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ELECTRONIC DOOR LOCK

Abstract

An electronic door lock assembly installed in a door jamb is designed to electronically move a latch assembly of a door latch or latch bolt out of the door jamb. The lock includes an exterior housing that houses an interior interlock housing, a strike actuator, at least two springs, a microprocessor, a plunger system, and a motor. When a signal is sent to the microprocessor and power is applied to the motor, the plunger translates within the interior interlock housing causing the strike actuator to extend such that the head member of the strike actuator pushes the latch out of the door jamb. Alternatively, when power is removed from the stepper motor, the electronic door assembly retracts the strike actuator, which allows the latch to rest within the door jamb.

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Background/Summary

FIELD OF THE INVENTION

[0001] The present invention relates generally to electronic door locks, and more particularly, to a jamb-mounted electronic door lock assembly that fits behind a strike plate of a door jamb and is configured to actuate a striker to move a latch assembly bolt of a door latch or latch bolt out of the door jamb, allowing the door to be opened.

SUMMARY OF THE INVENTION

[0002] The present invention is directed to an electronic door assembly. Introducing a first embodiment of the invention, the present invention consists of an electronic door lock assembly, comprising an outer housing that includes a proximal face member that is configured to receive a strike plate, at least one opening, and an internal space for receiving an interlock housing member. The interlock housing member includes a latch receiving space, and houses an actuator, one or more springs, a plunger, and a module. The module is coupled to the plunger on a distal end by a coupling device, such as a fastener, and the actuator is coupled to the plunger on a proximal end thereof via a pair of shoulder members that engage with exterior portions of the plunger. Activation of the module is configured to cause the plunger to translate within the interlock housing member to bias one or more springs coupled to the plunger and actuator and translate the actuator within the latch receiving space.

[0003] In one aspect, the outer housing is configured to fit behind a strike plate of a door jamb.

[0004] In another aspect, the module is a stepper motor that communicates with a microprocessor. The step motor may further include a driving member that is coupled to a coupling member that couples the driving member to the distal end of the plunger.

[0005] In another aspect, the electronic door lock assembly includes a biasing spring wrapped around a portion of the plunger. The electronic door lock assembly may further include a biasing spring disposed within an interior portion of the proximal end of the plunger and is in fluid communication with a portion of the actuator.

[0006] In another aspect, the latch receiving space is configurable to receive a portion of a door latch or latch bolt.

[0007] In another aspect, the module may communicate with an electronic device capable of monitoring whether the electronic door assembly is in a locked configuration or an unlocked configuration.

[0008] In another aspect, a power supply supplies power to the module. The power supply may include an AC adaptor, a DC adaptor, a mains adaptor, a RFID power source, a battery, a rechargeable battery, or combinations thereof.

[0009] In another exemplary embodiment, a method of moving a door latch out of a door jamb is introduced comprising the steps of: providing an electronic door lock comprising an exterior housing member housing an interior housing member, the interior housing member housing one or more springs, a plunger, a module coupled to a distal end of the plunger, an actuator coupled to the proximal end of the plunger, and a power supply powering the module; and sending an electrical signal to the module to activate the module and translate the plunger within the interior housing member biasing the one or more springs such that the actuator translates within the latch receiving space.

[0010] These and other objects, features, and advantages of the present invention will become more readily apparent from the attached drawings and the detailed description of the preferred embodiments, which follow.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] The preferred embodiments of the invention will hereinafter be described in conjunction

with the appended drawings provided to illustrate and not to limit the invention, where like designations denote like elements, and in which:

[0012] FIG. **1** presents a perspective view of the electronic door lock assembly in accordance with an exemplary embodiment of the present invention;

[0013] FIG. **2** presents a partially-exploded view of the electronic door lock assembly;

[0014] FIG. **3** presents an exploded view of the electronic door lock assembly;

[0015] FIG. **4** presents a cross-sectional view of the electronic door lock assembly engaging a spring-loaded latch to provide an open-door configuration;

[0016] FIG. **5** presents a cross-sectional view of the door lock assembly engaging a spring-loaded latch to provide a locked-door configuration;

[0017] FIG. **6** presents a cross-sectional view of the door lock assembly engaging a spring-loaded latch to provide an unlocked-door configuration; and

[0018] FIG. **7** presents a cross-sectional view of the door lock assembly with the electronic switch of the assembly activated.

[0019] Like reference numerals refer to like parts throughout the several views of the drawings.

DETAILED DESCRIPTION

[0020] The following detailed description is merely exemplary in nature and is not intended to limit the described embodiments or the application and uses of the described embodiments. As used herein, the word “exemplary” or “illustrative” means “serving as an example, instance, or illustration.” Any implementation described herein as “exemplary” or “illustrative” is not necessarily to be construed as preferred or advantageous over other implementations. All of the implementations described below are exemplary implementations provided to enable persons skilled in the art to make or use the embodiments of the disclosure and are not intended to limit the scope of the disclosure, which is defined by the claims. For purposes of description herein, the terms “upper”, “lower”, “left”, “rear”, “right”, “front”, “vertical”, “horizontal”, and derivatives thereof shall relate to the invention as oriented in FIG. **1**. Furthermore, there is no intention to be bound by any expressed or implied theory presented in the preceding technical field, background, brief summary or the following detailed description. It is also to be understood that the specific devices and processes illustrated in the attached drawings, and described in the following specification, are simply exemplary embodiments of the inventive concepts defined in the appended claims. Hence, specific dimensions and other physical characteristics relating to the embodiments disclosed herein are not to be considered as limiting, unless the claims expressly state otherwise.

[0021] Referring initially to FIGS. **1** through **7**, the present invention relates to a jamb-mounted electronic door lock assembly **100** (the “door lock assembly”) for moving the latch **300** of a latch assembly out of a door jamb to free the door from the jamb. Latch **300** includes but is not limited to a door latch, a deadbolt latch, or any type of sliding latch. The door lock assembly is designed to allow a locked door to be unlocked and freed with interference on the jamb side of the door. The door lock assembly **100** can be installed with minimal tooling, for example, a drill or a driver. This is an improvement over existing electronic locks that require drills, drivers, routers, chisels, and other tools to be installed successfully. With particular reference to FIGS. **1** and **2**, the door lock assembly **100** generally comprises an exterior housing assembly **102** that houses an interlock mechanism **200**. The exterior housing assembly **102** of the door lock assembly **100** comprises a housing body **104** that generally includes a unibody construction and has an opening **108** in the body **104**. At the proximal end of the housing body **104**, the exterior housing assembly **102** includes a face member **106** that includes one or more apertures **110** for receiving fasteners **112** that secures the exterior housing assembly **102** to at least one other component. In some exemplary embodiments, the body **104** of housing **102** is cylindrically shaped, and the face member **106** includes a substantially flat member that is rectangular shaped. The exterior housing assembly **102** includes a strike plate **114** with a central opening **116** and one or more aperture **118** for receiving

fasteners **112** through. The strike plate **114** mates with the head member **106** of the body **104** of the exterior housing assembly **102**, where the openings of both the head member **106** and the strike plate **114** are concentrically aligned. Disposable within the internal space **120** of the housing body **104** is the interlock mechanism **200**.

[0022] Turning now to FIGS. **2** and **3**, the interlock mechanism **200** comprises an interlock housing **202** that is formed by least an upper housing member **204** and a lower housing member **206**. The upper housing member **204** includes a male attachment member **208** disposed about a peripheral edge that engages a female attachment member **210** disposed about a peripheral edge of the lower housing member **206**. Accordingly, the upper housing member **204** and the lower housing member **206** are detachable coupled to one another. When the upper housing member **204** and the lower housing member **206** are attached, both members form the interlock housing **202**, which includes an internal space or cavity **211**. Inside the interior space **211** of the interlock housing **202**, the interlock mechanism includes and retains a strike actuator member assembly **238**, one or more springs **234**, **236**, a plunger, a lead screw **224**, and at least a portion of a stepper motor assembly **212**. The housing members of the interlock mechanism in one exemplary embodiment comprise a polymer such as nylon 6/6 30% glass filled or equivalent material with a melting point of 497 Fahrenheit and an operating temperature of about 230 Fahrenheit.

[0023] The stepper motor assembly, **212** of the interlock mechanism **200**, comprises a motor housing **214** that houses a motor, a mounting head **216**, and a driving shaft member **218** connected to the motor. In one exemplary embodiment, the stepper motor assembly **212** comprises a stepper motor model Ding's Motion E25PD14J12-30ACM-001 or equivalent that has a power capacity of 3.85 W, 12V, 160 mA phase current and is capable of operating at a temperate range of −20 to 55 Celsius. The mounting head **216** of the stepper motor assembly **212** includes at least one aperture **220** for receiving a fastener **222**. The fasteners in one exemplary embodiment comprise tamper-resistant screws. The distal end of the driving shaft member **218** is coupled to the lead screw **224** of the interlock mechanism **200**. The lead screw includes a coupling face **226** that includes one or more apertures for receiving fasteners **222** and a lead screw shoulder member **228** designed and otherwise configured to engage with the plunger **230** of the interlock mechanism. The apertures of the lead screw **224** concentrically align with the apertures on the mounting head **216** of the stepper motor assembly **212** to allow removable coupling of the stepper motor assembly to the lead screw.

[0024] With continued reference to FIG. **3**, the plunger **230** of the interlocking member comprises an elongated body that includes an external stopper **248**, a pair of fins **250**, and more than one upper surface **252** that create channels **244** on the exterior of the plunger **230** and further includes a proximal opening **232** and a distal opening **233** separated by an internal wall **254** (FIG. **4**). The strike actuator **238** of the interlocking member **200** comprises a head member **240** that makes contact with a latch, and shoulder members **242** that extend outwardly from the head member **240** and engage the formed channels **244** on the plunger **230**. Controlling the movement of stepper motor **212** is a microswitch PCB **246** that is removably coupled to a portion of either the upper housing **204** or lower housing **206** of the interlock housing **202**. The microswitch **246** is electronically connected to the stepper motor and can communicate through a wire or wirelessly over a network with another electronic device (not shown).

[0025] As used herein, the term “electronic device” is capable of executing instructions. The term electronic device includes, but is not limited to, a personal computer, server computers, computing tablets, set-top boxes, video game systems, personal video recorders, telephones, cellular telephones, digital telephones, personal digital assistants (PDAs), portable computers, notebook computers, and laptop computers. Computing devices may run an operating system, including, for example, variations of the Linux, Unix, MS-DOS, Microsoft Windows, Palm OS, Symbian OS, and Apple Mac OS X operating systems. Computing devices also include communications software that allows for communication over the network. Depending on the electronic device or computing device, the communications software may provide support for communications using one or more

of the following communications protocols or standards: the User Datagram Protocol (UDP), the Transmission Control Protocol (TCP), the Internet Protocol (IP), and the Hypertext Transport Protocol (HTTP); one or more lower-level communications standards or protocols such as, for example, the 10 and/or 40 Gigabit Ethernet standards, the Fiber Channel standards, one or more varieties of the IEEE 802 Ethernet standards, Asynchronous Transfer Mode (ATM), X.25. Integrated Services Digital Network (ISDN), token ring, frame relay, Point to Point Protocol (PPP), Fiber Distributed Data Interface (FDDI); and other protocols. Electronic devices may include a network interface card, network chip, or network chipset that allows for communication over the network. The electronic devices communicating with one another, in some exemplary embodiments, are interconnected to the Internet through many interfaces, including a network, such as a local area network (LAN) or a wide area network (WAN), dial-in-communications, cable modems, and special high-speed ISDN lines.

[0026] The term microprocessor, as used herein, refers to central processing units, processors, microcontrollers, reduced instruction set circuits (RISC), application-specific integrated circuits (ASIC), logic circuits, and any other circuit or processor capable of executing the functions described herein. As used herein, the terms “software” and “firmware” are interchangeable and include any computer program stored in memory for execution by the processor, including RAM memory, ROM memory, EPROM memory, EEPROM memory, and non-volatile RAM (NVRAM) memory. The above memory types are exemplary only and are thus not limiting as to the types of memory usable for storage of a computer program. In one exemplary embodiment, the microswitch **246** used to control the interlocking mechanism **200** is an E-Switch TD4700BW or equivalent that operates on a 5V, 1 mA current and has a life expectancy of 100,000 cycles and capable of operating in temperatures of −40 to 85 Celsius. The microprocessor and the stepper motor are powered by a power supply (not shown). The power supply includes an AC adaptor, a DC adaptor, a mains adaptor, a RFID power source, a battery, a rechargeable battery, or combinations thereof.

[0027] With reference now to FIGS. **4** through **7**, the electronic assembly **100** functions to lock and unlock doors used outside residential elevator shafts. It is to be installed into the door frame and interacts with the spring-loaded latch **300** within the door to either lock or unlock the door (not shown). Referring to FIGS. **3** and **4** illustrate the electronic lock assembly **100** in an open-door configuration as the spring-loaded latch **300** does not contact the actuator **238**. In this configuration, the stepper motor **212** receives a signal from an electronic device to maintain the stepper motor **212** idle, as springs **239** and **234** remain in an uncompressed configuration and spring **239** pushes against the actuator head **240** pushing it outwardly from the internal space **246** provided by the interlock housing **202**. When the electronic lock assembly **100** is engaged, a signal from an electronic device is transmitted to the microprocessor **246** and the stepper motor **212**. The signal can either be a signal to engage the stepper motor to provide a locked-door configuration (FIG. **5**) or an unlocked configuration (FIG. **6**). To provide a locked-door configuration, the signal transmitted to the microprocessor **246** prompts the microprocessor to send a command to the stepper motor **212** that is being supplied with an electrical current. The stepper motor **212** engages and rotates the driving member **218** engaging the lead screw **226**. This rotational movement causes the plunger **230** to move within the interlock housing **202** which includes one or more surfaces **243** that engage the outer surfaces **252** of the plunger **230**. This movement causes the actuator **238** to move inwardly, compressing spring **236** to create a void or space **246** within the interlock housing **202** for the latch **300** to enter and rest within space **246**. While engaged, the motor of the electronic lock assembly **100** counteracts the spring's **236** tendency to push the latch outwardly (as seen in FIG. **7**).

[0028] With reference now to FIGS. **3**, **6**, and **7**, the electronic lock assembly **100** is configured to remotely unlock doors by engaging the spring-loaded latch **300** within a door. To do that, the electronic door lock assembly **100** is in communication with an electronic device (not shown) that is capable of communicating with the electronic device and sending the electronic device **100** a

signal that engages the internal components of the electronic lock assembly **100**. In one exemplary embodiment, a signal is sent from the electronic device to the microprocessor **246**, and an electrical current is supplied to the stepper motor **212** via wires. The stepper motor **212** engages through the driving member **218**, the lead screw **224** that is in communication with one side of the plunger **230** of the interlock mechanism **200**. Movement of the plunger **230** causes the plunger **230** to translate within the internal space **211** of the interlock housing (i.e., away from the stepper motor and toward the opening by space **246**), which causes the spring **234** wrapped about the exterior of the plunger **230** to push against a surface and compress. The head member **240** of the actuator **238** makes contact with the latch **300** and pushes the latch outwardly from the internal space **246** of the interlock mechanism **200** provided by the upper housing **204** and lower housing **206** of the interlock housing **202** (See FIG. **7**). The actuator pushes the latch **300** until at least the head member **240** sits flush or is partially beyond the outermost peripheral edge of the interlock housing **202** (FIG. **6**), causing the latch **300** to extend out of the internal space **246** of the interlock mechanism **200**.

[0029] Since many modifications, variations, and changes in detail can be made to the described preferred embodiments of the invention, it is intended that all matters in the foregoing description and shown in the accompanying drawings be interpreted as illustrative and not in a limiting sense. Furthermore, it is understood that any of the features presented in the embodiments may be integrated into any of the other embodiments unless explicitly stated otherwise. The scope of the invention should be determined by the appended claims and their legal equivalents.

Claims

1. An electronic door lock assembly, comprising: an outer housing that includes a proximal face member, at least one opening, and an internal space; an interlock housing member that includes a latch receiving space, the interlock housing member housing an actuator, a plunger, and a module; wherein the module is coupled to the plunger on a distal end and the actuator is coupled to the plunger on a proximal end thereof, and wherein activation of the module is configured to cause the plunger to translate within the interlock housing member to bias one or more springs coupled to the plunger and actuator and translate the actuator within the latch receiving space.

2. The electronic door lock assembly of claim 1, wherein the outer housing is configured to fit behind a strike plate of a door jamb.

3. The electronic door lock assembly of claim 1, wherein a strike plate is removably attachable to the proximal face member of the outer housing.

4. The electronic door lock assembly of claim 1, wherein the module is a stepper motor.

5. The electronic door lock assembly of claim 4, wherein the stepper motor includes a driving member that is coupled to a coupling member that couples the driving member to the distal end of the plunger.

6. The electronic door lock assembly of claim 1, wherein a biasing spring is wrapped around a portion of the plunger.

7. The electronic door lock assembly of claim 1, wherein a biasing spring is disposed within an interior portion of the proximal end of the plunger and is in fluid communication with a portion of the actuator.

8. The electronic door lock assembly of claim 1, wherein the latch receiving space is configured to receive a portion of a door latch or latch bolt.

9. The electronic door lock assembly of claim 1, wherein the module communicates with an electronic device capable of monitoring whether the electronic door assembly is in a locked configuration or an unlocked configuration.

10. The electronic door lock assembly of claim 1, wherein the module communicates with a microprocessor configured to execute one or more commands and transmit signals to the module.

11. The electronic door lock assembly of claim 1, wherein a power supply supplies power to the module.
12. The electronic door lock assembly of claim 11, wherein the power supply includes an AC adaptor, a DC adaptor, a mains adaptor, a RFID power source, a battery, a rechargeable battery, or combinations thereof.
13. An electronic door lock assembly, comprising: an outer housing that includes a proximal face member, at least one opening, and an internal space; an interlock housing member including an upper half removably attachable to a lower half, the interlock housing member including a latch receiving space and configured to house an actuator, one or more springs, a plunger, and a microprocessor in communication with a stepper motor; and a power supply for powering the stepper motor; wherein the stepper motor is coupled to the plunger on a distal end and the actuator is coupled to the plunger on a proximal end thereof, and wherein activation of the stepper motor is configured to cause the plunger to translate within the interlock housing member to bias at least one of the springs coupled to the plunger or actuator and translate the actuator within the latch receiving space.
14. The electronic door lock assembly of claim 13, wherein the outer housing is configured to fit behind a strike plate of a door jamb.
15. The electronic door lock assembly of claim 13, wherein the stepper motor includes a driving member that is coupled to a coupling member that couples the driving member to the distal end of the plunger.
16. The electronic door lock assembly of claim 13, wherein a biasing spring is wrapped around a portion of the plunger.
17. The electronic door assembly of claim 13, wherein a biasing spring is disposed within an interior portion of the proximal end of the plunger and is in fluid communication with a portion of the actuator.
18. The electronic door assembly of claim 13, wherein the latch receiving space is configured to receive a portion of a door latch or latch bolt.
19. The electronic door assembly of claim 13, wherein the microprocessor and stepper motor communicate with an electronic device capable of monitoring whether the electronic door assembly is in a locked configuration or an unlocked configuration.
20. A method of moving a door latch out of a door jamb, comprising the steps of: providing an electronic door lock comprising an exterior housing member housing an interior housing member, the interior housing member housing one or more springs, a plunger, a module coupled to a distal end of the plunger, an actuator coupled to the proximal end of the plunger, and a power supply powering the module; and sending an electrical signal to the module to activate the module and translate the plunger within the interior housing member biasing the one or more springs such that the actuator translates within the latch receiving space.