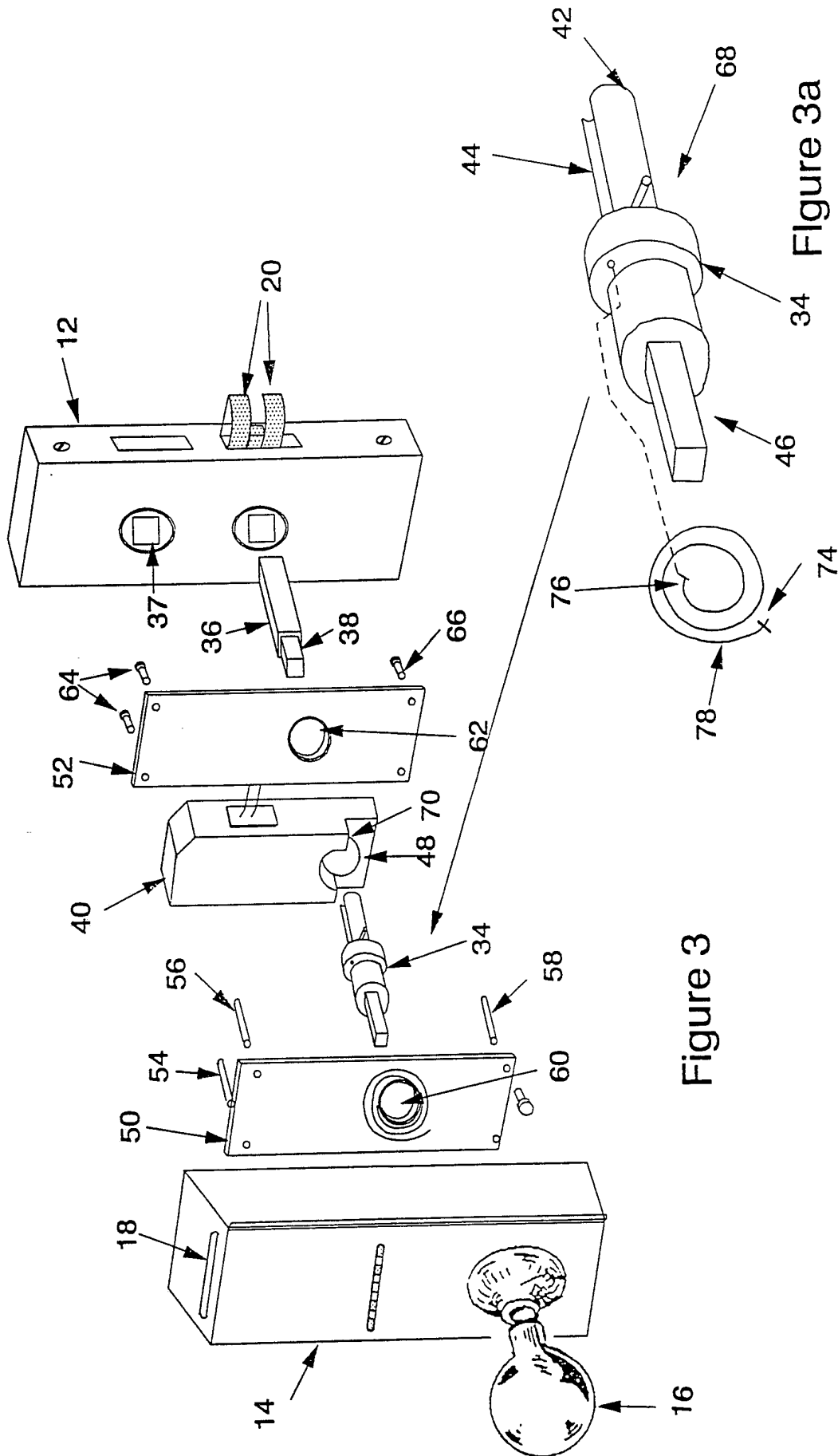


Figure 3

Figure 3a

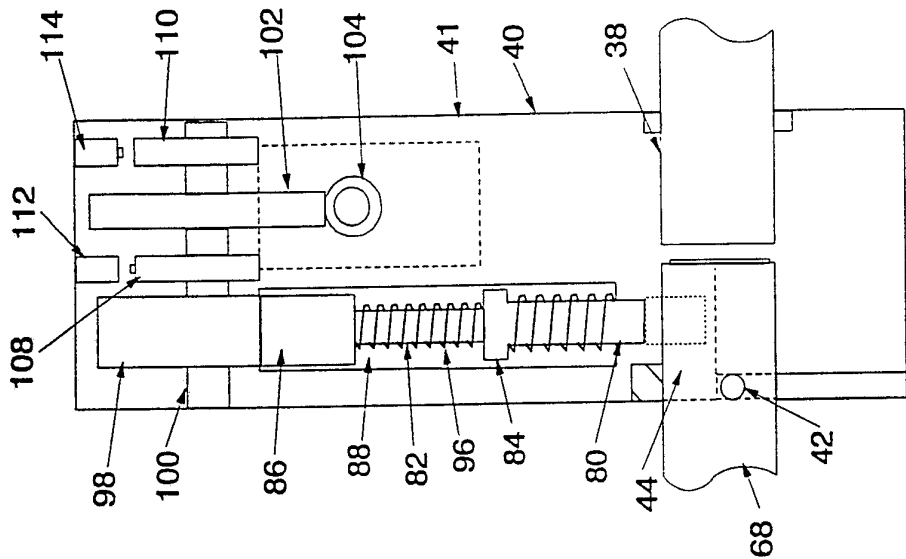


Figure 4c

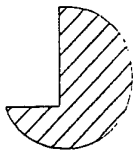


Figure 4d



Figure 4b

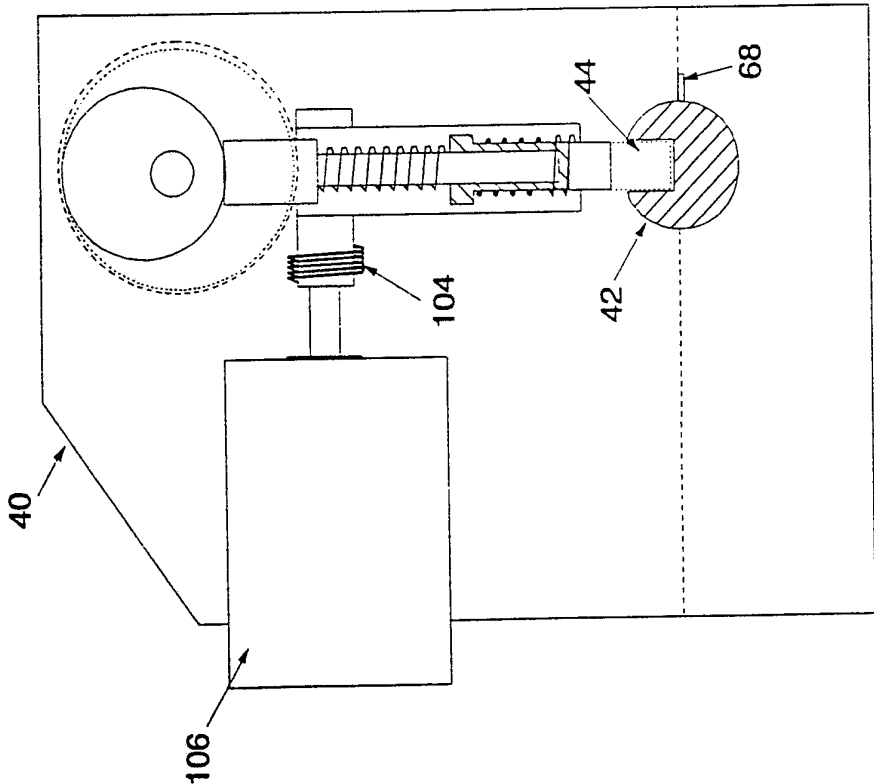


Figure 4a

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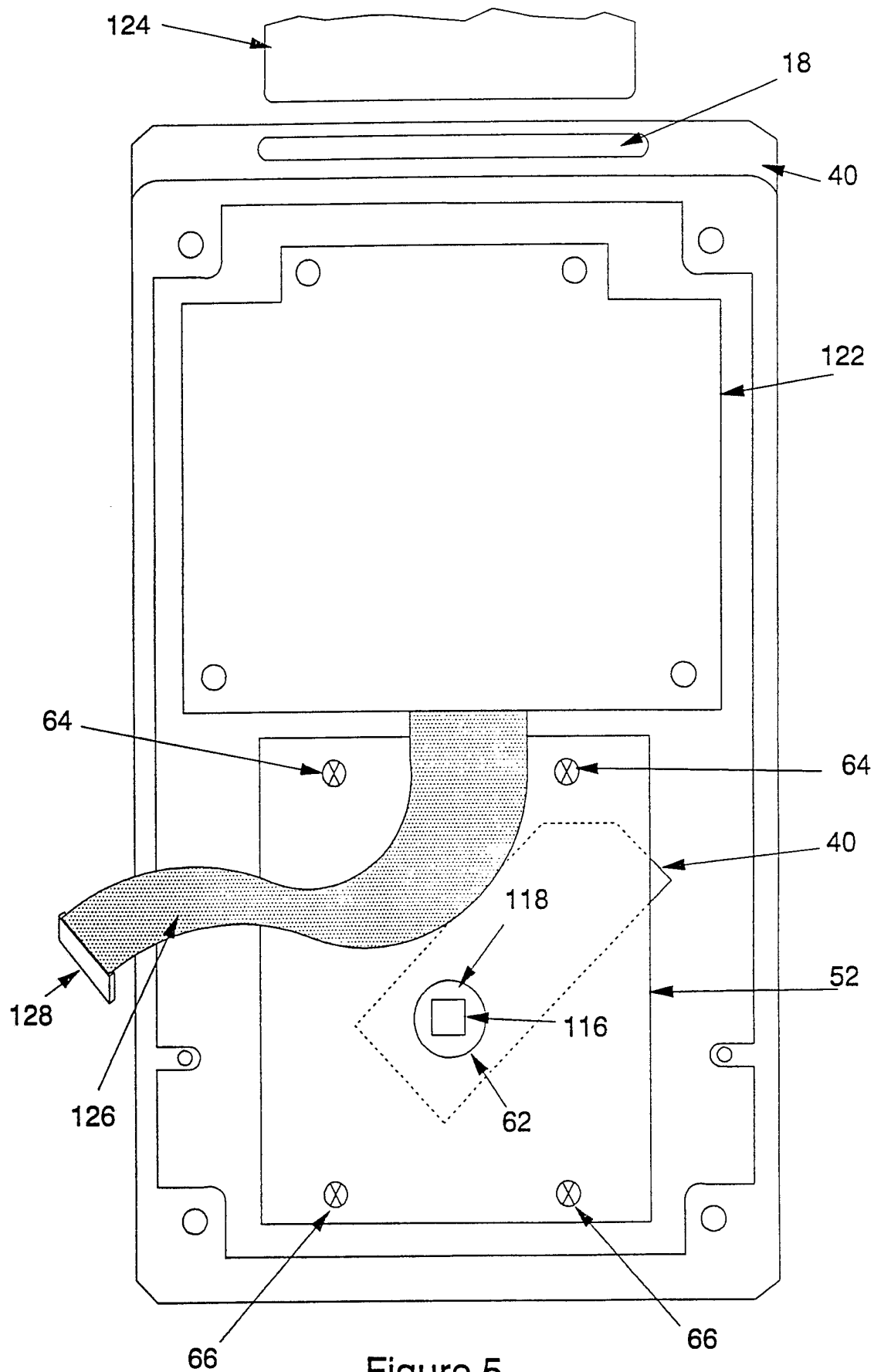


Figure 5

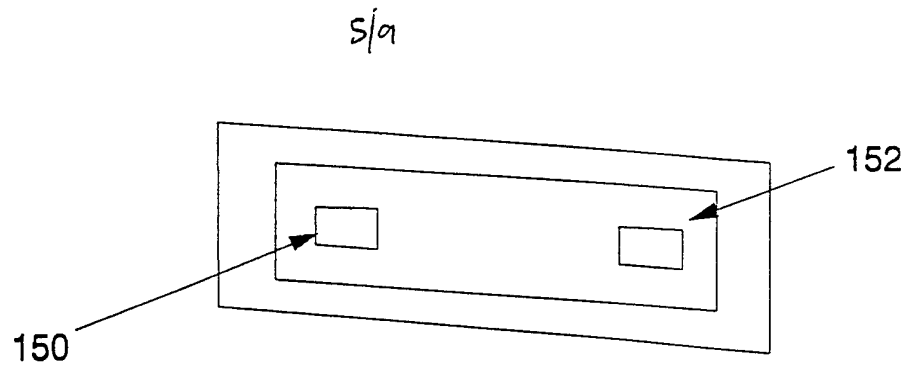


Figure 7

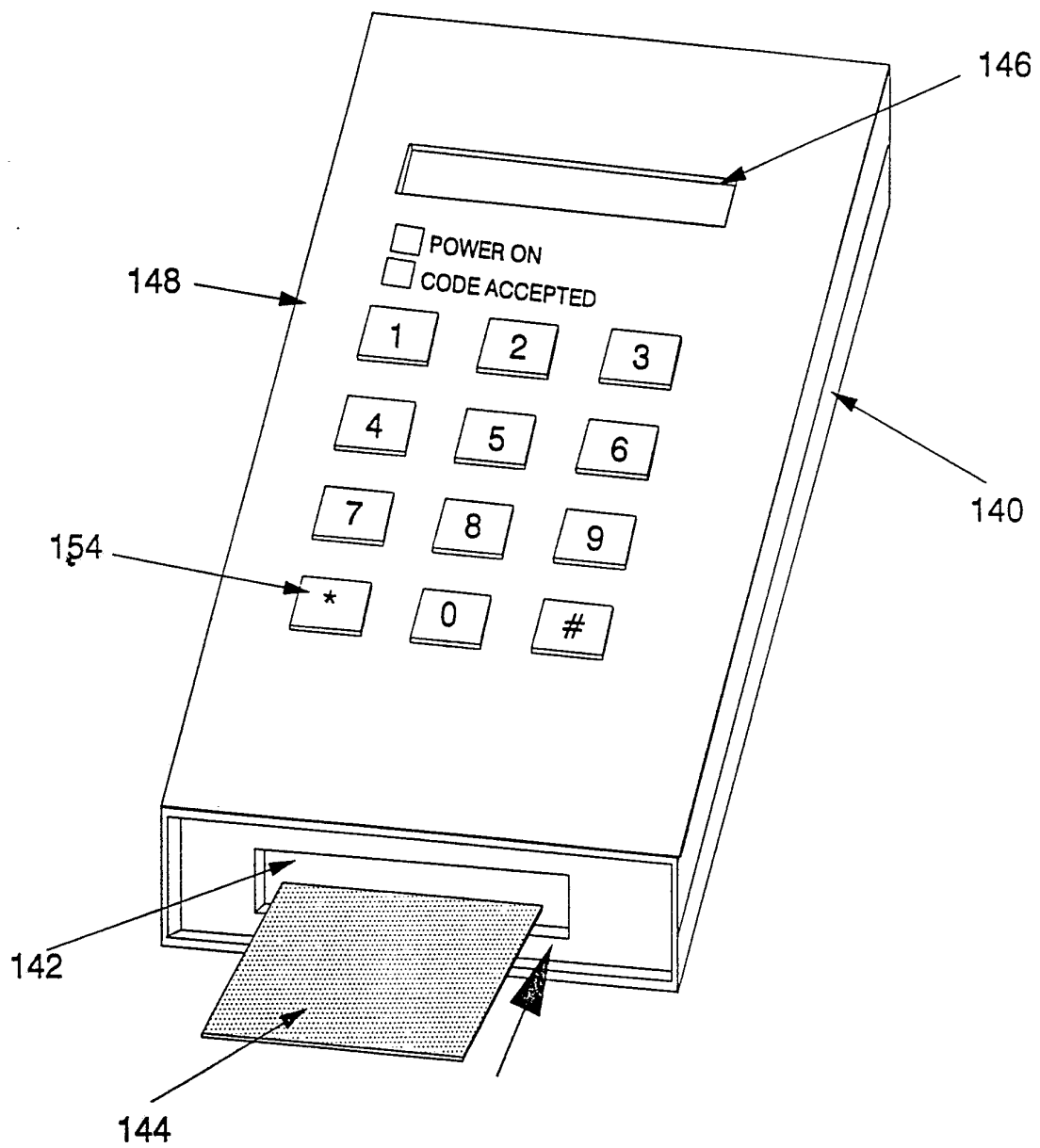


Figure 6

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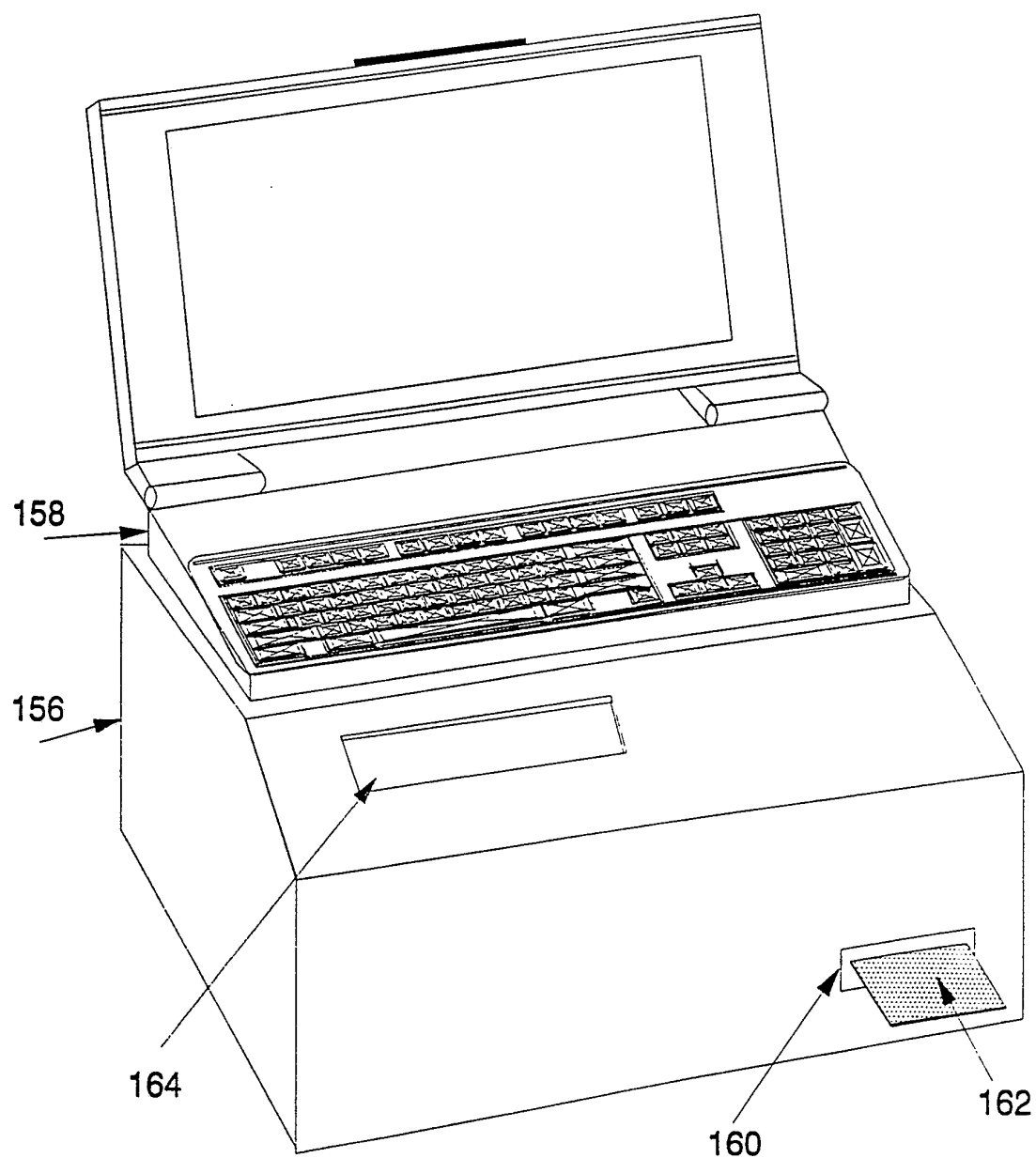


Figure 8

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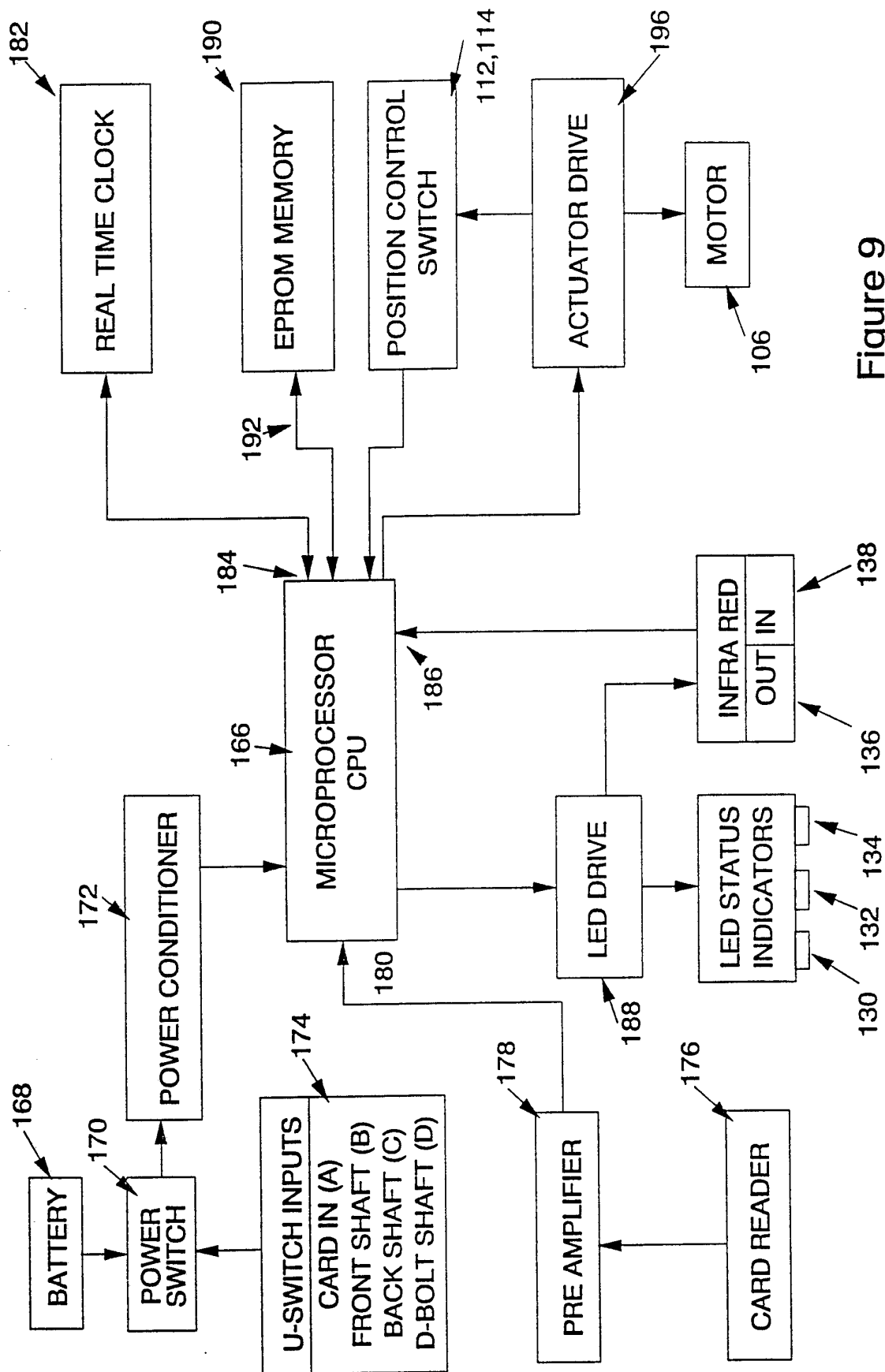


Figure 9

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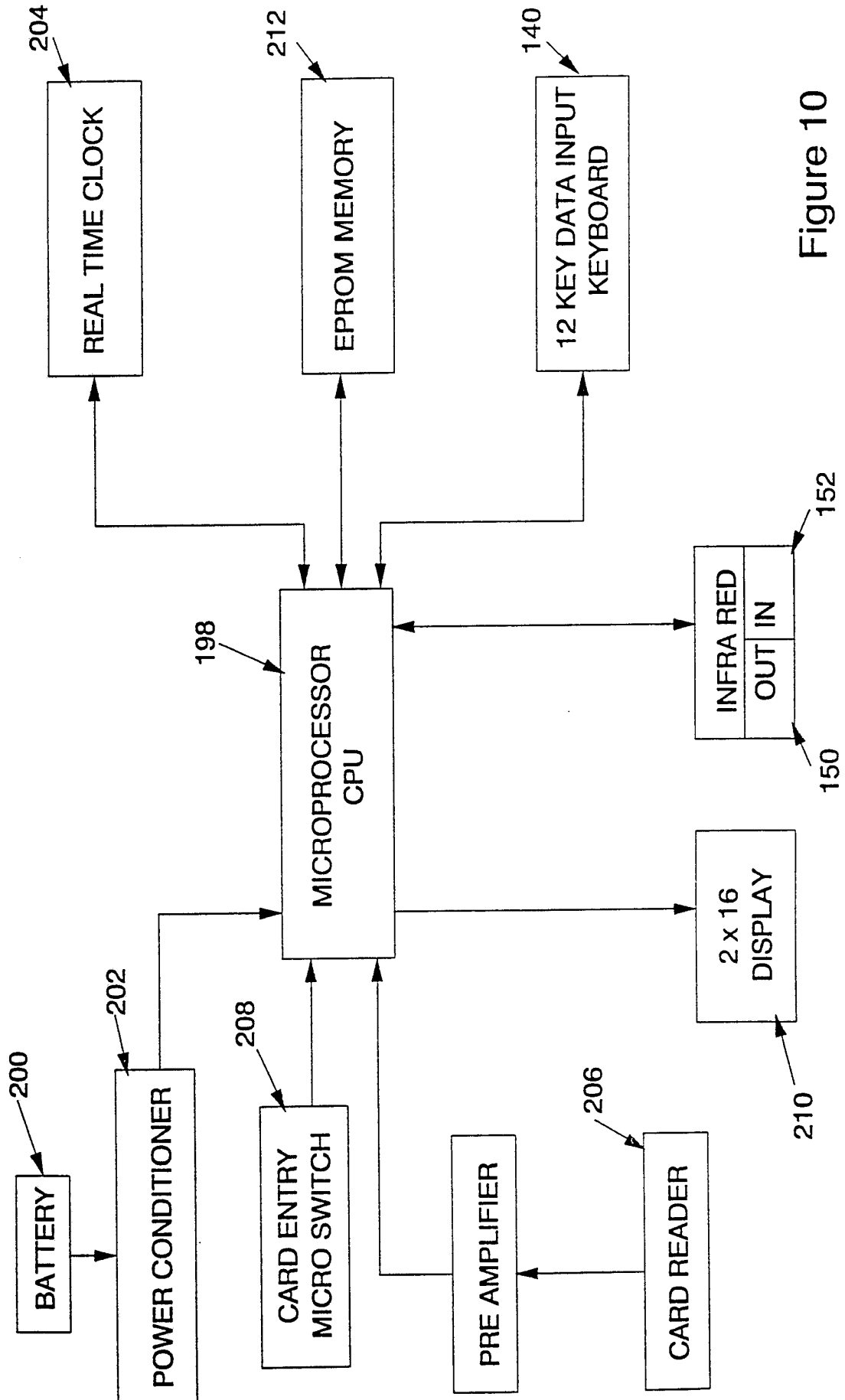


Figure 10

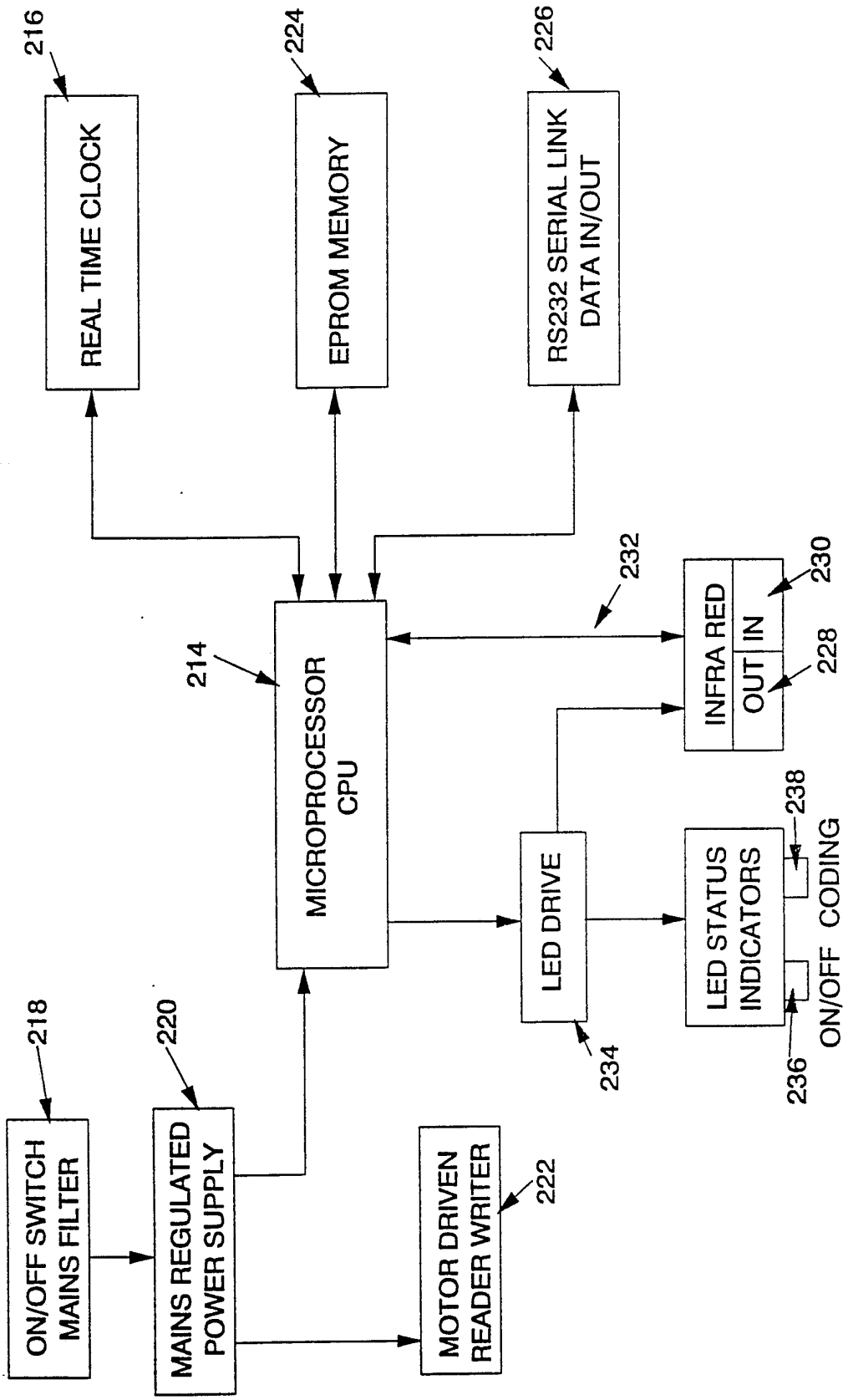


Figure 11

INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 92/02058

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ⁴ According to International Patent Classification (IPC) or to both National Classification and IPC IPC ⁵ : E 05 B 49/00														
II. FIELDS SEARCHED Minimum Documentation Searched ⁷ <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; border-bottom: 1px solid black; padding: 5px;">Classification System</td> <td style="width: 50%; border-bottom: 1px solid black; padding: 5px;">Classification Symbols</td> </tr> <tr> <td style="padding: 5px;">IPC⁵</td> <td style="padding: 5px;">E 05 B</td> </tr> </table> Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁸			Classification System	Classification Symbols	IPC ⁵	E 05 B								
Classification System	Classification Symbols													
IPC ⁵	E 05 B													
III. DOCUMENTS CONSIDERED TO BE RELEVANT ⁹ <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 10%; padding: 5px;">Category ⁹</th> <th style="width: 60%; padding: 5px;">Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²</th> <th style="width: 30%; padding: 5px;">Relevant to Claim No. ¹³</th> </tr> </thead> <tbody> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">X</td> <td style="padding: 5px;"> GB, A, 2 227 052 (CHI-CHENG LO) 04 December 1988 (04.12.88), see fig. 1-9; claims 1-7. </td> <td style="text-align: center; vertical-align: top; padding: 5px;"> 1-5, 7, 8, 11- 13, 17, 18, 21, 30, 36, 38, 39, 41, 42, 48 </td> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">X</td> <td style="text-align: center; vertical-align: top; padding: 5px;"> -- US, A, 4 125 008 (GENEST et al.) 14 November 1978 (14.11.78), see fig. 1-13; claims 1-10. </td> <td style="text-align: center; vertical-align: top; padding: 5px;"> 1, 7, 8- 10, 14- 17, 20, 21, 30, 36, 38, 41, 45, 48 </td> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">X</td> <td style="text-align: center; vertical-align: top; padding: 5px;"> -- US, A, 4 534 194 (AYDIN) 13 August 1985 (13.08.85), see fig. 1-5; claims 1-5. </td> <td style="text-align: center; vertical-align: top; padding: 5px;"> 1, 4, 5, 7, 8, 11, 21, 22, 28, 30-32, </td> </tr> </tbody> </table>			Category ⁹	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³	X	GB, A, 2 227 052 (CHI-CHENG LO) 04 December 1988 (04.12.88), see fig. 1-9; claims 1-7.	1-5, 7, 8, 11- 13, 17, 18, 21, 30, 36, 38, 39, 41, 42, 48	X	-- US, A, 4 125 008 (GENEST et al.) 14 November 1978 (14.11.78), see fig. 1-13; claims 1-10.	1, 7, 8- 10, 14- 17, 20, 21, 30, 36, 38, 41, 45, 48	X	-- US, A, 4 534 194 (AYDIN) 13 August 1985 (13.08.85), see fig. 1-5; claims 1-5.	1, 4, 5, 7, 8, 11, 21, 22, 28, 30-32,
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X	-- US, A, 4 125 008 (GENEST et al.) 14 November 1978 (14.11.78), see fig. 1-13; claims 1-10.	1, 7, 8- 10, 14- 17, 20, 21, 30, 36, 38, 41, 45, 48												
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¹⁰ Special categories of cited documents: ¹⁰ "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art. "Z" document member of the same patent family														
IV. CERTIFICATION <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; border-bottom: 1px solid black; padding: 5px;"> Date of the Actual Completion of the International Search 01 February 1993 </td> <td style="width: 50%; border-bottom: 1px solid black; padding: 5px;"> Date of Mailing of this International Search Report 12.02.93 </td> </tr> <tr> <td style="border-bottom: 1px solid black; padding: 5px;"> International Searching Authority EUROPEAN PATENT OFFICE </td> <td style="border-bottom: 1px solid black; padding: 5px;"> Signature of Authorized Officer CZASTKA et al. </td> </tr> </table>			Date of the Actual Completion of the International Search 01 February 1993	Date of Mailing of this International Search Report 12.02.93	International Searching Authority EUROPEAN PATENT OFFICE	Signature of Authorized Officer CZASTKA et al.								
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International Searching Authority EUROPEAN PATENT OFFICE	Signature of Authorized Officer CZASTKA et al.													

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)		
Category *	Citation of Document, ** with indication, where appropriate, of the relevant passages	Relevant to Claim No.
	-----	36-38, 40-42, 44, 45- 48, 50

ANHANG

zum internationalen Recherchen-
bericht über die internationale
Patentanmeldung Nr.

ANNEX

to the International Search
Report to the International Patent
Application No.

ANNEXE

au rapport de recherche inter-
national relatif à la demande de brevet
international n°

PCT/GB92/02058 SAE 67076

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