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[54] **ELECTRO-MECHANICAL DOOR LOCK SYSTEM**
6 Claims, 4 Drawing Figs.

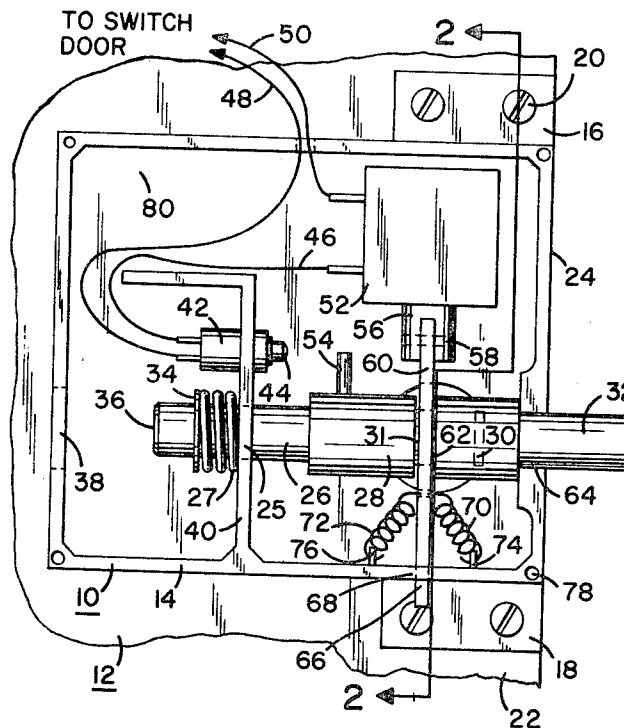
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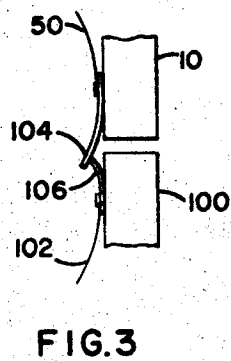
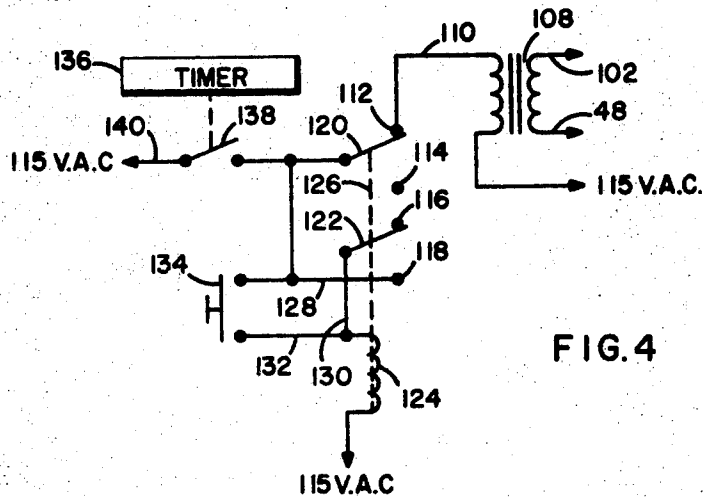
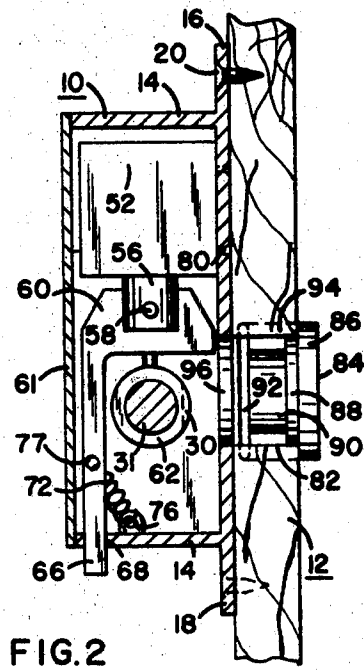
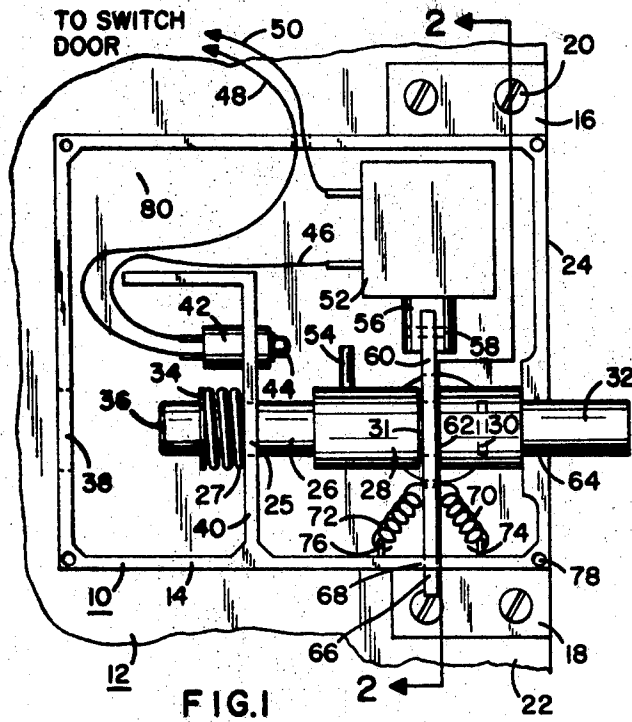
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ABSTRACT: An electromechanical door lock system that has a housing with a lock bolt that is resiliently biased to a retracted position with a solenoid operated latch that holds the lock bolt in the extended, locked position, and the housing has openings for mechanically locking and unlocking the bolt, and a timing circuit for selectively energizing the solenoid to release the lock bolt, which timing circuit has override switches for controlling the position of the lock bolt independently of the timing circuit.





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ELECTRO-MECHANICAL DOOR LOCK SYSTEM

BACKGROUND OF THE INVENTION

Many business establishments, as for example a coin operated commercial laundry, is open to the public without having the proprietor present. Often these establishments must be opened for business by the proprietor at an early hour, even though the proprietor need not be present. Thus while the proprietor is present to lock the establishment at night, he does not care to be present the next morning to open the door. Thus it would be desirable for the proprietor to not have to go to the establishment for the sole purpose of unlocking the door to the establishment. It is thus advantageous to have a means for unlocking the door to the establishment without the presence of the proprietor.

While many different types of locks are used on doors to business establishments, such as laundries or the like, these locks must be mechanically opened by a person at the establishment. The same applies to electric locks. While electric locks may be used to move a heavier lock mechanism and because they are not subject to being opened from the outside of the establishment by master keys, picking, or the like, the electric locks and the mechanical lock do not open automatically, unless they have very complicated and expensive mechanisms. Further, while there are some timer controlled lock systems, these timer controlled lock systems are operable only through the timing mechanism. Thus if the user desired to either lock or unlock the lock at times different from that of the established chronology of the timing mechanism, then this is normally difficult to accomplish.

Therefore it is advantageous to have a time controlled, automatically operable lock mechanism that is simple in construction and yet is substantially foolproof in operation and that can be locked or unlocked at times other than that set by the timing mechanism.

SUMMARY OF THE INVENTION

In a specific illustrative embodiment of the electromechanical door lock system of this invention, a door lock housing is mounted flush against the inside of the door to be locked. A lock bolt moves through an opening in the housing and is resiliently biased to the retracted or unlocked position. A solenoid operated, engaging means is resiliently biased to engage a slot in the lock bolt to hold the lock bolt in the locked or extended position. A circuit means energizes the solenoid at selective and controlled times to move the engaging means out of engagement with the lock bolt. The resilient biasing means then moves the lock bolt to the unlocked position. A timing circuit, such as the timer for controlling the lights in the business establishment, controls the operation of the solenoid and thus provides a timed operation of the solenoid to automatically unlatch the lock bolt.

The housing has openings permitting access to the lock bolt that allows tools to be inserted for moving the lock bolt against its resilient biasing means and also against the resiliently biased engaging means. Thus the lock bolt may be moved to the locked or extended position or to the retracted position mechanically and in difference to the solenoid being energized or deenergized by the circuit means and the timer. A switch in the housing that normally closes the circuit from the timer switch to the solenoid is opened by movement of the lock bolt to the unlatched position. Thus the solenoid is deenergized during the time that the electromechanical door lock is in the unlocked condition. The timer circuit functions to close a switch to the solenoid that energizes the solenoid only when the door lock bolt is in the locked condition.

The timer used to control the lock is one that is usually employed to control the lights in the establishment. The timer switch is normally closed while the lights are on and the timer switch is normally open when the lights are off. Thus the timer switch is armed to hold the solenoid in the energized condition during times that the lights are on, were it not for the solenoid

deenergizing switch that is opened by the lock bolt being in the retracted position. Thus it is not possible, when the timer holds the lights on in the establishment, to lock the electromechanical door lock because the movement of the bolt will allow the solenoid to be energized. Yet it is desirable to either lock the door lock or unlock the door lock at times other than when the system is operated by the timer, without having to reset the timer to these nonscheduled operations. Thus to lock the door lock when the timer switch is closed, a push button switch is closed energizing a self holding relay having switch contacts that open the circuit to the solenoid. This allows the lock bolt to be held in the locked position by the energizing means. The relay controlled switch is then deenergized upon the timer circuit opening in the normal timing sequence, and thus the entire lock system recovers to the normal timer controlled condition.

Thus it may be seen that the door lock system of this invention allows the electromechanical lock to be closed mechanically irrespective of the condition of the timer control and yet have the timer control assume control of opening the lock in its normal scheduled operation. This facilitates use of the lock system and does not require resetting the timer for unscheduled use of the electromechanical lock.

It is therefore an object of this invention to provide a new and improved electromechanical door lock system.

It is another object of this invention to provide a new and improved electromechanical door lock system that is automatically unlocked by an existing light controlling timer in business establishments.

It is another object of this invention to provide a new and improved electromechanical door lock system wherein the lock is mechanically locked and is opened electrically.

It is another object of this invention to provide a new and improved electromechanical door lock system wherein the opening of the door lock is controlled by a set timing mechanism having an on and off condition and which door lock may be selectively locked mechanically and the timing circuit is overridden by holding switch control means.

It is another object of this invention to provide a new and improved electromechanical door lock system that is timer controlled and that may be selectively mechanically operated at unscheduled times without having to reset the time of operation of the timing circuit.

Other objects and many advantages of my invention will become more apparent upon a reading of the following detailed specification and in viewing the drawing in which like reference numerals designate like parts throughout and in which:

FIG. 1 is a side view of the mechanism of an embodiment of the electromechanical door lock of this invention.

FIG. 2 is a cross-sectional view taken along lines 2-2 of FIG. 1.

FIG. 3 is a partial view with parts broken away of a door closing switch employed in the specific embodiment of this invention.

FIG. 4 is a block diagram and circuit diagram of electrical components employed in an illustrative embodiment of this invention.

Referring to the drawing, the electromechanical timer controlled door lock comprises a lock mechanism 10 having a rectangular housing 14 that is secured by side extensions 16 and 18 and screws 20 to the inside surface of a door 12. The front side edge of the housing 14 is generally aligned with the front side surface 22 of the door 12. The housing 14 has a cover plate 61 that is fastened by screws 20 in threaded holes 78. The door lock housing 10 may be cast or machined as desired from any suitable metal. Positioned in the housing 14 is a cylindrical lock bolt 28 that has an enlarged diameter central portion with reduced diameter end portions 26 and 32. End portion 32 projects through a circular opening 64 in the front side 24 of the housing 14. The housing 14 also has an opening 38 in the rear side wall through which a tool can be inserted to contact end 36 and mechanically move the lock

bolt 28. A circular slot 62 in the center of the lock bolt 28 provides a reduced diameter portion 31. The lock bolt 28 also has a slot 30 that is cut tangentially in the side of the enlarged diameter portion of the lock bolt 28. The reduced diameter end portion 26 extends through an opening 25 in wall 40. A circular washer or key 34 fits in a recess in the reduced diameter portion 26 and holds a compression spring 27 in position. Compression spring 27 normally biases the lock bolt 28 to a position wherein the front reduced diameter portion 32 is moved to the unlatched position and does not project through the outer edge of the opening 64. A pin 54 extends from the side of the enlarged diameter portion of the lock bolt and cooperates to depress switch button 44 of switch 42 upon rearward movement of the lock bolt 28 to the unlatched position.

A latching means that engages and holds the lock bolt 28 in the latched position and against spring 27, comprises a latching plate 60 that fits into slot 62 and that is secured by pin 58 to an inductor member 56. The inductor member 56 is movable vertically in the known manner by energizing the known solenoid 52 through electrical input lines 46 and 50. The latch plate has a downward projecting member 66 that projects through an opening 68 in the bottom edge wall of the housing 14. Springs 70 and 72 are held at their ends by opening 70 and tabs 74 and 76 of the housing 14. These springs bias the latch plate 60 to the down position where its lower edge passes into the slot 62 in the lock bolt 28 and holds the lock bolt 28 in the latched position. Energizing solenoid 52 pulls the inductor 56 upwardly in the known manner and pulls latch plate 60 out of slot 62 releasing the lock bolt 28 for rearward movement under the force of spring 27 to the unlatched position.

When the solenoid 52 is deenergized, springs 70 and 72 pull the latch plate 60 down against the lock bolt 28 and holds the latch 60 in slot 62 when the lock bolt 28 is in the locked position. The latch 60 can be moved mechanically out of slot 62 by pushing upwardly on the bottom end of member 66. This mechanically releases the lock bolt 28. The lock bolt 28 may be pushed to the latched condition by inserting a tool through opening 38 and contacting end 36 and moving the latch bolt 28 longitudinally against the force of spring 27 until the opening 62 is in alignment with the bottom edge of the latch plate 60. Springs 70 and 72 then pull the latch plate 60 into the slot 62.

The wall 80 of the lock housing 14 has an opening 96. The door structure 10 also has an opening 82 cut therein that corresponds with the opening 96. A key operated known cylindrical lock 84 is inserted into the opening 82. The opening has radial slots 94 that cooperate with the outer projecting ears of the rotating member 92. The lock 84 has an outer portion 86 and reduced in diameter cylindrical portions 88 and 90 that fit into the opening 82. In the known manner, a key is inserted into the tumbler lock that rotates the longitudinal member 92 to correspond to the slots 94 allowing the lock 84 to be removed from the opening 82. This allows a person outside the door 12 to lock or unlock the electric lock mechanically. To lock the lock bolt 28, a tool such as a screwdriver, key or other known tool is inserted through respective openings 82 and 96 and engages the slot 30. The tool is then used to force the bolt 28 against the spring 27 to the point that latch 60 is moved into the slots 62. To release the lock, a tool is inserted through the openings 82 and 96 to contact the bottom edge of the latch 60 to move the latch vertically and out of the slot 62, permitting the spring 27 to move the lock bolt 28 to the unlatched position.

The solenoid 52 is energized from a remote control panel by a programmed timer 136. The solenoid 52 is energized from a power source that is controlled by a remotely positioned control panel, see FIG. 4. Normal commercial power in a business establishment of 115 volts AC is fed through line 140, through down contact 138, through up contact 120 and line 110 to a transformer 108. The transformer 108 drops the voltage down in output lines 102 and 48 to approximately 24

volts AC. The relay 124 controls the position of contacts 120 and 122. These contacts are biased to the up position along dotted line 126 and are pulled to the down position by relay 124. Timer 136 controls the position of switch 138 that is normally resiliently biased to the up or open position. While any suitable timer can be used, the timer 136 that would normally be used in this circuit is an existing timer that is used in building establishments to turn the lights on and off. This timer, for example, would close a switch that turns the lights on in the building establishment automatically at 7:00 a.m. and would open the switch to turn the lights off at 11:00 p.m. Switch contact 138 is controlled in the same time sequence. Accordingly between the time period of 7:00 a.m. and 11:00 p.m., switch contact 138 is in the down position. Upon the timer opening the light circuit at 11:00 p.m., it also opens contact 138. At 7:00 a.m., timer 136 closes contact 138 energizing the solenoid 52 that pulls that latch plate 60 upwardly out of groove 62, allowing spring 27 to move the lock bolt 28 to the retracted, open position. Thus in the normal operation of setting the lock mechanism, at for example 11:00 p.m. or shortly thereafter when the electrical power to the solenoid circuit 52 is cut off and the latch plate 60 is pulled downwardly by springs 70 and 72, a tool such as a screwdriver or the like is inserted through opening 38 to contact end 36. The lock bolt 28 is pushed to the extended or locked position wherein the spring biased latch 60 is pulled into the slot 62 locking the lock bolt 28 in the locked position. At 7:00 a.m., the timer 136 turns on the lights and also closes contact 138. The solenoid 52 energizes, pulling the latch plate 60 upward and unlocking the lock bolt 28. As the lock bolt 28 moves to the open or retracted position, pin 54 contacts the end 44 of the push button switch 42 that opens the power source through lines 46 and 48 to the solenoid 52. Thus the solenoid circuit is open while switch 138 is closed.

The solenoid circuit through line 102 also passes through a door switch, see FIG. 3, wherein the door 12 and the adjacent wall 100 has spring contacts 104 and 106 that close the circuit between lines 102 and 50 only when the door 12 is closed. Thus it is only possible to energize the solenoid 52 from the power source when the door 12 is closed and the lock bolt 28 is in the locked condition.

Often it is desirable to lock the electromechanical door lock of this invention prior to the 11:00 p.m. time for operation of the timer 136. However, at this time switch contact 138 is closed. So moving the lock bolt 28 to the locked position energizes solenoid 52. Upon pushing push button switch 134 to the closed condition, electrical power flows through input 140, down contact 138, closed switch 134 and line 132 to relay 124. This energizes relay 124 pulling up contacts 120 and 122 to the down position and opens the circuit supplying power through line 110 to the transformer 108. Also down contact 122 closes a circuit through line 128 and line 130 that holds relay 124 energized and holds contacts 120 and 122 in the down position after releasing push button switch 134. Thus the solenoid circuit to solenoid 52 is opened even though the timer contact 138 is closed. Springs 70 and 72 then pull the latch 60 into slot 62 and the lock bolt 28 is held in the locked condition. At 11:00 p.m., the timer 136 opens contact 138. This opens the line potential to relay 124 through down contact 122 that deenergizes relay 124. Contacts 120 and 122 are then biased upwardly to the closed position. However since contact 138 is opened, solenoid 52 remains deenergized. At 7:00 a.m. the next morning, timer 136 turns on the lights in the business establishment and simultaneously closes contact 138. This energizes relay 52 and as previously described pulls the latch plate 60 upwardly out of slot 62 allowing spring 27 to bias the lock bolt 28 to the unlocked position.

Sometimes it is desirable to open the electromechanical door lock from outside the business establishment before 7:00 a.m. during which time contact 138 is open. In these situations, the key lock 84 is opened and removed from opening 92. A tool is then inserted through the opening to contact the lower edge of the latch plate 60, wherein the latch

plate 60 is move vertically and out of slot 62. The lock bolt 28 is then biased to the open position. Still further it may be advantageous at certain times to lock the latch bolt 28 from outside the business establishment. In these instances, a tool, such as a screwdriver or the like, is projected through openings 82 and 96 and into slot 30 and the bolt 28 is moved to the locked position.

Thus it may be seen that the electromechanical door lock system of this invention is flexible in its operation and control, and yet is simplified in its structure and operation and may be operated either electrically by a timer or mechanically. The system utilizes an existing timer that is normally present in business establishments, although a separate timer can be provided if desired.

I claim:

1. An electromechanical door lock system comprising:

a resiliently biased lock bolt that is normally biased to a retracted position,

means for engaging and holding the lock bolt in an extended position,

solenoid means for moving the engaging means to a nonengaging position in the energized condition,

circuit means for energizing the solenoid means,

first resilient means for biasing said lock bolt to said retracted position,

second resilient means for pulling said engaging means into engagement with said lock bolt,

said engaging means comprises a movable plate,

said lock bolt having a slot midway its length for receiving said plate,

a housing for enclosing said lock bolt, said engaging means and said solenoid means,

said plate has a longitudinal portion, the end of which extends out of said housing in a position to be contacted and moved, moving said plate against the force of said second resilient means and out of said slot,

said housing has an opening through which said lock bolt exclusively projects when in other than substantially completely retracted position, means within said housing cooperating with the housing at said opening for supporting and guiding said lock bolt,

and said housing has at least one opening adjacent said lock bolt for access to physically contact said lock bolt and move said lock bolt against the force of said first resilient means to a position to be engaged by said engaging means.

2. An electromechanical door lock system comprising:

a resiliently biased lock bolt that is normally biased to a retracted

means for engaging and holding the lock bolt in an extended position,

solenoid means for moving the engaging means to a nonengaging position in the energized condition,

circuit means for energizing the solenoid means, first resilient means for biasing said lock bolt to said retracted position,

second resilient means for pulling said engaging means into engagement with said lock bolt,

said engaging means comprises a movable plate,

said lock bolt having a slot midway its length for receiving said plate,

a housing for enclosing said lock bolt, said engaging means and said solenoid means,

said plate has a longitudinal portion, the end of which extends out of said housing in a position to be contacted and moved, moving said plate against the force of said second resilient means and out of said slot,

said housing has at least one opening adjacent said lock bolt for access to physically contact said lock bolt and move said lock bolt against the force of said first resilient means to a position to be engaged by said engaging means,

a normally closed first switch means in said circuit means positioned adjacent said lock bolt,

and said lock bolt having a side projection that contacts and opens said first switch means upon movement of said lock bolt to said retracted position.

3. An electromechanical door lock system as claimed in Claim 2 in which:

second switch means in said circuit means for opening said circuit means,

and timer means for opening said second switch means at selective time.

4. An electromechanical door lock system as claimed in Claim 3 in which:

a relay that when energized, opens a third switch means in said circuit means opening said circuit means,

second circuit means for energizing said relay, and fourth switch means for closing a second circuit means.

5. An electromechanical door lock system as claimed in Claim 4 in which:

said second circuit means holds said relay energized through a contact in said third switch means.

6. An electromechanical door lock system as claimed in Claim 5 in which:

said second switch means opens said second circuit means and deenergized said relay upon being opened by said timer means.

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