

[54] REMOTE CONTROL DOOR LOCK

FOREIGN PATENTS OR APPLICATIONS

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[52] U.S. Cl.....70/92, 70/146, 70/268, 70/283, 292/335

[51] Int. Cl.E05b 65/10, E05b 47/06

[58] Field of Search.....70/92, 146, 148, 157, 267, 70/268, 271, 283; 292/335

[57] ABSTRACT

Apparatus for selectively locking and controllably releasing a panic exit door include a lock structure having a door locking position and a door release position and including a pair of vertical bars for locking the door at the top and bottom thereof. A manually actuatable crash bar is located on one side of the door for actuating the lock, and a further manually actuatable device for actuating the lock is located on the other side of the door. A remotely controllable device selectively blocks and releases the further manually actuatable device, and a remote control selectively actuates the remotely controllable device.

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14 Claims, 8 Drawing Figures

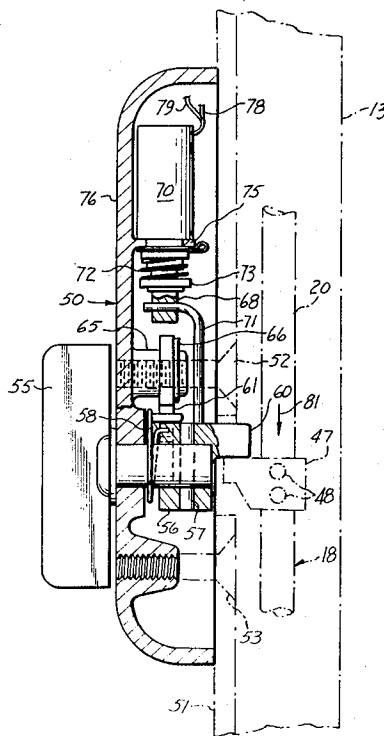


FIG. 1

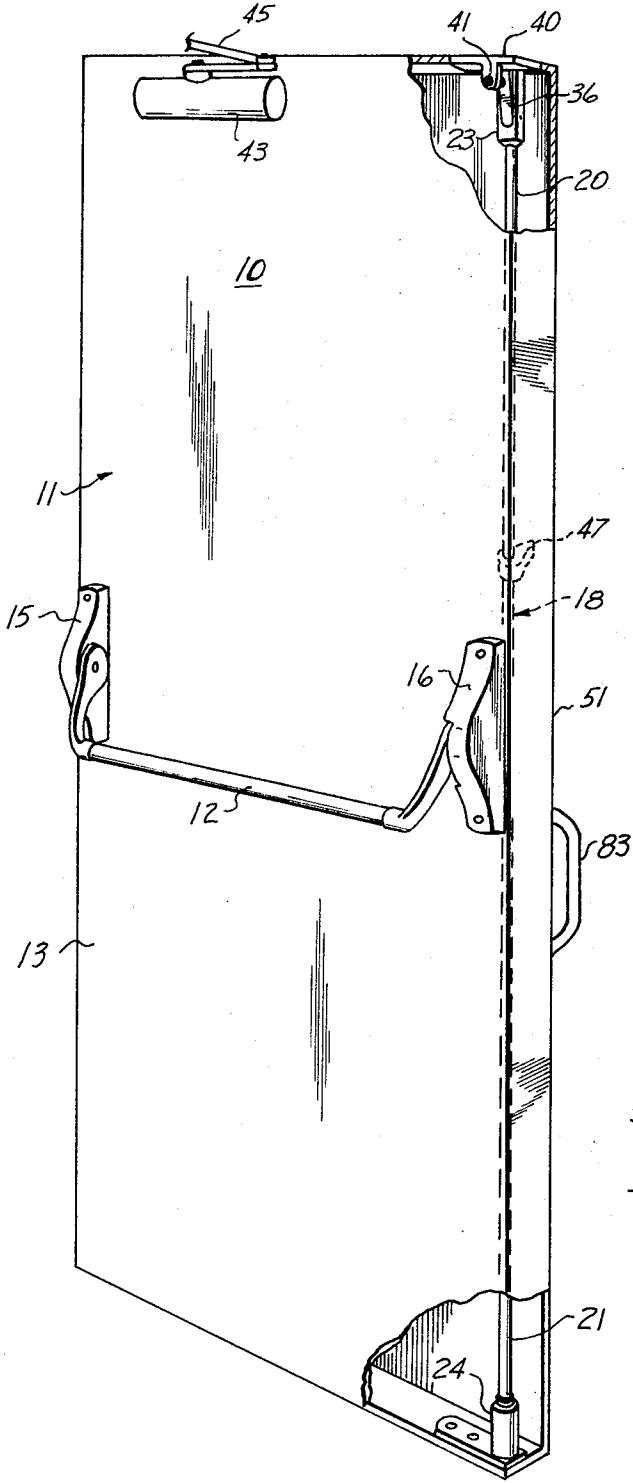


FIG. 3

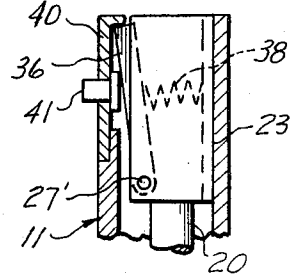
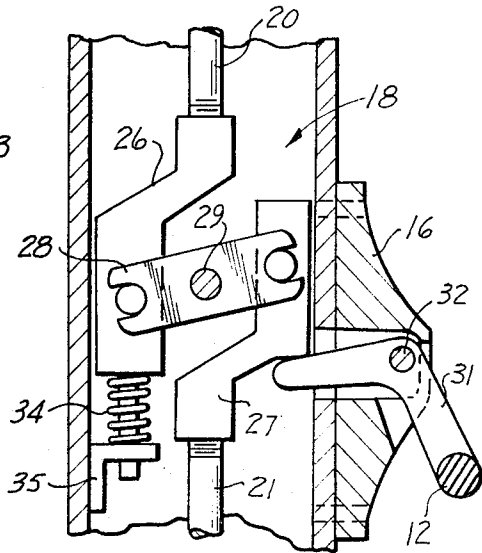
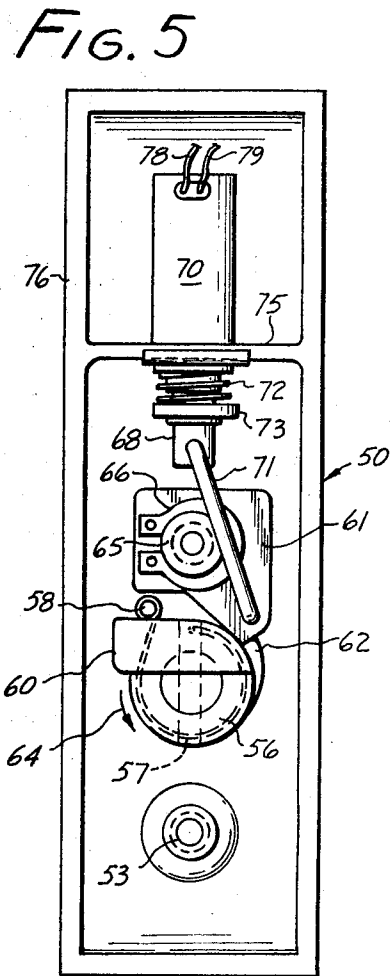
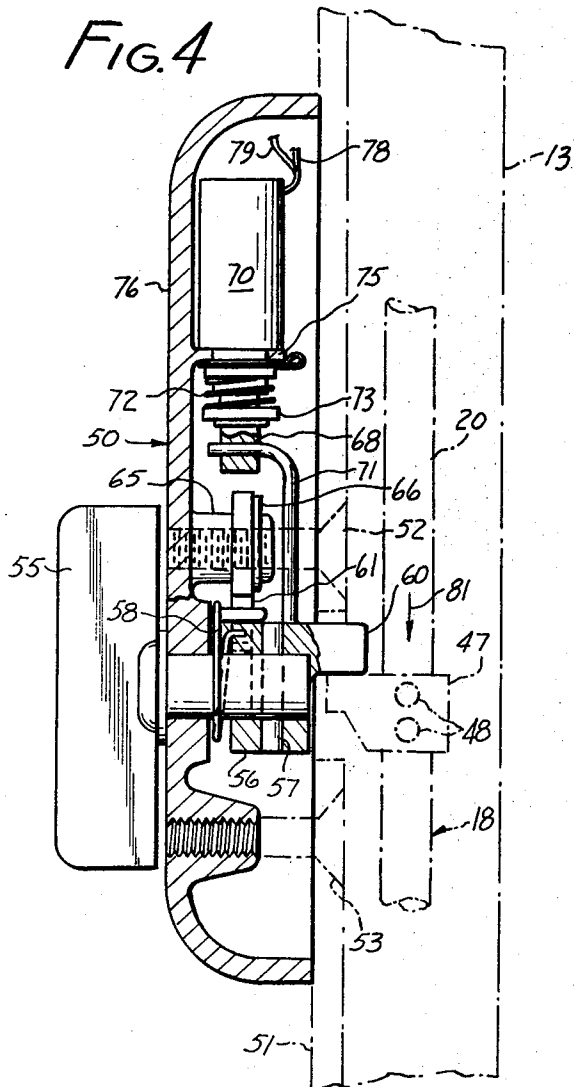


FIG. 2



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FIG. 7

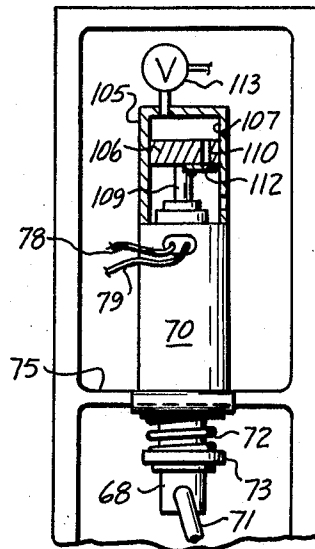


FIG. 6

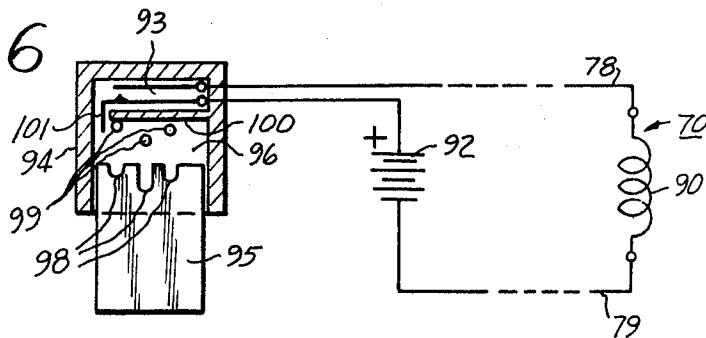
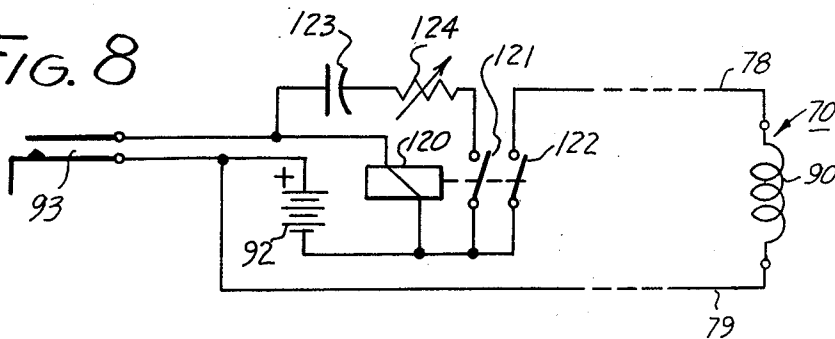


FIG. 8



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REMOTE CONTROL DOOR LOCK

BACKGROUND OF THE INVENTION

1. Field of the Invention

The subject invention relates to door locking systems and, more particularly, to apparatus for selectively locking and controllably releasing a panic exit door with the aid of a remote control.

2. Description of the Prior Art

The use of panic exit doors is becoming more and more widespread as the number of building and safety codes which require such devices is increasing. The most important requirement for an acceptable panic exit door is that it can always be opened from the inside with a minimum of effort and without any impediment. In fact, many codes and regulations now require that panic exit doors be provided with a crash bar that will automatically open the door from the inside when engaged by one or more people intent on leaving the particular room or building.

The latter safety requirements are frequently paralleled by the desire to lock the door from the outside to prevent unauthorized access to the room or building closed by the door. Frequently, this desire to lock the door from the outside is accompanied by the requirement that the particular lock be remotely controllable, either from a location which is distant from the door or from a location which is adjacent the door.

In recent years, coded cards have come to replace traditional keys in many situations. For instance, if a door is to be used by a larger number of people, it is now generally more advantageous to use locks that are operated with coded cards, such as the so-called "magnetic key cards," rather than locks that use conventional keys. The reason for this growing preference is primarily attributable to the fact that ordinary types of keys are easily imitated with relatively simple equipment. Accordingly, authorized use of the same kind of key by a large number of people unfortunately tends to be accompanied by a growing number of unauthorized uses.

On the other hand, since no practical way for imitating magnetic or other key cards exists, the unauthorized use of key cards is much less widespread.

In a similar type of situation, doors that are used by a large number of people are often controlled by a guard or receptionist who will open the door for authorized personnel with the aid of a remotely controlled electric lock.

While reasonably satisfactory electric locks exist for handling ordinary types of doors, difficulties are encountered in case of panic exit devices or other doors where a rapid or at least unimpeded exit feature is to be combined with remotely controlled lockability. By way of example, at least two serious problems arise if one of the familiar types of frame-mounted electrical locking devices is employed.

These devices typically have a movable shim member which cooperates with the door latch in retaining the door closed until electrical current is applied to the lock. In the past, electrically controlled locking devices of the latter type have often proved unsatisfactory in the case of heavily used panic exit devices which inflict heavy wear on frame-mounted locks. Moreover, frame-mounted electrical locks are incapable of handling double doors in a satisfactory manner.

However, for lack of a better solution, the familiar vertical locking bars in panic exit doors have in the past been omitted in some installations so that a conventional type of electrical lock could be used. In that case, mechanical top and/or bottom latches had to be provided. This typically represents an unsatisfactory solution from the point of view of ease of operation and sometimes also from the safety standpoint.

SUMMARY OF THE INVENTION

The subject invention overcomes the above mentioned disadvantages and provides remotely controllable lock means that will be more fully described as this disclosure proceeds.

More particularly, the subject invention provides apparatus for selectively locking and controllably releasing a panic exit

door. According to the invention, these apparatus comprise, in combination, selectively actuatable lock means having a door locking position and a door release position, these lock means comprising means including a first vertical locking bar for selectively locking said door at the bottom thereof, means including a second vertical locking bar for selectively locking said door at the top thereof, and means coupled to said locking bars for biasing said first and second vertical locking bars away from one another into locking positions, first manually actuatable means coupled to the lock means for selectively applying actuating power to these lock means, these first manually actuatable means comprising a panic exit crash bar and actuating means for moving said first and second vertical locking bars toward one another into door release positions upon actuation of said crash bar means for mounting the first manually actuatable means on the door for access from one side of the door, second manually actuatable means selectively coupled to the lock means for selectively applying actuating power to the lock means, means for mounting the second manually actuatable means on the door for access from another side of the door, remotely controllable means selectively coupled to these second manually actuatable means for selectively blocking and permitting the application of actuating power by these second manually actuatable means to the lock means, these remotely controllable means including means for permitting said application of actuating power in response to a remote control operation and means for automatically blocking said application of actuating power upon cessation of said remote control operation and remote control means connected to the controllable means for selectively effecting said remote control operation.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will become more readily apparent from the following detailed description of preferred embodiments thereof, illustrated by way of example in the accompanying drawings, in which:

FIG. 1 is a perspective view of a panic exit door and of hardware mounted thereon and therein for opening and closing the door;

FIG. 2 is a side view on an enlarged scale of a detail of the hardware used in the door of FIG. 1;

FIG. 3 is a side view on an enlarged scale of an automatic locking device employed in the door of FIG. 1;

FIG. 4 is a side view of a remotely controlled locking apparatus in accordance with a preferred embodiment of the subject invention;

FIG. 5 is a rear elevation of the apparatus according to FIG. 4;

FIG. 6 is an electric circuit diagram and a section through a remote control device for actuating the locking apparatus according to FIGS. 4 and 5;

FIG. 7 is a view similar to FIG. 5, showing a detail of a modification of the apparatus according to FIGS. 4 and 5; and

FIG. 8 is a circuit diagram of a modification of the control FIG. 6 for use with the apparatus of FIGS. 4 and 5.

DESCRIPTION OF PREFERRED EMBODIMENTS

The panic exit device 10 shown in FIG. 1 includes a door 11 which is mounted in and hinged to a conventional door frame (not shown) by conventional hinging devices (not shown). A first manually actuatable device in the form of a crash bar 12 is mounted to one side 13 of the door 10 by means of mounting brackets 15 and 16.

Conventional locking bar hardware 18 includes a first vertical locking bar 20 and a second vertical locking bar 21. The locking bar 20 carries at its upper end a locking member or plunger 23 which in a locking position projects into a cavity in the door frame top (not shown). Similarly, the locking bar 21 carries at its lower end a locking member or plunger 24 which, in a locking position, projects into a cavity in the threshold (not shown).

The crash bar 12 and the locking bars 20 and 21 are linked together in a conventional manner so that the bars 20 and 21 move vertically toward each other when the crash bar 12 is moved toward the door 11. This movement of the bars 20 and 21 retracts the locking plungers 23 and 24 from their corresponding cavities so that the door can be opened by further pushing against the crash bar 12. A conventional mechanism for the latter purpose is shown in FIG. 2 where the locking bars 20 and 21 are interconnected through link members 26 and 27 and a lever 28 pivoted at 29. The crash bar 12 is connected to the link member 27 through a bell crank lever 31 pivoted at 32.

When the crash bar 12 is pushed toward the door 11, the bell crank lever 31 lifts the link member 27 upwardly. This raises the locking bar 21 and, through the lever 28 and link member 26, lowers the locking bar 20. The locking plungers 23 and 24 are accordingly withdrawn into the door, thereby permitting opening of the door through further pushing against the crash bar 12.

In accordance with standard practice, the locking bars 20 and 21 are spring biased away from each other so that the locking plungers 23 and 24 are moved into the corresponding cavities in the door frame and threshold by at least one bias spring 34. In the example shown in FIG. 2, this bias spring is located between a stationary member 35 and the link member 26. Accordingly, the spring biases the locking bar 20 upwardly and, through the lever 28, the locking bar 21 downwardly.

Another conventional feature as applied to the locking plunger 23 is shown in detail in FIG. 3.

According to FIG. 3, the plunger 23 is hollow and has a latch 36 pivoted thereto at 27'. Part of the latch 36 is contained in the plunger 23, while another part of the latch 36 is forced out of the plunger 23 by a bias spring 38. A catch member 40 is mounted at the top of the door as shown in FIGS. 1 and 3 and has the purpose of catching the latch 36 in its illustrated extended position so that the plunger 23 is retained in a retracted position. Due to the linkage between the locking bars 20 and 21, the lower plunger 24 will then also be retained in a retracted position.

When the door 11 is closed, a push button 41 in the catch member 40 is pushed toward the locking plunger 23 as this button 41 contacts part of the door frame top (not shown). In this manner, the latch 36 is pushed into the locking plunger 23 and is thereby freed from the catch member 40. The locking bar 20 and locking plunger 23 will thereupon be forced upwardly by the previously mentioned bias spring 34 (see FIG. 2). Since the bars 20 and 21 are linked together, upward movement of the bar 20 will be accompanied by downward movement of the bar 21, so that both locking plungers 23 and 24 enter their respective cavities in the door frame top and threshold.

In practice, the door 11 is typically provided with a conventional actuator 43 (see FIG. 1) which has actuator linkage 45 connected to the door frame top (not shown). It will be recognized that the actuator 43 constitutes a means for automatically closing the door 11, and that the device shown in FIG. 3 constitutes a means for automatically locking the door upon closure thereof.

As shown in FIGS. 1 and 4, the locking bar 20 has a fitting 47 attached thereto. A pair of screws 48 is shown in FIG. 4 for attaching the fitting 47 to the bar 20.

As shown in FIG. 4, a remotely controlled lock 50 is mounted by a pair of screws 52 and 53 on the outside 51 of the door and adjacent the fitting 47. The purpose of the remotely controlled lock 50 is to unlock the door from the outside 51, while the purpose of the crash bar 12 is to open the door from the inside 13.

The lock 50 has a manually actuatable member 55 and a power transmitting coupling 56 connected to the member by a pin 57. As shown in FIGS. 4 and 5, a spring 58 biases the manually actuatable member 50 and coupling 56 to a rest position. The coupling 56 has a lug 60 which abuts the fitting 47.

Transmission of power from the manually actuatable member 55 to the fitting 47 is normally blocked by a locking dog 61 which abuts a nose 62 on the coupling 56, thereby preventing rotary motion of the coupling 56 in the direction of the arrow 64 shown in FIG. 5.

The dog 61 is mounted for rotary movement about a shaft 65 by a spring washer 66. A plunger 68 of a solenoid 70 is connected to the dog 61 by a link 71. The solenoid 70 has a spring 72 for biasing the plunger 68 in a downward direction. This bias spring 72 acts on a collar 73 on the plunger 68. This downward bias of the solenoid plunger 68 acts on the dog 61 through the link 71 so as to bias the dog 61 into locking engagement with the coupling 56 at the coupling nose 62. The solenoid itself is mounted in a conventional manner on a partition wall 75 in the lock casing 76. The plunger 68 is pulled upwardly when the solenoid 70 is electrically energized through a pair of leads or wires 78 and 79. This, in turn, causes the link 71 to move the dog 61 out of engagement with the coupling 56 and beyond the coupling nose 62.

The latter action of the solenoid 70 does not actuate the locking mechanism 18 in any manner. Rather, that solenoid action frees the coupling 56 for the transmission of power from the manually actuatable member 55 to the fitting 47 on the locking bar 20. More specifically, as long as the dog 61 is withdrawn from the coupling nose 62, the manually actuatable member 55 may be turned in the direction of the arrow 64. This, in turn, causes the lug 60 of the coupling 56 to press the fitting 47 downwardly.

Since the fitting 47 is attached to the locking bar 20, this locking bar is moved in the direction of the arrow 81 shown in FIG. 4 when the fitting 47 is depressed downwardly.

Referring to the above mentioned principles of operation of the lock mechanism 18, it will be understood that the locking bar 21 is moved upwardly by action of the lever 28 when the locking bar 20 is moved downwardly by action of the coupling lug 60 on the fitting 47. In this manner, the locking plungers 23 and 24 are withdrawn from their respective cavities in the door frame top and threshold (not shown) when the manually actuatable member 55 is rotated in the direction of the arrow 64 shown in FIG. 5.

After the door has been unlocked by electrical energization of the solenoid 70 and manual rotation of the member 55, it may be pulled open, such as with the aid of a conventional handle bar, part of which is shown at 83 in FIG. 1. As the door opens, the push button 41 shown in FIGS. 1 and 3 is free to move outwardly under the action of the spring 39 which causes the latch 36 to engage the catch plate 40 at the top of the door. In this manner, the lock mechanism 18 is retained in an unlocked or door release position, as discussed above in connection with FIG. 3.

As soon as the manually actuatable member 55 has returned to its rest position by action of the spring 58, and as soon as the energization of the solenoid 70 has stopped, the bias spring 72 of the solenoid acts through the link 71 in returning the dog 61 to its position shown in FIG. 5 in which it engages the coupling 56 at the nose 62. This automatically blocks the coupling 56 against further transmission of power from the manually actuatable member 55 to the fitting 47, until the solenoid 70 is again energized.

The door is automatically closed by the actuator 43 shown in FIG. 1 and is automatically locked upon closure by actuation of the mechanism shown in FIG. 3 and including the button 41, latch 36 and spring 34 (see FIGS. 2 and 3).

The subject invention is ideally suited for use with doors of the heavy type herein disclosed, since the solenoid 70 is not required to actuate any part of the locking mechanism 18 as such. Rather, that actuation is either performed by the crash bar 12 or the manually actuatable member 55, and the solenoid is merely required to selectively release the coupling 56 between the manually actuatable member 55 and the lock fitting 47. Accordingly, the solenoid 70 may be of a relatively light type requiring only a moderate electrical current for its energization. Since there is a lost-motion connection between the

fitting 47 and the coupling 56, the door can at all times be unlocked by the crash bar 12 independently of the lock 76.

As shown schematically in FIG. 6, the solenoid 70 has a coil 90 for establishing a magnetic field which attracts the ferromagnetic plunger 68. FIG. 6 further shows a simple circuit for energizing the solenoid coil 90, as well as a simple control for remotely controlling the energization of the solenoid coil.

At this juncture it should be understood that the term "remote control" as herein employed does not necessarily refer to great distances. For instance, the unit for controlling the solenoid 70 may be located adjacent the door 11 but still at a distance from the solenoid 70 to which the remote control unit may be connected by way of a flexible cable including the wires 78 and 79.

Reverting to FIG. 6 it will be noted that the solenoid coil 90 is electrically energized by a battery 92 or other source of electric current upon closure of a normally open switch 93 in a control unit 94. A key card 95 is insertable into a slot 96 in the remote control unit 94. By way of preferred example, the use of a magnetic card key and of a corresponding remote control unit is herein preferred. However, in view of the fact that magnetic card keys and card key units are well known, and in an effort to simplify the illustration, a key card with different slots 98 has been shown. The configuration of these slots 98 is determined by a number of pins 99 positioned in the control unit ahead of a bar 100 which curbs unauthorized access to the contact 93. Since the card 95 has the required slot combination 98, it will be able to close the contact 93 upon insertion into the unit 94 and actuation of a contact pin 101. In this manner, the card key 95 controls actuation of the solenoid 70 and thus the release of the manually actuable member 55 shown in FIGS. 4 and 5.

In many situations it is desirable to provide for the passage of a predetermined period of time before the release dog 61 will reenter the coupling 56 at the nose 62 in blocking relationship. This delayed action permits the user of the card key to remove the card from the unit 94 before being compelled to actuate the manually actuable member 55 for an unlocking of the door. A similar delay is desirable if the energization of the solenoid 70 is controlled by a guard or receptionist.

A mechanical device for retaining the dog 61 shown in FIGS. 4 and 5 in a withdrawn position for a predetermined time is shown in FIG. 7 where like reference numerals as among FIGS. 4 to 6 illustrate like parts.

The solenoid 70 of FIG. 7 is provided with a dashpot 105 which has a piston 106 movable in a cylinder 107. The piston 106 has a piston rod 109 connected to the plunger 68. Accordingly, the piston 106 is moved upwardly as the solenoid plunger 68 is drawn into the solenoid upon energization thereof. The piston 106 has a bore 110 and a valve 112 below the bore 110. The valve 112 is opened and air can readily escape therethrough as the piston 106 is moved upwardly in the cylinder 107. Accordingly, practically no delay or only a short delay, occurs upon actuation of the solenoid 70. However, once the upward movement of the solenoid plunger 68 and piston 106 has stopped, the valve 112 closes. Air can then only enter into the cylinder space above the piston 106 through a valve 113. This valve 113 may be a needle valve which has a small orifice for only a restricted admission of air to the cylinder space above the piston 106.

Accordingly, the piston 106 and solenoid plunger 68 can only move downwardly at the slow rate permitted by the restricted flow of air into the cylinder 107 through the valve 113. In consequence, the dog 61 will be retained through the link 71 in a withdrawn position beyond the coupling nose 62 for a predetermined period of time determined by the adjustment of the dashpot valve 113.

An electrical alternative to the mechanical solution of FIG. 7 is shown in FIG. 8 where like reference numerals as among FIGS. 6 and 8 designate like parts.

Upon closure of the remote control contact 93, the battery 92 electrically energizes a relay 120. This closes the normally open relay contacts 121 and 122. Closure of the relay contact

121 causes a capacitor 123 to be slowly charged through a resistor 124 which has a sufficiently high value as to preclude an adverse effect on the operation of the relay 120 by the charging of the capacitor 123. Closure of the relay contact 122 permits the battery 92 to energize the winding 90 of the solenoid 70. In this manner, the dog 61 is advanced to its released position beyond the nose 62 of the coupling 56, and manual actuation of the locking mechanism 18 by operation of the member 55 is rendered possible.

When the remote control contact 93 is opened after removal of a card key 95 or removal of a finger from a push button, etc., the energization of the relay 120 from the battery 92 stops. However, the relay then continues to be energized by discharge current provided by the charged capacitor 123 by way of the resistor 124. In this manner, the relay contact 122 remains closed and the solenoid 70 thus remains energized by current from the battery 92 for a period of time determined by the time constant of the R/C circuit provided by the capacitor 123 and resistor 134. If desired, the resistor 124 may be made adjustable to permit adjustment of the period of time during which the dog 61 will be retained in its released position.

Upon exhaustion of the electric charge of the capacitor 123, the relay 120 will drop off thereby opening its contacts 121 and 122. The dog 61 will accordingly be returned to its locking position against the coupling 56 and the locking of the door will be completed when the manually actuable member 55 is released and the push button 41 shown in FIGS. 1 and 3 has hit the adjacent door frame portion.

It will now be recognized that the subject invention provides a material advance and substantial improvements in the field of remote controlled locks.

I claim:

- Apparatus for selectively locking and controllably releasing a panic exit door, comprising in combination:
 - selectively actuable lock means on said door having a door locking position and a door release position, said lock means comprising means including a first vertical locking bar for selectively locking said door at the bottom thereof, means including a second vertical locking bar for selectively locking said door at the top thereof, and means coupled to said locking bars for biasing said first and second vertical locking bars away from one another into locking positions;
 - first manually actuable means coupled to said lock means for selectively applying actuating power to said lock means, said first manually actuable means comprising a panic exit crash bar and actuating means for moving said first and second vertical locking bars toward one another into door release positions upon actuation of said crash bar;
 - means for mounting said first manually actuable means on said door for access from one side of said door;
 - second manually actuable means selectively coupled to said lock means for selectively applying actuating power to said lock means;
 - means for mounting said second manually actuable means on said door for access from another side of said door;
 - remotely controllable means selectively coupled to said second manually actuable means for selectively blocking and permitting the application of actuating power by said second manually actuable means to said lock means, said remotely controllable means including means for permitting said application of actuating power in response to a remote control operation and means for automatically blocking said application of actuating power upon cessation of said remote control operation; and
 - remote control means connected to said controllable means for selectively effecting said remote control operation.
- Apparatus as claimed in claim 1, wherein:
 - said second manually actuable means include coupling means permitting application of actuating power to said lock means by said first manually actuable means while said second manually actuable means are blocked by said remotely controllable means.

3. Apparatus as claimed in claim 2, including:
means coupled to said door for automatically closing said door; and
means coupled to said lock means for automatically actuating said lock means to said door locking position upon closure of said door. 5

4. Apparatus as claimed in claim 2, wherein:
said coupling means include a lost-motion coupling between said second manually actuatable means and said vertical locking bar. 10

5. Apparatus as claimed in claim 1, wherein:
said second manually actuatable means include a manually actuatable member and power-transmitting means coupled between said manually actuatable member and said lock means for actuating said lock means to said door release position upon manual actuation of said manually actuatable member; and 15

said remotely controllable means include means operatively associated with said power-transmitting means for selectively freeing said power-transmitting means in response to a remote control operation and means for automatically blocking said power-transmitting means upon cessation of said remote control operation. 20

6. Apparatus as claimed in claim 1, wherein:
said remotely controllable means include an electrical actuator; and 25

said remote control means include means for electrically energizing said actuator.

7. Apparatus as claimed in claim 1, wherein:
said remotely controllable means include an electrical actuator; and 30

said remote control means include means incorporating a predetermined code, and means responsive to said code for electrically energizing said actuator.

8. Apparatus as claimed in claim 1, wherein: 35

said remote control means include means for delaying said

automatic blocking of said actuating power for a predetermined period of time.

9. Apparatus as claimed in claim 8, wherein:
said remote control means include time delay means for delaying said automatic blocking of said actuating power for said predetermined period of time.

10. Apparatus as claimed in claim 1, wherein:
said remotely controllable means include an electrical actuator for selectively permitting said application of actuating power and time delay means coupled to said automatic blocking means for releasing said automatic blocking means only after expiration of a predetermined time delay.

11. Apparatus as claimed in claim 1, wherein:
said remotely controllable means include an electrical actuator; and 40

said remote control means include a card key incorporating a predetermined code, and means responsive to said code on said card key for electrically energizing said actuator.

12. Apparatus as claimed in claim 11, wherein:
said remotely controllable means include an electrical actuator for selectively permitting said application of actuating power and time delay means coupled to said automatic blocking means for releasing said automatic blocking means only after expiration of a predetermined time delay.

13. Apparatus as claimed in claim 11, wherein:
said remote control means include means for delaying said automatic blocking of said actuating power for a predetermined period of time.

14. Apparatus as claimed in claim 13, wherein:
said remote control means include time delay means for delaying said automatic blocking of said actuating power for said predetermined period of time. 45

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