March 21, 1933. A. SWAHN 1,902,195

LOCKING SYSTEM FOR STRONG BOXES

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Fig. 1.

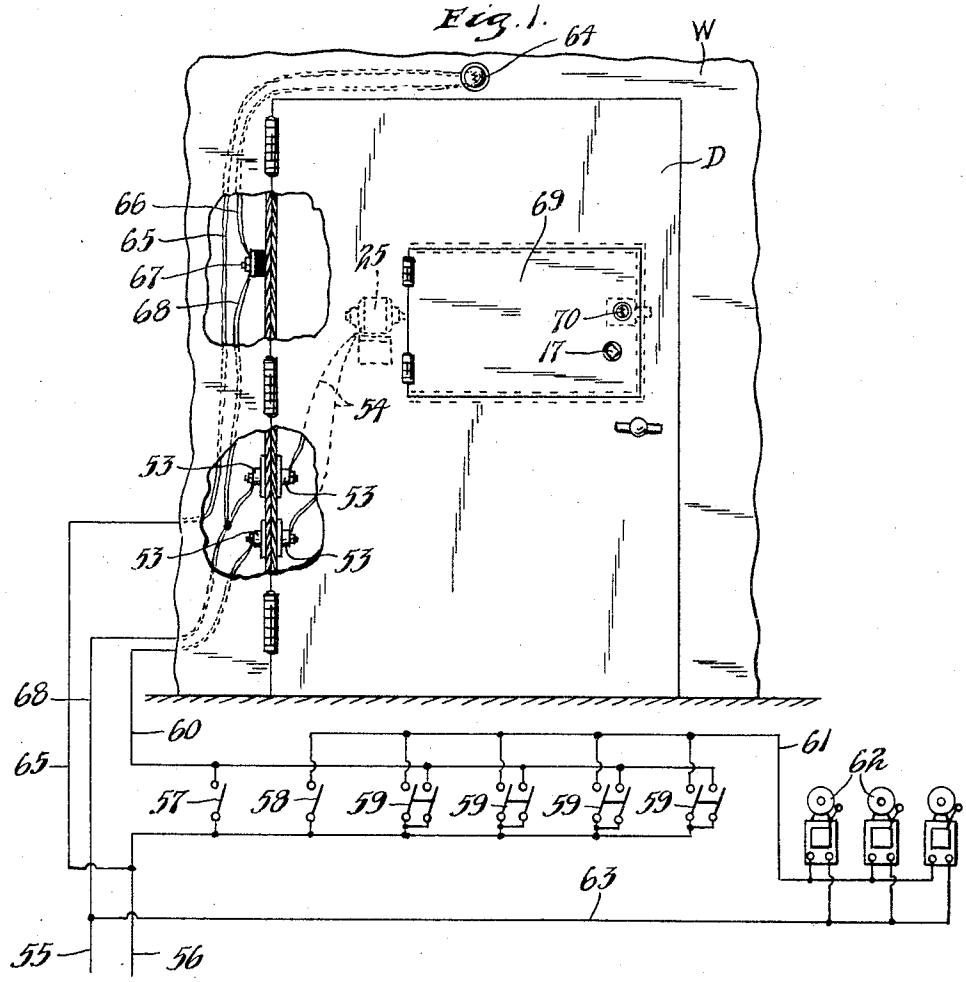



Fig. 8.

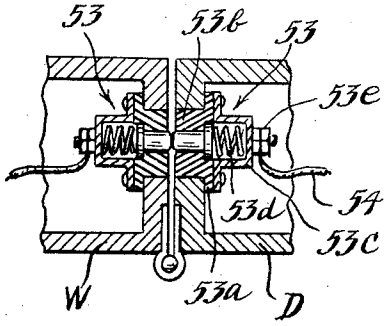
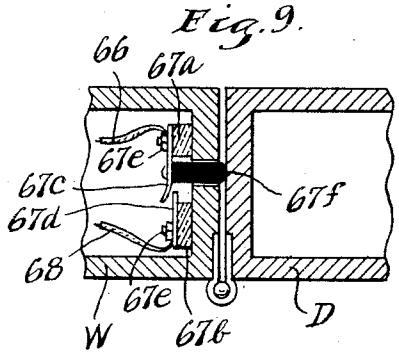



Fig. 9.




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Fig. 5.

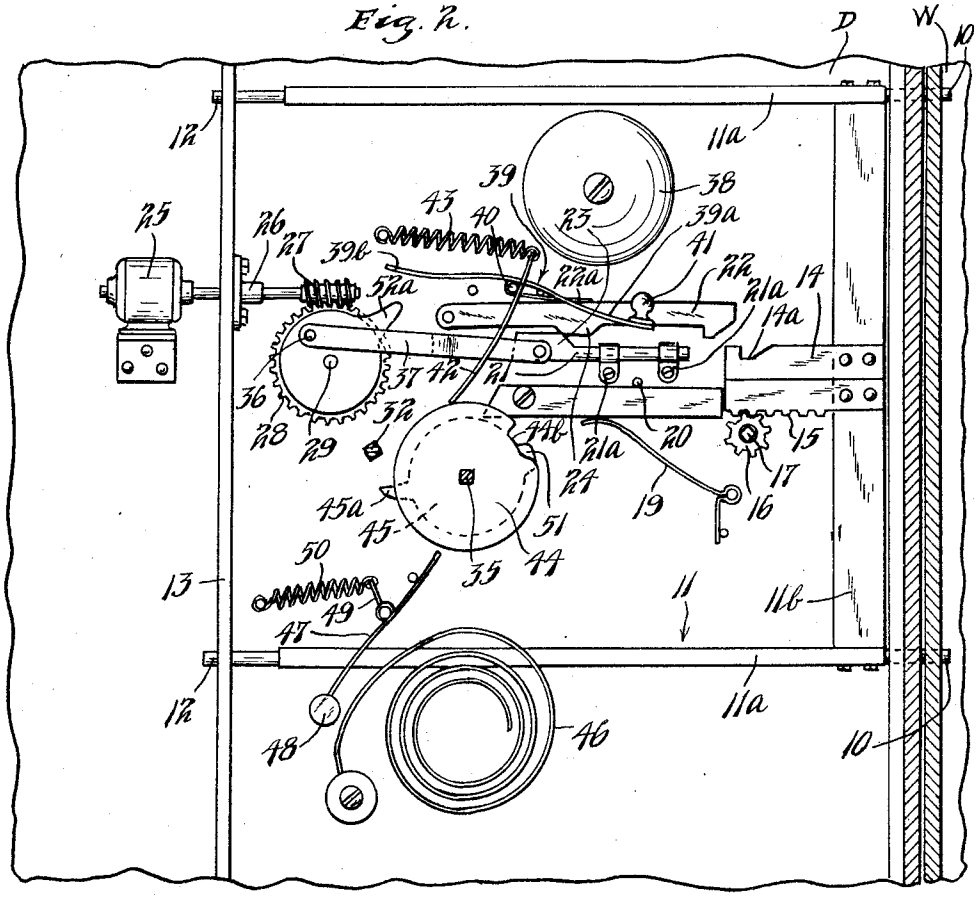



Fig. 6.

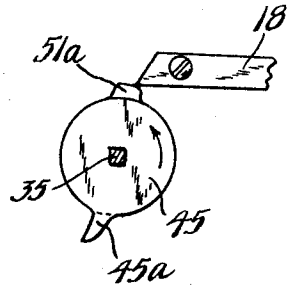
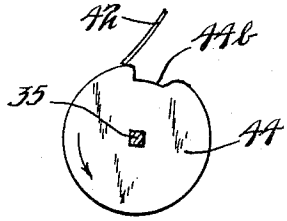



Fig. 7.




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Fig. 3.

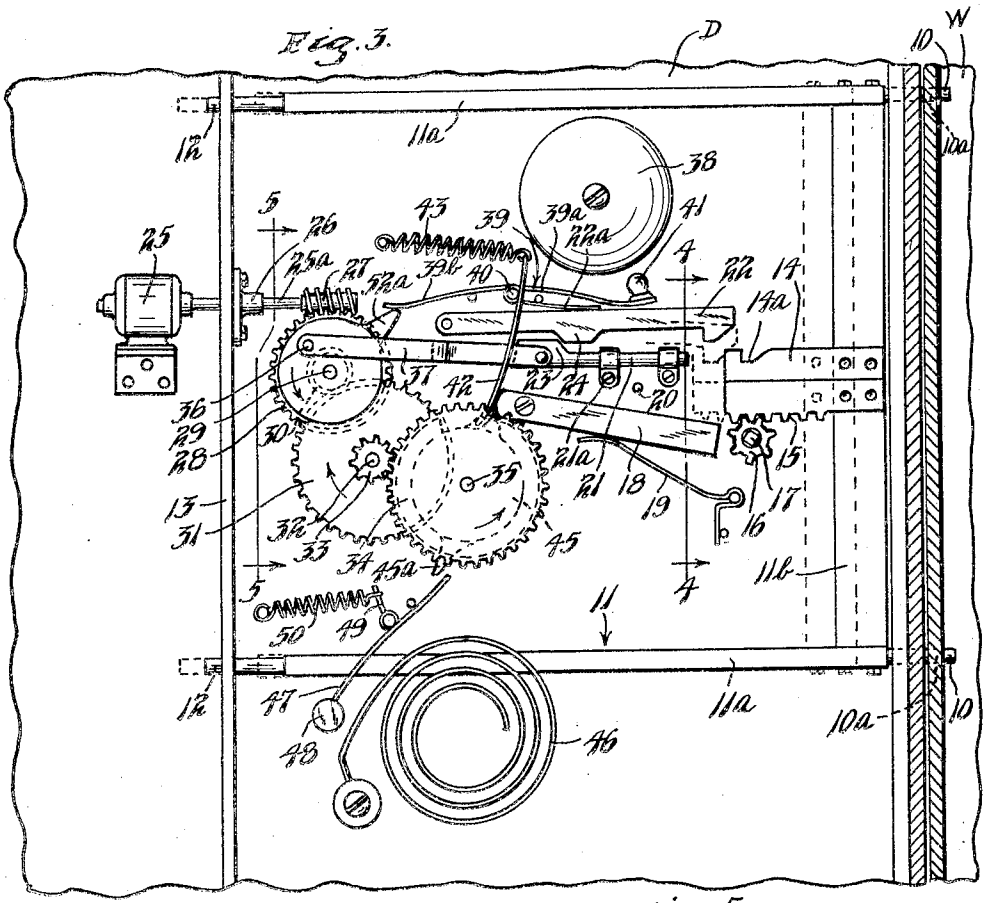



Fig. 4.

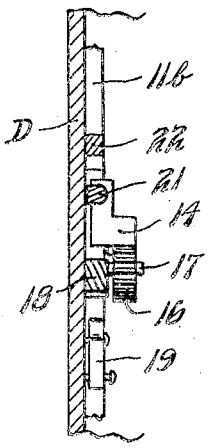
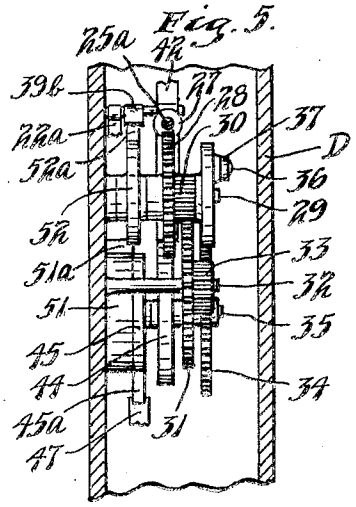



Fig. 5.




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Williamson & Williamson

Patented Mar. 21, 1933 1,902,195

# UNITED STATES PATENT OFFICE

ADOLPH SWAHN, OF ELLSWORTH, WISCONSIN

## LOCKING SYSTEM FOR STRONG BOXES

Application filed May 6, 1932. Serial No. 609,613.

My invention relates to locking systems for strong boxes and the like and particularly to time controlled locking systems.

An object of my invention is to provide a system of the class described wherein a strong box, such as a vault in a bank, can be easily and immediately locked by control devices conveniently situated in various parts of the bank when entrance of robbers is first seen or anticiptated, and wherein time controlled means prevent unlocking of the vault until the expiration of a substantial predetermined period of time, thus rendering duress and threats, intended to force employees to open the vault, ineffectual.

Another object of my invention is to provide a locking mechanism of the class described wherein parts actuatable by an electric motor normally prevent retraction of the locking bolts, wherein the release of the locking bolts for retraction thereof is impossible until the motor has been placed in operation for a substantial predetermined period of time, and wherein further operation of the electric motor, when the bolts have been released for retraction, acts to again lock the bolts in their projected position.

A still further object of my invention is to provide a locking system of the class described wherein a strong box may be quickly locked by electrically operated means electrically controllable by any one of a number of control switches, after which said strong box cannot be unlocked until the electric operating means has again been energized and has been allowed to remain energized for a relatively long, predetermined period of time, wherein said strong box can then be unlocked only after de-energizing the electrically operated means during one of a limited number of very short periods of time immediately following the above mentioned long period of time, and wherein signal devices announce the termination of the long period of time and the beginning of each short period of time.

These and other objects and advantages of the invention will be fully set forth in the following description made in connection with the accompanying drawings, in which like reference characters refer to similar parts throughout the several views, and in which:—

Fig. 1 is an exterior view of a vault door in which my system is installed and a connection diagram of the electrical control circuit of my system;

Fig. 2 is an interior view of a vault door with my system installed therein showing the mechanism of my system in its locked position;

Fig. 3 is an interior view of a vault door with my system installed therein with the mechanism of my system shown in its unlocked position, the bolt and associated parts in their projected position being shown in full lines and in their retracted position shown in dotted lines;

Fig. 4 is a vertical cross sectional view taken along the line 4—4 of Fig. 3 as indicated by the arrows;

Fig. 5 is a vertical cross sectional view taken along the line 5—5 of Fig. 3 as indicated by the arrows;

Fig. 6 is a view of the cams for operating the gong and the bolt top bar of my locking system;

Fig. 7 is a view of the bell operating cam of my system;

Fig. 8 is a horizontal cross sectional view of one of the two separable connections in the circuit to the motor, and

Fig. 9 is a horizontal cross sectional view of the door operated switching means in the circuit to the indicating lamp.

The embodiment of my invention shown is applied to a vault door, but it will be understood that my invention is equally applicable to strong boxes of many other kinds.

Referring to the drawings, a vault door D is hingedly mounted to register with an opening in the wall W of a vault, said door being of box-like construction to provide space in the interior thereof. Retractable sliding bolts 10 project through apertures in the edge of the door opposite the hinged edge into bolt sockets 10*a* in the edge of opening in the wall W, these bolt sockets registering with the apertures when the door is in its completely closed position. The

bolts 10 are carried by a frame comprising the horizontal members 11*a* and the vertical member 11*b*. The inner end of each of the horizontal members carries a guide rod 12 extending outwardly therefrom. The guide rods are slidably supported in apertured portions of a vertically disposed bar 13 rigidly attached to the interior of the rear portion of the door.

The vertical member 11*b* of the bolt carrying frame carries on the medial portion thereof a short inwardly projecting bar 14 having a notch 14*a* in the upper side thereof near the inner end thereof.

Attached to the bar 14 is a rack 15, the teeth of which project downwardly a short distance below the lower edge of the bar. A pinion 16 mounted on a shaft 17 in fixed relation thereto is engaged with the teeth of the rack 15. The shaft 17 extends to the front exterior portion of the door D and at its front end is arranged for engagement of a special key therewith.

A stop bar 18 is pivotally mounted at a point nearer its inner end than its outer end and is so located that the outer end thereof is adapted to abut the inner end of the bar 14 when the bar 14 is in its outermost or locking position, as shown in Fig. 2. A spring 19 urges the stop bar 18 upwardly into a horizontal position where the upper side of the stop bar 18 abuts a fixed stop pin 20 as shown in Fig. 2.

Above the stop bar is a horizontally slidable bar 21 carried by guides 21*a* and aligned to abut the inner end of the bar 14 when slid outwardly.

Above the slidable bar 21 is a bolt retaining lever 22 pivotally mounted at its inner end and shaped at its outer end to engage the notch 14*a* in the bar 14 when the bar 14 is in its innermost position as shown in dotted lines in Fig. 3. The inner end of the upper surface of the slidable bar 21 is raised to form a cam 23 adapted to engage a cam follower 24 depending from the medial portion of the lever 22. A spring 22*a* is mounted above the lever 22 to urge the lever downward. An electric motor 25, supported by means of a bracket attached to the door D has an outwardly extending horizontally disposed shaft 25*a* journaled in a bearing 26 secured to the bar 13. A worm gear 27, carried by the outer end of said shaft in fixed relation thereto, is meshed with the teeth of a gear 28 rotatably mounted on a shaft 29. A pinion 30, mounted on the shaft 29, is connected to the gear 28 to be driven thereby. The teeth of the pinion 30 are engaged with a gear 31 which is rotatably mounted on a shaft 32. A pinion 33 mounted on the shaft 32 is connected to the gear 31 to be driven thereby. The teeth of the pinion 33 are meshed with the teeth of a gear 34 mounted on a shaft 35 in fixed relation thereto.

The gear 28 carries an eccentrically located crank pin 36 to which the inner end of a link 37 is pivotally connected. The outer end of the link 37 is pivotally connected to the inner end of the slidable bar 21.

A signal, such as a bell 38, is mounted somewhat above the lever 22 and a double ended clapper lever 39 is pivotally mounted at its medial portion on a pin 40 secured to the door. The outer arm 39*a* of the lever 39 carries on the end thereof a clapper 41 positioned for striking the bell 38. A second double ended lever 42, disposed approximately at right angles to the lever 39, is pivotally mounted on the pin 40 and is in fixed relation to the lever 39 with respect to rotation. The upper and shorter arm of the lever 42 is engaged with the outer end of a helical tension spring 43 arranged to urge said arm in an inward direction and anchored to the door at its inner end.

The shaft 35 carries three cams in fixed relation with the gear 34. A bell operating cam 44 is circular in shape except for a notch 44*b* having a radial leading side and a sloping trailing side. The lower and longer arm of the lever 42 is pressed into engagement with the surface of the cam 44 due to the pull exerted by the spring 42. When the lever is engaged with the circular portion of the periphery of the cam the clapper 41 is held away from the bell 38 as shown in Fig. 2 and when the end of the lever drops into the slot 44*b* the clapper is permitted to be swung to strike the bell 38.

Another cam 45 is circular in shape except for an outwardly projecting finger 45*a*. Somewhat below the cam 45 a gong 46 is rigidly attached to the door. A double ended lever 47, pivotally mounted at its medial portion, carries at its lower end a clapper 48 disposed adjacent the gong 46 and at its pivot carries a short lever 49 the end of which is connected to one end of a helical tension spring 50, said spring being anchored at its remaining end and connected to urge the clapper toward the gong 46. The upper end of the lever 47 is so disposed that the finger 45*a* of the cam 45 will engage the same to move the clapper 48 away from the gong 46 against the tension of the spring 50.

A third cam 51 has a circular periphery except for an outwardly extending lug 51*a* adapted to engage the inner end of the stop bar 18 to raise the same and lower the opposite end of the bar against the pressure of the spring 19.

A cam 52, mounted on the shaft 29 in fixed relation to the gear 28, carries an outwardly extending finger 52*a* adapted to engage the end of the lever arm 39*b* to raise the same and lower the lever arm 39*a* and the clapper 41 away from the bell 38.

The motor 25 is connectible to a source of electrical energy through a control circuit and associated devices which are arranged as follows:—

Two pairs of spring pressed electrical contact devices 53 are mounted in opposing relation to each other respectively in the hinge side of the door D and the portion of the wall registering therewith as shown in Fig. 1. Each contact device, as shown in Fig. 8, may comprise a bushing 53*a* of insulating material having a central aperture therethrough, a metal contact button 53*b* disposed in the aperture and carrying a flange at its inner end to limit its outward movement through the aperture, a metal cup 53*c* concentrically attached to the inner end of the bushing 53*a*, a helical compression spring 53*d* contained in the cup and arranged to urge the contact button outward, and an electrical connection terminal 53*e* secured to the metal cup.

The terminals of the motor 25 are connected through the wires 54 to the pair of contact devices 53 located in the door D. Electrical conductors 55 and 56 are connected to a source of electrical energy. The conductor 55 is connected to one of the contact devices 53 mounted in the wall W. The conductor 56 is connected to one terminal of each of a pair of single pole single throw switches 57 and 58 and to one terminal of each pole of each of several double pole, single throw switches 59. The remaining terminal of the switch 57 and the remaining terminal of one pole of each of the switches 59 is connected by means of the electrical conductor 60 to the remaining one of the contact devices 53 mounted in the wall W. The remaining terminal of the switch 58 and the remaining terminal of the second pole of each of the switches 59 are connected by means of an electrical conductor 61 to one terminal of each of several electric bells 62. The remaining terminal of each of the bells 62 is connected by means of an electrical conductor 63 to the electrical conductor 55. An electrical indicating lamp 64 is mounted on the wall W above the door D. One terminal of the lamp is connected by means of an electrical conductor 65 to the electrical conductor 56. The other terminal of the lamp is connected by means of an electrical conductor 66 to one terminal of an electrical contact device 67 and the other terminal of the electrical contact device is connected by means of an electrical conductor 68 to the conductor 55. The electrical contact device 67 as shown in Fig. 9 consists of two blocks 67*a* and 67*b*, respectively, supporting a resilient contact finger 67*c* and a contact bar 67*d*, an electrical terminal 67*e* associated with each of the two contact members, and a plunger 67*f*. The resilient contact finger 67*c* is tensioned to engage the contact bar 67*d*. One end of the plunger 67*f* abuts the contact finger and the other end thereof is abutted by the inner edge of the door D to cause separation of the contact members 67*c* and 67*d* when the door is in its fully closed position.

In a suitable aperture in the front wall of the door D is mounted a small inspection door 69 hinged at one end and provided at the other end with a heavy lock 70.

*Operation*

In a commercial installation of my invention, as employed in a bank, for example, the door D may be the main door to a vault or may be used in addition to the main door. The bells 62 may be situated in various locations outside of the bank, such as in nearby places of business, on the exterior of the bank building, and in the police station or detective bureau. The switches 59, for use in locking the vault door in emergencies, are distributed throughout the bank in locations convenient of access to various employees. The switch 57, for use in locking or unlocking the door under normal conditions, and the switch 58 for testing the bells 62 and the wiring associated therewith are situated in a well concealed location in the bank. The key for retracting the bolts of the door when unlocked may be placed in concealment. The key for the lock on the inspection door 69 would be held by a reliable person outside of the bank.

The gear 28 and the cam 52 carried thereby are driven at low speed, such as four revolutions per minute, by the motor 25. The gear 34 and the cams 44, 45 and 51 associated therewith are driven from the shaft 29 through the gears 30, 31 and 33 at extremely low speed, such as one revolution in fifteen minutes.

In the unlocked position, the bolts 10 are in their retracted position as shown in dotted lines in Fig. 3, the lever 22 is in its lowered position as shown in dotted lines, and the remaining parts of the mechanism are as shown in full lines. It will be noted that the stop bar 18 is held in its disengaged position by the cam 51 and that the hook shaped outer end of the lever 22 is engaged with the notch 14*a* in the bar 14.

To cause immediate projection and locking of the bolts under emergency conditions, one of the switches 59 is closed to energize the motor 25 and the bells 62 as will be subsequently explained. Rotation of the motor then causes rotation of the revoluble parts mechanically connected thereto. Rotation of the gear 28 and the crank 36 causes reciprocation of the slidable bar 21. In sliding outward the cam 23 on the bar 21 engages the lug on the lower side of the medial portion of the lever 22 and raises the lever to disengage the hook-shaped portion at the end of the lever from the notch 14*a*. Further outward movement of the slidable bar causes the outer end thereof to abut the inner end of the bar 14

and to drive the bolts 10 into their projected position. During the above described operation the gear 34 and the associated cams have been slowly rotating. The cam 51 then allows the stop bar to be forced by the spring 19 into its raised position in which the outer end of the stop bar abuts the inner end of the bar 14 to prevent retraction of the bolts. The finger 45*a* of the cam 45 has engaged the lever 47 to draw the clapper 48 away from the gong 46, as the stop bar arrives in its raised position the finger 45*a* leaves contact with the lever 47 and allows the spring 50 to suddenly swing the lever 47 and the clapper 48 to sound the gong 46, the sounding of the gong being indication that the bolts 10 are locked in their projected position. The motor 25 is then de-energized to stop further operation of the mechanism.

To energize the motor for locking the door under normal conditions the switch 57 is closed to connect one side of the source of electrical energy through the conductor 56, the switch 57, the conductor 60, one of the contact devices 53, and one of the wires 54 to one terminal of the motor 25. The other terminal of the motor 25 is connected to the remaining side of the source through the remaining wire 54, the remaining one of the contact devices 53 and the wire 55. When locking the door under emergency conditions, the motor is energized by closure of any one of the switches 59 in a manner similar to that described above and an additional circuit is completed from one side of the source through the wire 56, one pole of a switch 59, the wire 61, the bells 62, the wire 63, and the wire 55 to the remaining side of the source. The contact devices 53 are closed only when the door is in its fully closed position and hence will prevent operation of the motor and the locking mechanism when the door is in any other position. The contact device 67 is closed when the door is in any position other than fully closed and completes a circuit to the indicating lamp.

When it is desired to operate the motor 25 to unlock the door, the switch 57 is closed. The rotation of the gear 28 causes reciprocation of the slidable bar 21 and oscillation of the lever 22, neither of which can engage the members with which they are associated. At the termination of the period of time for which the mechanism is designed, the cam 51 engages the stop bar 18 and lowers the outer end thereof out of abutment with the inner end of the bar 14. Simultaneously with the lowering of the bar 18, the notch 44*b* of the cam 44 reaches a position permitting the end of the lever 42 to drop thereinto, thereby allowing the spring 43 to swing the levers 42 and 39*a*, causing the clapper 41 to strike the bell 38, and to swing the end of the arm 39*b* to a position in the path of the finger 52*a* of the cam 52. As the gear 28 rotates the outer end of the slidable bar 21 abuts the end of the bar 14 during a portion of each revolution and is totally retracted in another portion of each revolution. Immediately preceding that portion of each revolution when the slidable bar is totally retracted, the finger 52*a* of the cam 52 engages the arm 39*b* and causes the clapper 41 to be swung away from the bell 38 after which the finger 52*a* moves out of engagement with the arm 39*b* and allows the spring 43 to suddenly swing the arm 39*a* and the clapper 41 to sound the bell 38. Immediately after this sounding of the bell 38, the electric motor 25 is de-energized by opening the switch used in starting the same. The mechanism is now in position to permit retraction of the bolts 10. It will be noted that the lever 22 is in the position shown in dotted lines in Fig. 3. A key or equivalent means is engaged with the shaft 17. When the key is turned, the shaft and the pinion 16 secured thereon are rotated and the pinion moves the rack 15 to retract the bolts 10. The door D is now unlocked and can be opened. It will be noted that the stop bar 18 must be in its lowered or disengaged position and the slidable bar 21 must be in its retracted position when the motor is stopped in order to release the bolts 10 for retraction. When the bolts 10 are fully retracted the hook-shaped end portion of the lever 22 is urged by the spring 22*a* into engagement with the notch 14*a* of the bar 14 to prevent the bolts 10 from being jarred outward to interfere with subsequent closing of the vault door.

It is apparent that I have invented a new and very efficient form of electrically controlled locking system wherein a door of a vault or other strong box can be very quickly locked and subsequently cannot be unlocked until the expiration of a relatively long predetermined period of time and then only when the operating means is deenergized during one of several very brief periods of time occurring only during a relatively short period of time immediately following the long period of time.

It is obvious that my system may be applied equally well to a single main door of a vault or to a second door auxiliary to the main door. It is also obvious that a conventional combination lock may be used to control an additional means for preventing retraction of the bolts.

It will, of course, be understood that various changes may be made in the form, details, proportions and arrangement of the parts, without departing from the scope of my invention, which, generally stated, consists in a device capable of carrying out the objects above set forth and in the novel parts and combinations of parts disclosed and defined in the appended claims.

What is claimed is:—

1. In a time controlled locking system for strong boxes, a projectable bolt, an apertured portion aligned to receive said bolt, a stop member to prevent retraction of said bolt, said stop member being movable to an inoperative position, means for moving said stop member to its inoperative position for a portion of a given recurring period of time, means for projecting said bolt, means for retracting said bolt, and means for reciprocating said movable member.

2. In a time controlled locking system for strong boxes, a projectable bolt, an apertured portion aligned to receive said bolt, a stop member movable to a position wherein it will prevent retraction of said bolt, electrically controlled means for moving said stop member out of its operative position for a portion of a given recurring period of time, said stop member being in operative position during the balance of said period, a movable member adapted to engage the inner end of said bolt, electrically controlled means for reciprocating said movable member, and means for retracting said bolt.

3. In a time controlled locking system for strong boxes, projectable bolts, apertured portions aligned to receive said bolts, a stop bar swingable to abut the inner ends of said bolts when same are in projected position, electrically controlled means for swinging said stop bar out of abutment for a brief portion of a given recurring period of time, said stop bar being held in abutment throughout the balance of said period, a slidable bar, the outer end of said slidable bar being positioned for movement into abutment with the inner ends of said bolts, electrically controlled means for causing reciprocation of said slidable bar, and means for retracting said bolts.

4. In a time controlled locking system for strong boxes, projectable bolts registering bolt sockets, a stop bar swingable to abut the inner ends of said bolts when same are in projected position, an electric motor, means driven by said motor for swinging said stop bar out of abutment for a brief portion of a given recurring period of time, said stop bar being spring pressed into abutment throughout the balance of said period of time, a slidable bar, the outer end of said slidable bar being positioned to be movable into abutment with the inner ends of said bolts, means driven by said motor for causing reciprocation of said slidable bar, a rack secured to said bolts, a pinion having teeth engaged with the teeth of said rack, and means for rotating said pinion.

5. In a time controlled locking system for strong boxes, projectable bolts, registering bolt sockets, a swingable stop bar normally positioned to abut the inner ends of said bolts when same are in projected position, a cam to swing said stop bar out of abutting relation, a slidable bar, the outer end of said slidable bar being positioned to be movable into abutment with the inner ends of said bolts, a crank, a link, the ends of said link being respectively pivotally connected to said crank and the inner end of said slidable bar, an electric motor, mechanical transmission means connecting said motor to rotate said crank and said cam, the cam being rotated at a lower speed than the crank, a rack attached to said bolts, a pinion mounted with the teeth thereof engaged with the teeth of said rack and means for manually rotating said pinion to cause said bolts to be retracted.

6. In a time controlled locking system for strong boxes, projectable bolts, bolt sockets located to register with said bolts, a swingable stop bar normally positioned to abut the inner ends of said bolts to prevent retraction thereof, a cam to swing said stop bar out of abutting relation, a slidable bar, the outer end of said slidable bar being positioned to be movable into abutment with the inner end of said bolts, a crank, a link, one end of said link being pivotally connected to the inner end of said slidable bar and the other end being pivotally connected to said crank, an electric motor, mechanical transmission means connecting said motor to rotate said crank and to rotate said cam at a lesser speed than the crank, a momentary signal device, means associated with said cam for causing said signal device to function when said cam swings said stop bar out of abutment, means for causing said signal device to function each time said slidable bar approaches its retracted position during the time when said stop bar is out of abutment, a second momentary signal device, means for causing said second signal device to function as said cam permits said stop bar to swing into abutting relation, a rack attached to said bolt, a pinion engaged with said rack, and means for manually rotating said pinion to cause said bolts to be retracted.

7. In an electrically controlled vault locking system, a door frame, a door adapted to register with said frame, said door being hingedly supported at one side thereof by said frame, slidable bolts mounted in said door and projectable beyond the free edge of said door, bolt sockets in said frame located to register with said bolts, a framework to which said bolts are secured for movement in unison, a swingable stop bar normally positioned to abut the inner side of said framework when said bolts are in their projected position to prevent retraction of said bolts, a cam to swing said stop bar out of abutting relation with said framework, a slidable bar, the outer end of said slidable bar being positioned to be movable into abutment with the inner side of said framework, a crank, a link, one end of said link being pivotally connected to the inner end of said slidable bar and the

other end thereof being pivotally connected with said crank, an electric motor, mechanical transmission means between said motor, said crank and said cam to impart rotational movement to said crank and said cam, the movement of said cam being slower than the movement of said crank, a bell, a clapper adapted to strike said bell, means rotationally connected with said cam for causing said clapper to strike said bell when said cam swings said stop bar out of abutting relation, means associated with said crank for causing said clapper to strike said bell each time said slidable bar approaches its retracted position during the period of time when said stop bar is out of abutting relation, a gong, a clapper adapted to strike said gong, means associated with said cam for causing said clapper to strike said gong as said cam permits swinging of said stop bar into abutting relation, a rack attached to said framework, a pinion having teeth engaged with the teeth of said rack, and means for rotating said pinion to cause said bolts to be retracted.

8. The structure defined in claim 6 and a notched member secured to said framework, a member shaped to engage said notch, means associated with said slidable bar for holding said member in its disengaged position except when said slidable bar is in its retracted position, and resilient means for urging said member toward its engaged position.

In testimony whereof I affix my signature.

ADOLPH SWAHN.