

July 28, 1970

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3,521,921

ELECTRIC LOCK OR ELECTRIC DOOR OPENER

Filed July 31, 1967

6 Sheets-Sheet 1

FIG 1

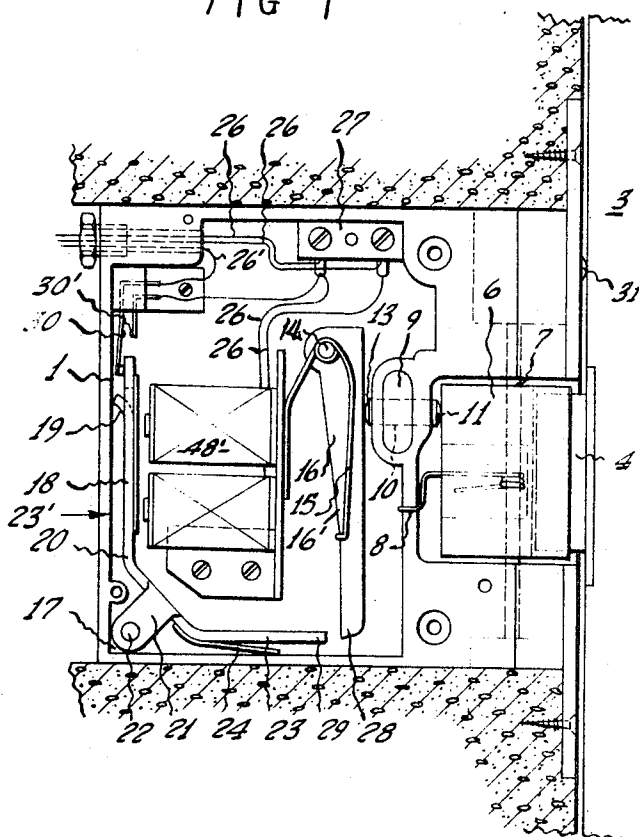
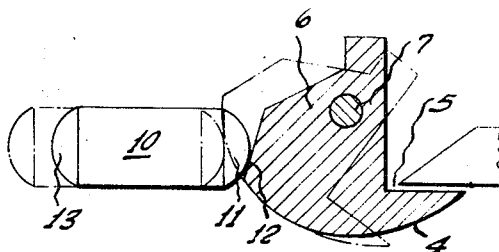


FIG 4



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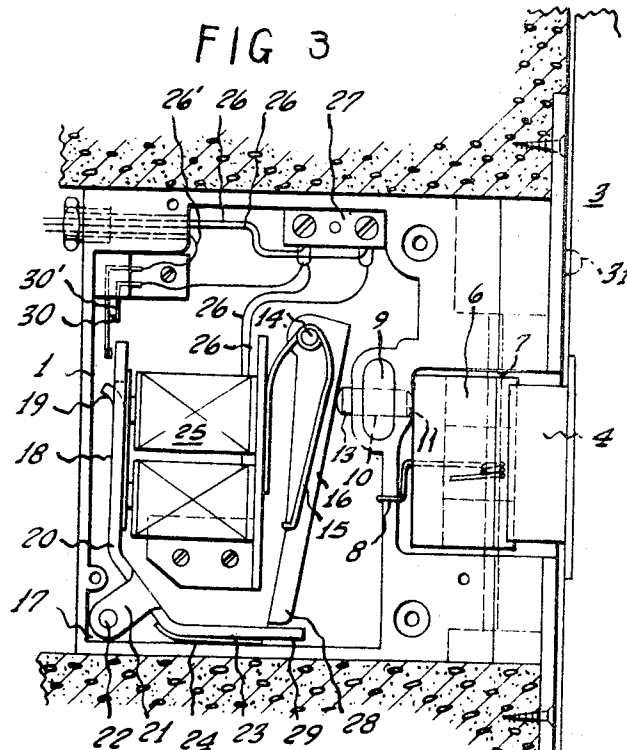


FIG 6

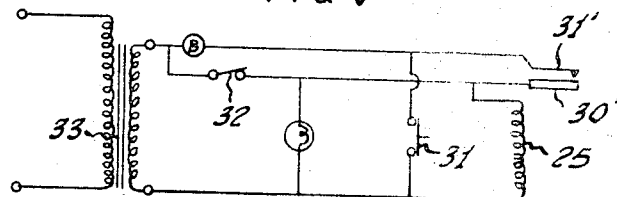
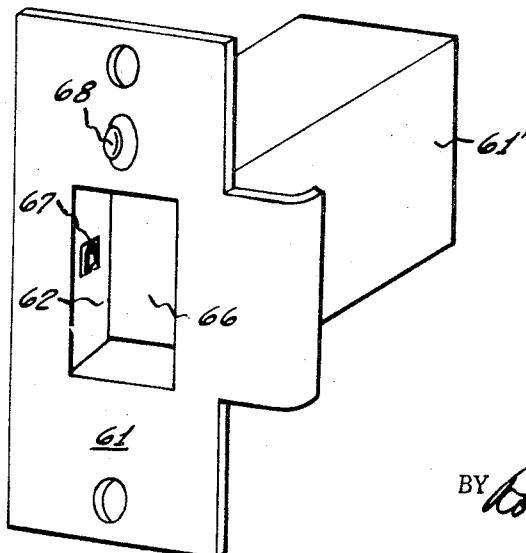


FIG 7



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FIG 8

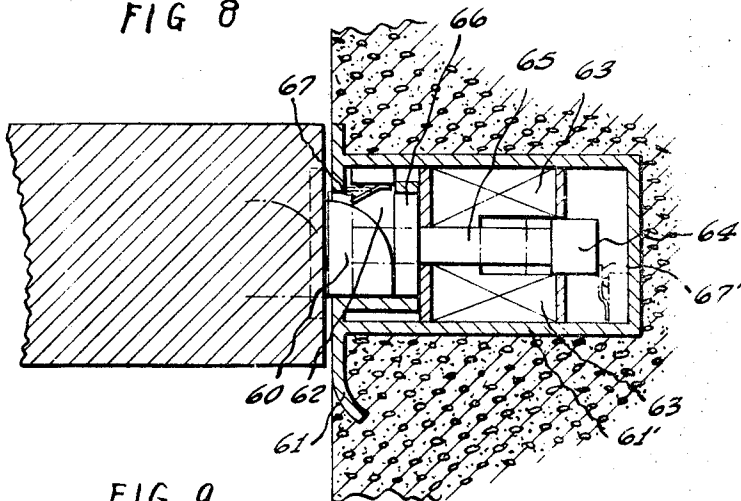


FIG 9

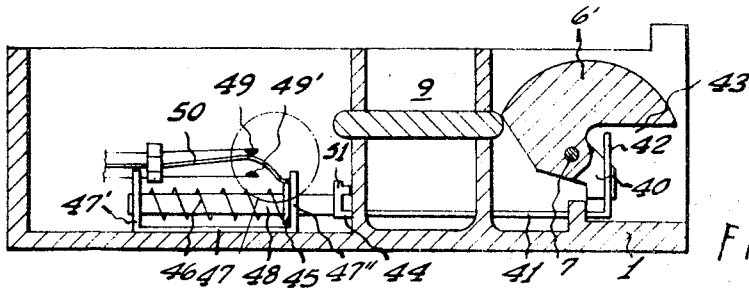


FIG 11

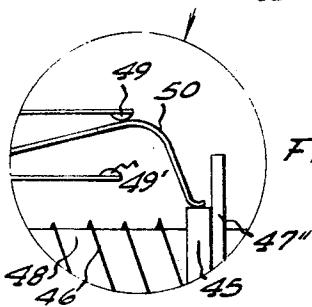
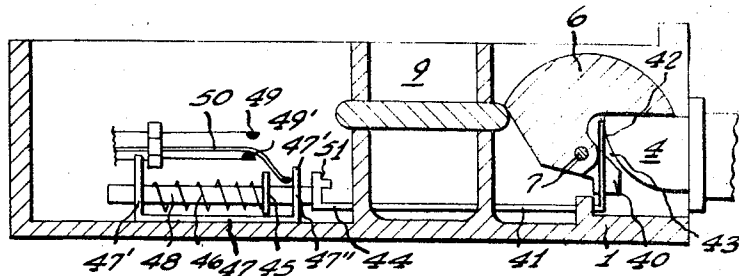
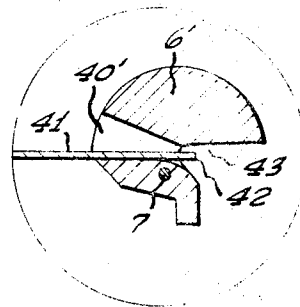


FIG. 11A

FIG 10



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FIG 12

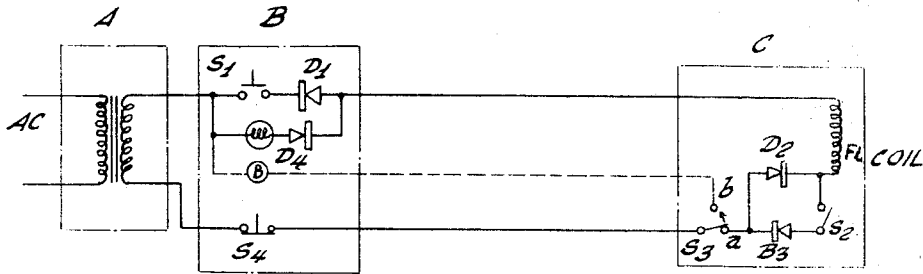


FIG 13

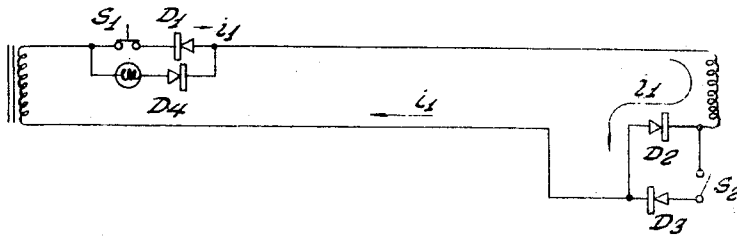
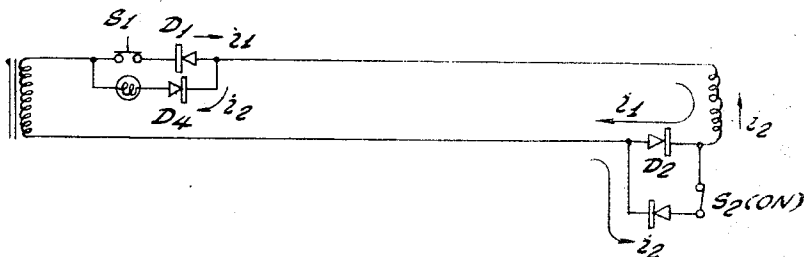


FIG 14



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Filed July 31, 1967

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FIG 15

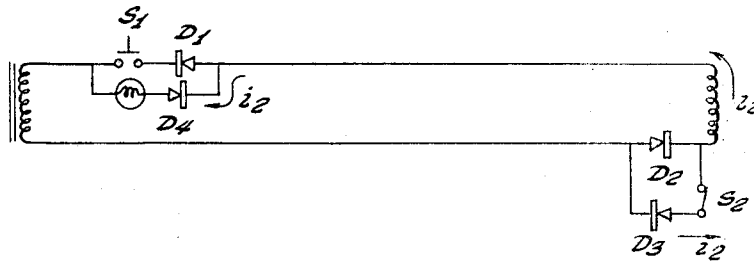


FIG 16

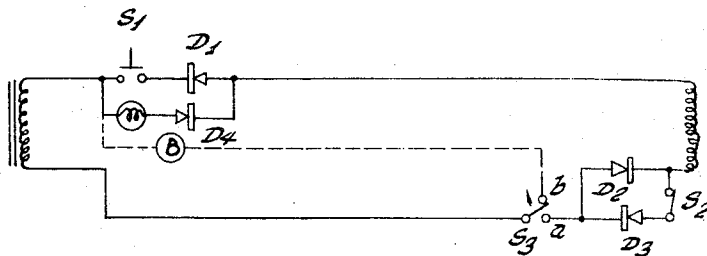
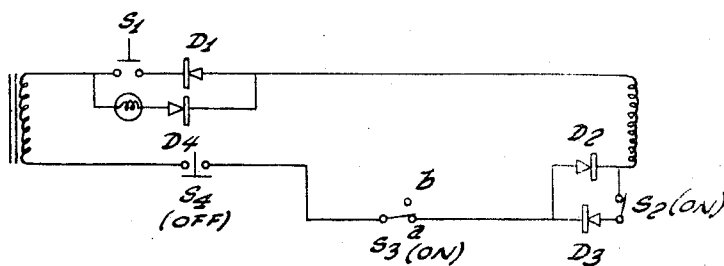


FIG 17



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ELECTRIC LOCK OR ELECTRIC DOOR OPENER
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Filed July 31, 1967, Ser. No. 657,207

Int. Cl. E05c 3/00; E05b 15/02

U.S. Cl. 292—201

2 Claims

ABSTRACT OF THE DISCLOSURE

Electric locks for doors and the like embody electromechanical locking and unlocking mechanisms combined with electromagnetic circuits and electric signalling means. A novel recessed rotary keeper slidably receiving a portion of a lock bolt is associated with a novel reciprocating latch pressure member engages the outer plural-angled periphery of the keeper and is operatively connected with an electromagnetic armature circuit with electric switches directly manually actuated, or activated upon manual opening and/or closing the door or the like. The electric signal is incorporated in the circuitry.

This invention relates to electric locks characterised in that unlocking mechanisms and the provision of self-holding electromagnetic circuits are combined in order to provide door locks.

The main object of this invention is to provide electromagnetic locks which function, upon pressure upon an electric switch actuator, actuated as a result of manual operations, to render the lock bolt operative or inoperative.

Another object of this invention is to provide a rotary keeper provided with a recess to slidably receive a portion of the lock bolt, associated with a reciprocating latch pressure member one end face of which engages the outer plural-angled periphery of the keeper and is reciprocated by a working lever which is, in turn actuated by the movements of an electromagnetic armature in circuit with electric switches directly manually actuated or actuated upon manually opening and/or closing the door.

Still another object of the invention is to provide electric locks which incorporate signal means to indicate conditions of the locks and positions of the door such as where a door appears to be closed but is still slightly open.

Other objects and advantages of the invention will be apparent during the course of the following detailed description of the invention, taken in connection with the accompanying drawings, forming portions of this disclosure, and in which drawings:

FIG. 1 is a side elevational view of a lock housing of this invention, within a recess in a support, as a door jamb, and showing portions of the lock mechanism therein in locked condition with respect to a lock bolt of a door.

FIG. 2 is an elevational view along the lines of FIG. 1 but showing the lock mechanism in unlocking condition.

FIG. 3 is an elevational view along the lines of FIGS. 1 and 2 but with the lock fully unlocked and the door open.

FIG. 4 is a horizontal sectional view on an enlarged scale over the showings in FIGS. 1-3 of the keeper forming an important part of the invention, with associated structures in plan.

FIG. 5 is a wiring diagram of an electric circuit which may be employed in conjunction with the structure of FIGS. 1-3.

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FIG. 6 is a wiring diagram of an electric circuit which may be substituted for that of FIG. 5.

FIG. 7 is a perspective view of a modification of portions of the lock structure.

FIG. 8 is a horizontal sectional view of the lock of FIGS. 1-3 showing the door switch in detail.

FIG. 9 is a horizontal sectional view of a lock differing from that of FIGS. 1-4 showing the keeper and modified associated parts in detail.

FIG. 10 is a horizontal sectional view along the lines of FIG. 9 but showing a modification of the structure associated with the keeper.

FIGS. 11 and 11A are enlarged fragmentary top plan and horizontal sectional views respectively of electric contacts (FIG. 11) and the keeper and associated parts (FIG. 11A) respectively of FIG. 10.

FIG. 12 is a wiring diagram illustrating the locked state of an electric lock of this invention.

FIGS. 13 to 17 inclusive are wiring diagrams illustrating the order of operations effecting the unlocked to the locked states of the lock according to the circuit of FIG. 12.

In the drawings, wherein for the purpose of illustration are shown preferred and modified forms of the invention, the preferred lock is best shown in FIGS. 1-4 inclusive.

The lock of FIGS. 1-4 inclusive includes a lock housing 1 with conventional side, end, top and bottom walls, defining a compartment, with one end wall having an opening to receive a portion of a conventional lock bolt 4 carried by a closure 3 as a door, for sliding into and out of the compartment, which compartment houses a keeper 6, best shown in FIG. 4, in horizontal section, comprising a body having an arcuate side face or periphery 2 joining a preferably flat face 12 both of which are adapted to contact a face 11 of a latch pressure member 10 to be subsequently described. Opposite the face 12, the keeper body is provided with a recess 5 defined by right-angular faces of the body, to receive the bolt 4. The keeper 6 is pivotally supported by a pivot member 7 operatively carried by, for example, the housing walls so that the keeper 6 rotates between the full line position in FIG. 4 to the dot-and-dash position thereon. When in the latter position, the keeper 6 is wholly to one side of the vertical plane of the bolt 4. Rotation of the keeper 6 is effected by a leaf spring 8 (FIGS. 1-3), one end portion of which may be conventionally secured to the body of the latch or keeper 6 and the other end portion thereof to a conventionally located fixed portion of the housing 1.

Associated with the keeper 6 is the reciprocating latch pressure member 10 (FIGS. 1-4), slidably carried by and to project through and outwardly of a lubricant box 9, rigidly carried by the housing 1. The outwardly-projecting end portion 11 of the member 10 contacts either the face 2 or face 12 of the keeper 6 (depending upon rotation of the latter), while the opposite outwardly-projecting portion 13 of the member 10 contacts the side of a lever arm 16.

The lever arm 16 is adapted to oscillate on the pivot member 14 (FIGS. 1-3) at one end portion of the lever arm, and is urged into contact with the end portion 13 of the member 10 by a bow spring 15 (FIGS. 1-3) one end of which bears against the intermediate portion of the lever arm while the other end portion of the spring 15 may contact a convenient fixed portion of the housing 1. The bow spring 15 has an eye at its bight portion to receive a portion of the pivot member 14.

With reference to electrical control means 23' for the electric lock, in the lower corner portion of the compartment of the housing 1, is a bearing portion 21 of a bifurcated member 20 which member 20 includes an

upwardly-extending armature 18 having a projection or lug 19 extending at substantially a right angle therefrom and adapted to limit movement of the armature away from an electromagnet 25, since the projection is adapted to contact the housing wall which provides a stop, as is clear in FIGS. 1-3. The bearing portion 21 of the member 20 is pivotally mounted upon a pivot member 22 which may be carried by the housing 1. Rigidly carried by the bearing portion 21 is a substantially horizontally-disposed arm 23, biased by an expansion spring 24, one end of which bears against the bottom wall of the housing 1 and the other end bears upon the underside of the arm 23, thus tending to force the armature out of contact with an electromagnet 25.

The electromagnet 25 may be conventionally rigidly supported by a conventional bracket carried by the housing 1.

Referring to FIGS. 1-3, in FIG. 1, it will be noted that the armature is out of electric contact with the electromagnet 25 and the free end portion 29 of the arm 23 is raised by the spring 24, while the lower end portion 28 of the lever arm 16 is out of contact with the arm 23. In FIG. 2, the armature 18 has been drawn to the electromagnet 25 but the lower end portion 28 of the lever arm 16 is still out of contact with the free end portion 29 of the arm 23. In FIG. 3, the lower end portion 28 has ridden over the free end portion 29 thus preventing movement of the armature 18. The sequence of movements will be explained in connection with the electrical components next to be detailed and associated with the control means 23' above described.

Conductor 26 (upper end of FIGS. 1-3), operatively connected to the source of electric current, extends to the electromagnet 25 by way of the junction box 27. Above the upper portion of the armature 18 are a movable contact point 30 and a fixed contact point 31' arranged as shown in FIG. 2, for example, and diagrammatically shown in FIG. 6. The contact points 30 and 31' are in circuit with a door operated electric switch 31 (FIGS. 2 and 5, for example). This switch may be disposed within the housing 1 with the button projecting as shown. An unlocking electric switch 32 may be disposed so as to be accessible for manual operation and is interposed in the electric circuit as in FIG. 6, where an electric transformer 33, on the controlling side, is interposed a locking electric switch 34.

Associated with the structure detailed above may be signal means (FIGS. 9 to 11 inclusive) to indicate whether the door is open or closed. Extending inwardly from the periphery of the latch 6' and in communication with the bolt-receiving recess 43 is a second recess 40' having side walls converging toward the recess 43. Slidably extending through the recess 40' and preferably slightly into the recess 43 is an L-shaped reciprocating rod 41 (see FIG. 11A) with the free end portion 42 disposed at substantially a right-angle with reference to the major portion of the rod 41, as shown in FIG. 9, to be contacted by the bolt 4. The intermediate section of the major portion of the rod 41 extends through the lubricant box 9 and outwardly thereof. The opposite end portion 44 of the rod 41, upturned as at 51, is adapted to be contacted by one end of a reciprocating spring-biased rod 48 (FIG. 10), slidable within a bearing 47. Intermediate its ends the rod 48 has an abutment 45, with one end of an expansion spring 46 bearing against it. The other end of the spring 46 bears against the upstanding end 47' of the bearing 47. Carried by the upstanding end portion 47' are two normally spaced apart electric contacts 49 and 49' mounted on arms and adapted to be alternately contacted by an electric conductor wire 50 extending to the source (not shown) of electric energy. The conductor wire 50 is also supported by the same dielectric block which supports the arms of the contact points 49 and 49' although all three (49, 49' and 50) are insulated from each other by the block. The end of the conductor wire 50

is carried by the upstanding forward end of the bearing 47 and, with reciprocation of the rod 48, the wire so arches to take either the position shown in FIG. 9 or the position shown in FIGS. 10 and 11.

Operation of the lock's electric circuit is as follows: Referring to FIG. 5, in the event that control elements grouped as B is centered in the room or the like and the door being locked (as in FIG. 1) and entry is desired into the room or the like, unlocking switch 32 is closed and electricity flows through contacts 26 and 26' and the electromagnet 25 is energized attracting armature 18 and rotate the L-shaped or bifurcated lever 20 on its pivot 22 adjacent the corner portion 17 of the housing 1 (FIG. 2 for example). Rotation of the lever 20 is effected against the bias of the expansion spring 24. Movable contact point 30 closes the electric circuit by separating from the armature 18 and contacts the fixed contact point 30' and, at the same time, movement of the arm 23 is stopped by coming in contact with the wall of the housing 1 (as in FIG. 2). Referring now to FIG. 5, the electric circuit is through transformer 33, unlocking switch 32, electromagnet 25, door switch 31, locking switch 34, to transformer 33. Consequently, the edge portion of arm 23 of lever 20 moves to a position lower than the lower end portion 28 of the lever 16. During this time, the door knob (not shown) is grasped by the operator from outside and rotated, whereby bolt 4 is withdrawn and latch 6 rotates against the bias of spring 8 and the reciprocating latch pressure member 10 rides along the periphery 2 of the latch 6 (or the periphery 12) and the member 20, having retracted, contacts armature 16, which rotates on its pivot 22 to the right (FIG. 3) and the door may be opened. The electric circuit also operates, upon closing the circuit through the contact points 30 and 30', and the current flow is: controlling side of transformer 33, electromagnet 25, door switch 31, locking switch 34 and transformer 33. Accordingly, even when the unlocking switch 32 is opened, the electromagnet is self-pressured for functioning, and the locked state of the lock is resumed. In other words, as long as the switch 32 is not actuated (not closed) by the controller side B (FIG. 5), the operation to rotate the lever 16 is impossible except upon opening or shutting the door.

Referring mainly to FIG. 6, the circuit provides for the sounding of a signal (alarm) in the event the door appears to be tightly closed but is, in reality, not fully closed.

Referring to FIGS. 7 and 8, a solenoid electromagnet structure 63 replaces the latch structure of FIGS. 1-4, and is disposed in the recess 62 (FIG. 7) of the frame 61' rearwardly of the strike plate 61 into which the lock member 60 (FIG. 8) of the door extends upon closing the door. Associated therewith are the armature 64 and head 66. In this case, when the electromagnet is enlarged by closing the electric unlocking switch 32, the head 66 advances to the mouth of the strike plate 61, through the recess 62, causing the lock member 60 to retract against, for example, the bias of an expansion spring (not shown), causing the lock member 60 to move from the recess 62 so as to release the connection. In this case, self-locking is effected as detailed above, contact points 67 and 67' being provided for self-holding, and the door can be opened. When opening the same, when door edge and strike plate are separated, the door switch 68, (in circuit as set out above for door switch 31) opens and provides a self-holding circuit.

The description above relates to a door habitually locked and only, when of necessity, unlocked. However, it is applicable to the system under which a door is habitually unlocked and only, in emergency, locked by pressing the electric switch.

Next as to an improvement of the door switch including signalling as to the locked or unlocked state of the lock, as shown in FIG. 9, in unlocking the door, insulator 45 is moved to the right end of movable contact 50, springs

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upwardly and, coming in contact with the fixed contact 49, closes the circuit. At the same time insulator 45 and rod 48 move to the right whereby the reciprocating rod 41 moved therewith, and its end portion 42 moves out of the recess 43 of latch 6. And when, in shutting the door, the bolt 4 fits in the recess 43 of latch 6, against the bias of the spring 46, the edge 42 of reciprocating rod 41 is pressed by the end portion 42 of the bolt 4 and the retraction of the rod 41 actuates arm 44 and insulator 45, as shown in FIG. 10, to the left against the bias of the spring 36. And, by movement of the insulator 45, movable contact 50 is released and breaks contact with the fixed contact point 49 and opens the circuit, coming in contact with fixed contact point 49' and, when the recess 40' is positioned as in FIG. 11A, the operating latch 41 will be disposed as therein.

Referring to the double line system of the lock circuit as modified and shown in FIG. 12 to FIG. 17, in FIG. 12, A denotes power supplying transformer; B, switch; C, a F.A. pattern free lock; D₁, D₂, D₃, D₄, diodes; S₁, unlocking switch; S₂ movable interrelation switch when C unlocks, and contact point closes. S denotes a door switch closed; *a* is a contact point and, in open state, moves to *b* contact point. S₁ is a return-to-locked-state press switch. FIG. 13 illustrates the period (switch S₁ pressed), that is, the instant switch S₁ is closed (current being direct current half wave), diodes D₁, D₂, are influenced. FIG. 14 shows unlocked state (switch S₁ is continuously closed succeeding the showing in FIG. 13).

As lock C is unlocked by current, switch S₂ is closed. Current *i*₁*i*₁ (*i*₂ is half wave direct current) passes diodes D₃, D₄. Accordingly, whole wave (alternate current) passes the coil of lock C and lights a signal lamp. FIG. 15 shows unlocked state with switch S₁ open but switch S₂ closed, and current *i*₂ passes diodes D₃, D₄. As for lock C, when switch S₁ is opened, there is an unlocked state and the signal lamp is lighted. In FIG. 16, the door is opened, lamp S₃ being energized, and moves *a* contact point to *b* contact point. In the lock C coil, excited current is blocked by switch S₃' and the locked state of door is restored automatically. In this case, electric circuit as shown in dotted line relates to opening of the door. The system portion B can, in addition to its first function as above, functions to operate in connection with a door which may be left open accidentally since the system operates independently of locking or unlocking of the door switch. FIG. 17 shows conditions when it is desired to return from the locked state to the unlocked state of the door independently of opening or shutting the door. In this case, opening of switch S₄ restores the system to the locked state of the door when switch S₃ is opened.

The current voltage may be very small, lock C can surely unlock with currents *i*₁, *i*₂ to maintain unlocking may be enough with currents *i*₁, *i*₂ and in this case *i*₂ lights, too, the signal lamp, indicating the unlocked condition of the door.

While the preferred embodiments of the invention have been illustrated by way of example in the drawings and

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particularly described, it will be understood that modifications may be made in the construction and that the invention is in no way limited to the embodiments shown.

What is claimed is:

1. An electric lock for a door assembly including a door and a frame therefor provided with a sliding bolt, an electric lock for said door, said lock including a lock housing having an opening to receive therein a portion of said bolts, when said bolt is in one position; electromechanical locking and unlocking means carried by said housing including an electric switch; means opened upon manual opening of said door and automatically closed upon, closing of said door; and a solenoid structure within said housing said solenoid structure having an armature and head thereon, constructed and arranged, when said armature is advanced, to strike said bolt and force retraction of said bolt when a portion thereof is within said housing, said solenoid being electrically connected with said switch for operation thereof; self-holding electromagnetic circuit means within said housing and extending outwardly thereof for actuation of said electromechanical locking and unlocking means upon actuation of said switch means to render the bolt selectively operative at once when said door is closed and inoperative when said door is open.

2. The combination according to claim 1 characterized in that a rotary bolt keeper provided with a recess to slidably receive a portion of said bolt, and an outer periphery defining a cam face spring means to rotate said bolt keeper, a reciprocating pressure member having one end face constructed and arranged to engage a selected portion of said cam face, and means operatively connecting said reciprocating pressure member and said self-holding electromagnetic circuit means for reciprocation of said pressure member; and said electromechanical locking and unlocking means includes a lubricant-containing box having an opening with a portion of said pressure plate within said box, carried thereby, and extending outwardly thereof.

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U.S. Cl. X.R.

292—254, 341.16