

J. NORDENBERG
ELECTRICALLY OPERATED LOCKING MECHANISM.

APPLICATION FILED SEPT. 16, 1904.

2 SHEETS—SHEET 1.

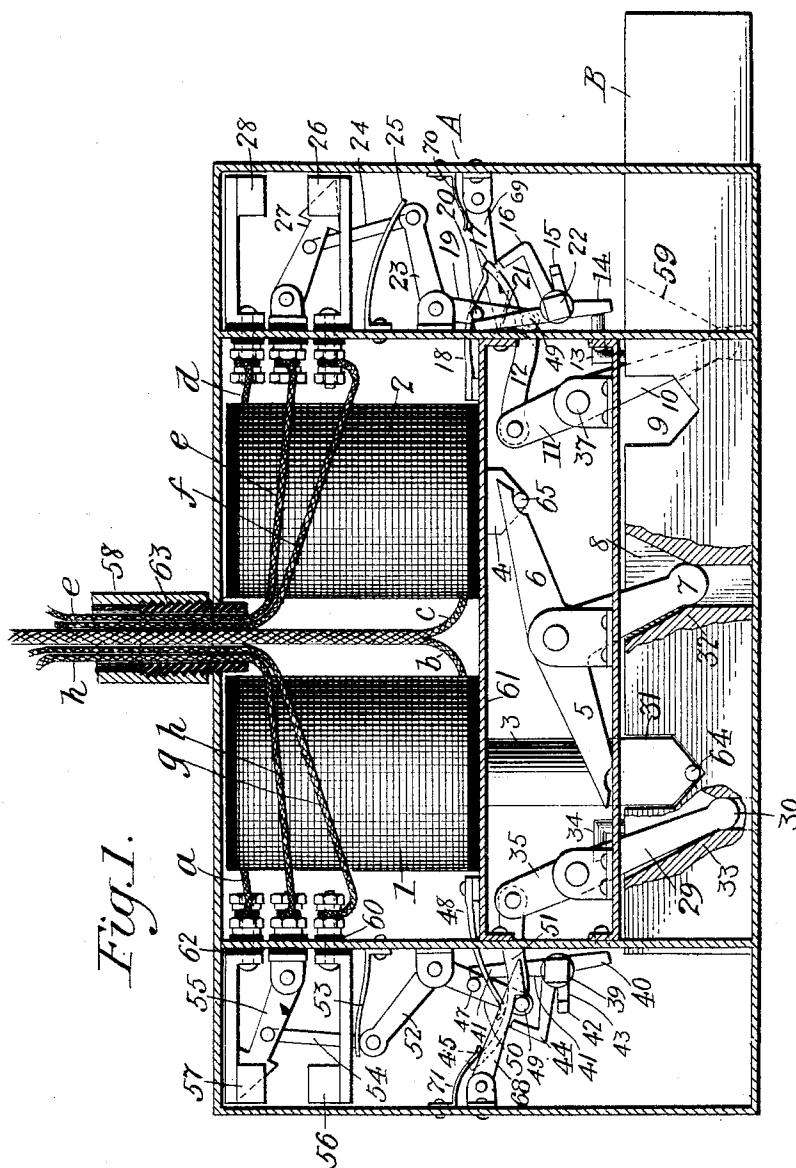


Fig. 1.

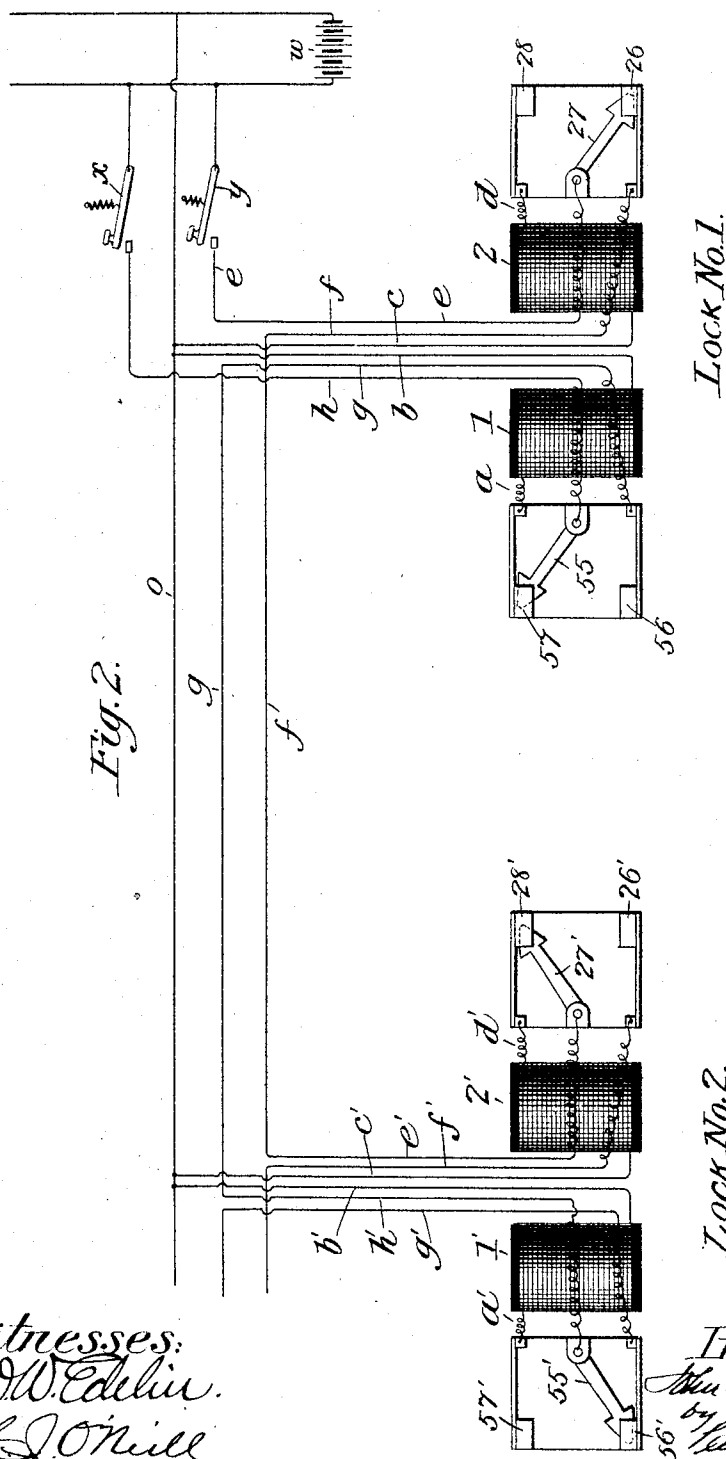
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UNITED STATES PATENT OFFICE.

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ELECTRICALLY-OPERATED LOCKING MECHANISM.

SPECIFICATION forming part of Letters Patent No. 784,064, dated March 7, 1905.

Application filed September 16, 1904. Serial No. 224,726.

To all whom it may concern:

Be it known that I, JOHN NORDENBERG, a citizen of the United States, residing at Canon City, county of Fremont, State of Colorado, have invented certain new and useful Improvements in Electrically-Operated Locking Mechanism; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to electrically-operated locking mechanism, and is hereinafter set forth with special reference to the operation of the locks of prison-cells and the like, although, of course, it is adapted for use in other relations than that indicated, and the invention is not, therefore, to be limited to the particular use stated.

It has been proposed heretofore to operate and control a series of locks by electrical means, such means usually involving separate and independent circuits for operating each lock irrespective of the other locks or in some instances comprising a common circuit by means of which all of the locks of the series are simultaneously operated. Both of these systems are obviously objectionable, the first because of the heavy expense of installation, maintenance, and operation, as well as the great complexity of circuits, switches, and appurtenant apparatus, the second for the reason that the control of individual locks cannot be maintained from the central switchboard, as all of the locks are operated at the same time.

One of the objects of this invention is to provide a protective system comprising a series of locks adapted to be operated separately and successively from a common source of electricity, together with means for rendering any of said locks inoperative or irresponsive to the electric current without affecting the operation of the other locks of the series, so that all of the locks may be locked or unlocked in regular sequential order by an attendant stationed at a central switchboard or any given lock or number of locks may be

operated separately and independently of the others from the same switchboard. 50

A further object of my invention is to so arrange the several locks of a series that the operation of any one of them, either in locking or unlocking under normal conditions, establishes a circuit connection to the next lock to permit the latter to be operated in the same manner by a subsequent closure of the circuit from the controlling-station. 55

A further object of the invention is to provide an electrically-operated lock which in the locking operation establishes a proper circuit connection for the subsequent unlocking operation thereof, and vice versa, said lock being provided with means, preferably manually operated, for rendering the same irresponsive to either a locking or an unlocking current. 60

These and other objects of the invention will more particularly appear in the following detailed description and in the claims hereunto appended. 65

In the accompanying drawings, Figure 1 is a sectional elevation of one of the locks, portions thereof being broken away to more clearly indicate the coöperation of the various parts thereof. Fig. 2 is a diagrammatic view showing two locks of the series and the circuits by means of which all of the locks are controlled from a central station. 70

Referring to Fig. 1 of the drawings, A indicates the usual form of lock-casing, made of steel or other suitable material, which is preferably mounted on the door-framing and in the lower portion of which is mounted for sliding reciprocatory motion a bolt B, which is adapted to engage a ward or keeper on the door when said bolt has been shot and to be withdrawn within the casing A when said bolt has been retracted. Secured within the casing A and dependent from the top thereof are two solenoids 1 2, the former of which serves to withdraw the bolt and the latter to advance the bolt in the locking operation. Said solenoids are provided with cores or armatures 3 and 4, respectively, which are provided at their lower ends with non-magnetic projec- 80 85 90 95

tions, which are adapted to enter recesses 31 and 9 in the upper face of the bolt B to lock the same in its advanced and retracted positions, respectively. Upon the ends of said armatures are also located laterally-projecting pins 64 and 65, which when the armatures are drawn up by their respective solenoids engage with the ends 5 and 6 of a T-shaped rock-lever mounted in suitable bearings within the lock-casing. The dependent arm 7 of the lock-lever engages a vertical slot 8 in the bolt B, said slot being provided with outwardly-flaring sides 32 to accommodate the movement of said arm 7, as indicated in Fig. 1. It is to be noted that as the core 4 of solenoid 2 is attracted by the latter the rock-lever aforesaid advances or shoots the bolt B into locking position, and when solenoid 1 is energized the upward movement of its core 3 moves the rock-lever in the opposite direction, causing arm 7 to withdraw bolt B within the casing, and thereby unlock the apparatus. The operation of moving the rock-lever by the attraction of either of the solenoid-cores causes said rock-lever to positively withdraw the core of the other solenoid should the latter for any reason remain in its attracted position, so that said core will be in position to engage the proper recess 9 or 31, as the case may be, when the bolt has been moved to one of its extreme positions.

As thus far described it will be noted that my improved lock constitutes a simple and efficient apparatus capable of being positively operated in both its locking and unlocking movements by the closure of electric circuits including the respective solenoids 2 and 1. It is essentially the purpose of my invention, however, to employ a series of locks so related as to be capable of separate and successive operation by an attendant stationed at a central switchboard, each lock of the series being provided with automatically-actuated circuit-controlling devices whereby the locking operation will set one of the circuit-controllers to permit the said lock to be subsequently unlocked, and the corresponding unlocking operation will adjust the other circuit-controller to establish a connection whereby upon the closure of the appropriate circuit the locking-bolt will be shot. In addition to these features of operation it is proposed to provide additional mechanism, preferably controlled by manually-operated means, for changing the relation of either of the circuit-controllers, so as to render the lock incapable of being operated without affecting any of the other locks in the series. To accomplish these objects, there are mounted in each lock-casing A adjacent to the locking-solenoid 2 two insulated switch-contacts 26 and 28, between which moves a swinging contact 27. Contact 26 is connected to a leading-in wire *f*, while contact 28 is connected with the solenoid by a wire *d*. The movable contact 27 is connected

with the wire *e*, which by reference to Fig. 2 will be seen to connect, through normally open switch *g*, with one side of a common battery *w*. The other end of the solenoid-coil is connected by a wire *c*, which leads back to the battery *w* through a common return-conductor *o*. Pivoted to the lock-casing below the contacts 26 and 27 is a bell-crank lever having the two arms 19 and 23, the latter of which is connected by a link 24 to the movable contact 27, so that as said bell-crank is rocked the contact 27 is thrown alternately in engagement with contacts 26 and 28. A flat spring 25, also connected to the lock-casing, tends to move the bell-crank into its lowest position, thereby causing the movable contact 27 to engage the fixed contact 26. In order to move the bell-crank in the opposite direction, there is provided the finger 12, engaging a laterally-projecting pin 49 on the lower end of arm 19 of the bell-crank, said arm 19 being connected to the upper end 11 of a rock-lever pivoted in bearings 37 in the casing, the lower end 10 of said lever engaging a vertical slot 59 in the upper face of the bolt B, so that as said bolt is withdrawn from its locking position it swings the lever 10 11 so as to cause finger 12 to engage pin 49 of the bell-crank lever 19 23 and move the latter outward and upward, and thereby shift contact 27 into engagement with the fixed contact 28. A flat spring 18, secured to the casing and engaging an upturned end of finger 12, serves to hold said finger normally in engagement with the pin 49 on the bell-crank lever. It will be seen, therefore, that as long as the bolt B is advanced or in its locking position the movable contact 27 engages fixed contact 26 and no current will pass through the solenoid 2. Pivoted to the casing below the bell-crank 19 23 is a short shaft 22, having a squared head adapted to be engaged by a suitable key for turning the shaft. Secured to the shaft 22 is a lever having an upwardly-projecting arm 21 and a laterally-projecting finger 15, the former cooperating with a pin 20 on arm 19 of the bell-crank lever and the finger 15 being adapted to engage and lift a small bell-crank loosely pivoted on the shaft 22 and comprising arms 16 and 14. The arm 16 of the bell-crank lever, which is provided with an upturned member, is adapted to engage the forward end of finger 12, and arm 14 projects into the path of and is adapted to be engaged by a detent 13 on the bolt B as the latter is moved into locking position. A latch 69, pivoted to the side of the lock-casing, is adapted to engage pin 49 on bell-crank 19 23 and hold said lever in its advanced position while finger 12 is being withdrawn by the advance of the bolt in order to keep the circuit closed between contacts 27 and 28 during the whole locking movement. Said latch is forced into engagement with the pin 49 by a spring 70, and the opposite movement of the latch to

disengage the same from pin 49 is effected by bell-crank 14 16 as the latter is turned either by detent 13 or by key placed on shaft 22. A similar arrangement of circuit-controlling mechanism is located in the opposite side of the lock-casing adjacent to the unlocking-solenoid 1 and consists of fixed contacts 56 and 57, between which swings a movable contact 55, connected by a link 54 with a bell-crank lever 52 50, the latter member of which is provided with projecting pins 47 and 49, which cooperate with the upper member 41 of a lever corresponding to lever 21 15 on the opposite side of the lock and the pawl-like finger 51, similar to finger 12, respectively. Said finger 51 is connected to a rock-lever 35 29, which engages with a flared recess 33 in the top side of the bolt, said rock-lever having a bearing 36 mounted in the lock-casing. Flat springs 53 and 48 serve to throw the bell-crank lever 50 52 and the finger 51 into their lowest positions. Lever 41 43 is fixed to a short shaft 39, corresponding to shaft 22, hereinbefore described, which is provided with a squared head to receive a key. The outturned end 42 of member 43 of said lever is adapted to engage a bell-crank 40 44, which is loosely mounted upon said shaft 39 and moves said bell-crank so that its upturned end will engage the end 45 of finger 51 and release the latter from engagement with pin 49 on the bell-crank 50 52. The detent 34, mounted on the upper face of the bolt B, serves to engage the depending member 41 of the bell-crank above referred to when the bolt has been moved to its extreme retracted position. A latch 68, similar to latch 69 on opposite side of the lock, serves to engage pin 49 on bell-crank 50 52 to hold the latter in its outward position while finger 51 is being withdrawn by the retraction of the bolt. Said latch is disengaged from pin 49 by bell-crank 40 44 when the latter is rocked by detent 34 on the complete withdrawal of the bolt.

The circuit leading to the solenoid 1 and the circuit-controller cooperating therewith are similar to those referred to in connection with solenoid 2 and consist of a lead *h*, connected by a suitable switch *x* with the common source of electrical supply *w*, which lead is connected to the movable contact 55, a second lead *g*, connected to the fixed contact 56, a wire *a*, leading from the fixed contact 57 through the solenoid-coil, said coil being connected at the other end to a lead *b*, which is connected to the common return *o*. The various circuit-wires connected with the interior mechanism of the lock are led through an insulating-bushing 63 in the top of the lock and thence through suitable conduits 58, which are preferably made of iron piping to protect the various circuits throughout their course.

The operation of a single lock as above described is as follows: Assuming the bolt to be in locking position, the various parts of

the mechanism are in the relation shown in Fig. 1. In order to unlock or withdraw the bolt B, the operator at the central switch-board depresses circuit-closing key *x*, which closes a circuit from central battery *w* through lead *h*, movable contact 55, fixed contact 57, wire *a*, a coil of solenoid 1, lead *b*, and common return *o*, thence back to battery *w*. The solenoid 1 is thereby energized and attracts core 3, the lower end of which passes out of the recess 31 in the bolt, thereby releasing the latter. Pin 64 on the end of the core engages the end 5 of the T-shaped rock-lever and causes the depending end 7 thereof to withdraw the bolt. The opposite arm 6 of the T-shaped rock-lever descends, and if the core 4 of solenoid 2 is in its upward position the latter will be withdrawn and forced downward until its end rests upon the top of the bolt. As said bolt is fully retracted the lower end of core 4 drops into the recess 9 in the bolt and locks the latter in its retracted position. As the bolt approaches the limit of its inward movement detent 34 strikes the depending member 40 of bell-crank 40 44 and said bell-crank is rocked upwardly, thereby lifting latch 68 out of engagement with pin 49 on the bell-crank lever 50 52, which permits spring 53 to force the said bell-crank lever downward, thereby moving contact 55 out of engagement with fixed contact 57 and into engagement with the opposite contact 56, and accordingly cutting out the coil of the solenoid 1. As the bolt B moves inward lever 10 11 is rocked on its bearing and finger 12 forces bell-crank lever 19 23 outward and upward, thereby moving contact 27 out of engagement with fixed contact 26 and into engagement with contact 28 and establishing a circuit connection through the coil of solenoid 2. If the switch *y* be now closed by the operator, a circuit will be completed through solenoid 2 as follows: from battery *w*, lead *e*, movable contact 27, fixed contact 28, wire *d*, through the coil of the solenoid, to lead *c*, to the common return *o*, thence back to the battery. The coil of solenoid 2 being thus energized attracts its core 4, which passes out of engagement with recess 9 in the bolt and elevates the arm 6 of the T-shaped rock-lever and causes said rock-lever to assume the position shown in Fig. 1, thereby shooting or advancing the bolt B to locked position. The forward movement of said bolt causes lever 29 35 to be rocked to the left, thereby engaging finger 51 with bell-crank 50 52 and shifting the movable contact 55 into engagement with contact 57, which again establishes a circuit connection through the solenoid 1 to prepare the latter for a subsequent unlocking operation. The forward movement of the bolt also rocks lever 10 and 11 and withdraws finger 12 from engagement with rock-lever 19 23, and as detent 13 engages and raises bell-crank 14 16 and releases latch 69 from engagement with pin 49 on bell-crank

19 23 the latter is forced down by spring 25, and the movable contact 27 of the circuit-controller is moved into engagement with fixed contact 26, thereby cutting out the coil of solenoid 2. When the bolt has been moved to locking position, as shown in Fig. 1, and it should be found desirable to render the lock incapable of being unlocked, a key is applied to the squared end of shaft 39 and the latter is turned to the right, thereby causing bell-crank 40 44 to lift finger 51 and latch 68 out of engagement with pin 49 and permit spring 53 to move said lever and the movable contact 55, connected therewith, downward, so as to break the circuit connection with solenoid 1. Under these conditions the operation of the switch *x* would not affect solenoid 1, and the bolt B would remain in its locked position. To restore the lock to a condition wherein it may be unlocked, the key is applied to shaft 39 as aforesaid, and the latter is turned to the left so that arm 41, attached to said shaft, engages pin 47 on the bell-crank 50 52 and rocks the latter against the tension of spring 53, thereby moving contact 55 again into engagement with 57 and reestablishing the circuit connection to solenoid 1 and also causing finger 51 and latch 68 to engage pin 49, so that upon a subsequent operation of switch *x* said solenoid will be energized to retract the bolt, as before described. A corresponding operation of shaft 22 and its appurtenant connections will operate the circuit-controller for the locking-solenoid 2, so that the latter will be unresponsive when the switch *y* is closed, and the lock will remain in unlocked position. This is accomplished by applying the key to the squared head of shaft 22 and turning said shaft to the left, which causes finger 15 to elevate the bell-crank 14 16 and disengage finger 12 and latch 69 from pin 49 on bell-crank lever 19 23, so that spring 25 will rock said bell-crank downward and move contact 27 out of engagement with contact 28 and into engagement with the lower contact 26. A reverse movement of shaft 22 will restore the circuit-controller to its former condition—that is to say, so that contact 27 engaging contact 28 establishes a circuit through solenoid 2 when the switch *y* is closed.

In applying my improved lock as hereinbefore described to a protective system—as, for example, a series of prison-cells—the several locks are connected to a common battery *w* in the manner shown in Fig. 2, wherein I have illustrated two locks of a series so arranged that the operation of the first lock either in locking or unlocking establishes a proper circuit connection for the corresponding operation of the next lock in the series, so that all of said locks may be operated regularly and successively by means of the two simple circuit-closers or switches *x* and *y*. For example, solenoid 2 in the right-hand lock of the diagram shown in Fig. 2 has moved

the bolt into locked position, corresponding to that illustrated in Fig. 1, thereby establishing a circuit to solenoid 2' of the other lock, so that the latter may be locked in turn by momentarily closing the switch *y*. The circuit by which this latter operation is accomplished is as follows: battery *w*, switch *y*, lead *e*, movable contact 27, fixed contact 26, lead *f* to lead *e'*, contact 27' of lock No. 2, thence by way of fixed contact 28' and wire *b'* through the coil of solenoid 2', thence by lead *e'* and common return *o* back to battery *w*. Should it be desired to leave lock No. 2 unlocked and lock the next lock of the series, movable contact 27' is shifted out of engagement with contact 28' and into engagement with the opposite contact 26' by means of a key, as above described, thereby making circuit connection with lead *f''*, which runs to the corresponding solenoid of the next lock. It will thus be seen that the operation of each lock prepares the next lock in the series for a corresponding operation, and to prevent the latter it is only necessary to shift the movable member of the circuit-controller therein to cut out the corresponding solenoid, so that the circuit will then be established to the following lock. By this means all of the locks may be locked sequentially in regular order, or any number of them may be operated without affecting the others of the series. In the unlocking operation the procedure is substantially the same. The switch *x* is momentarily closed, thereby energizing solenoid 1 of lock No. 1, which withdraws the bolt and shifts the movable members 27 and 55 of the circuit-controllers into proper relation to establish circuit connections, first, to permit the next lock in the series to be locked, and, second, to permit the first lock aforesaid to be unlocked, and so on throughout the series. When it is desired to render any or all of the locks incapable of being unlocked, the circuit-controllers of the unlocking-solenoid thereof are appropriately shifted by means of the key, as hereinbefore described, so that the unlocking-solenoids of the locks thus affected will be individually cut out of the circuit without in any way affecting the operation of the other locks in the series. Taking, for example, the two locks of the series shown in Fig. 2, when the switch *x* is momentarily closed a current will flow from battery *w*, wire *h*, movable contact 55, fixed contact 57, wire *a*, coil of solenoid 1, wire *b* to the common return *o* and back to battery, thereby energizing the solenoid 1, retracting the bolt of the lock and adjusting the movable members of the circuit-controllers as hereinbefore described. A subsequent closure of the switch *x* establishes a circuit from battery *w*, through wire *h*, movable contact 55, fixed contact 56, wire *g*, to wire *h'*, movable contact 55' of lock No. 2, fixed contact 56, thence by wire *g'* to the circuit-controller of the unlocking-solenoid in the third lock, and if the latter be in

position for unlocking its bolt will be withdrawn. It will thus be seen that in the unlocking operation also all of the locks may be operated in succession, or any of them may be rendered inoperative without affecting the proper operation of the others of the series. It is also to be noted that the operation of the entire system requires no heavier current than does the operation of a single lock and that the whole system is directly controlled by two simple switches.

What I claim as my invention is—

1. The combination with a series of locks, of means whereby the locks may be successively operated from a common source of electricity, and means for rendering any of said locks inoperative without affecting the other locks of the series.

2. The combination with a series of locks, of means whereby the locks may be successively operated from a common source of electricity, and means in each lock for rendering that particular lock inoperative without affecting the other locks of the series.

3. The combination of a series of locks, an electromagnet in each lock for operating the same, an electric circuit common to the several magnets, a circuit-closer in said circuit, and circuit-controlling devices in each lock, whereby the locks will be successively operated upon successive closures of the circuit.

4. The combination of a series of locks, an electromagnet in each lock for operating the same, an electric circuit common to the several magnets, a circuit-closer in said circuit, circuit-controlling devices in each lock, whereby the locks will be successively operated upon successive closures of the circuit, and manually-actuated means in each lock for rendering the same inoperative without affecting the other locks of the series.

5. The combination of a series of locks having sliding bolts, an electromagnet in each lock for operating the bolt, an electric circuit common to the several electromagnets, and a circuit-controller in each lock operated by the movement of the bolt, whereby the locks will be successively operated by successive closures of the common circuit.

6. The combination of a series of locks having sliding bolts, an electromagnet in each lock for operating the bolt, an electric circuit common to the several electromagnets, a circuit-controller in each lock operated by the movement of the bolt, whereby the locks will be successively operated by successive closures of the common circuit, and manually-operated means in each lock for actuating the circuit-controller therein to short-circuit the electromagnet without affecting the other locks of the series.

7. The combination of a series of locks having sliding bolts, electromagnets in each lock for shooting and withdrawing the bolt respectively, electric circuits common to the respec-

tive sets of magnets, and circuit-controllers in each lock operated by the movement of the bolt whereby the locks may be successively locked or successively unlocked upon successive closures of the respective circuits.

8. The combination of a series of locks having sliding bolts, electromagnets in each lock for shooting and withdrawing the bolt respectively, electric circuits common to the respective sets of magnets, circuit-controllers in each lock operated by the movement of the bolt whereby the locks may be successively locked or successively unlocked upon successive closures of the respective circuits, and manually-operated means in each lock for actuating the respective circuit-controllers to short-circuit the corresponding magnets without affecting the other locks of the series.

9. In an electrically-actuated lock, the combination of a bolt, an electromagnet in said lock for moving said bolt, a circuit for said electromagnet, and manually-operated means in said lock for rendering said electromagnet inoperative.

10. In an electrically-actuated lock, the combination of a bolt, an electromagnet in said lock for moving said bolt, a circuit for said magnet, a circuit-controller in said lock, and manually-operated means in said lock for operating said circuit-controller to render the electromagnet inoperative.

11. In an electrically-controlled lock, the combination of a sliding bolt, an electromagnet for shooting said bolt, an electromagnet for withdrawing said bolt, circuit-controllers for the respective magnets in said lock, and means operated by the respective locking and unlocking movements of the bolt for setting the corresponding circuit-controller to permit the opposite movement of the bolt.

12. In an electrically-controlled lock, the combination of a sliding bolt, an electromagnet for shooting said bolt, an electromagnet for withdrawing said bolt, circuit-controllers for the respective magnets in said lock, means operated by the respective locking and unlocking movements of the bolt for setting the corresponding circuit-controller to permit the opposite movement of the bolt, and manually-operated means for the respective circuit-controllers to render the corresponding magnets inoperative.

13. In an electrically-actuated lock, the combination of a sliding bolt, and electromagnets for moving said bolt to locked and unlocked position respectively, the armature of the inoperative magnet serving to lock the bolt in the position to which the latter is moved by the other magnet.

14. In an electrically-actuated lock, the combination of a sliding bolt, electromagnets for moving said bolt to locked and unlocked position respectively, a rock-lever operatively connecting said bolt with the armatures of said magnets, electric circuits for the respec-

tive magnets, a circuit-controller for the locking-magnet operated by the unlocking movement of the bolt, and a circuit-controller for the unlocking-magnet operated by the locking movement of the bolt.

15 5 In an electrically-actuated lock, the combination of a sliding bolt, electromagnets for moving said bolt to locked and unlocked position respectively, a rock-lever operatively
10 connecting said bolt with the armatures of said magnets, electric currents for the respective magnets, a circuit-controller for the locking-magnet operated by the unlocking move-

ment of the bolt, a circuit-controller for the unlocking-magnet operated by the locking movement of the bolt, and manually-operated means for shifting the respective circuit-controllers to render the corresponding magnets inoperative.

In testimony whereof I affix my signature in presence of two witnesses.

JOHN NORDENBERG.

Witnesses:

WILLIAM CROCKER,
FRANK ROGERS.