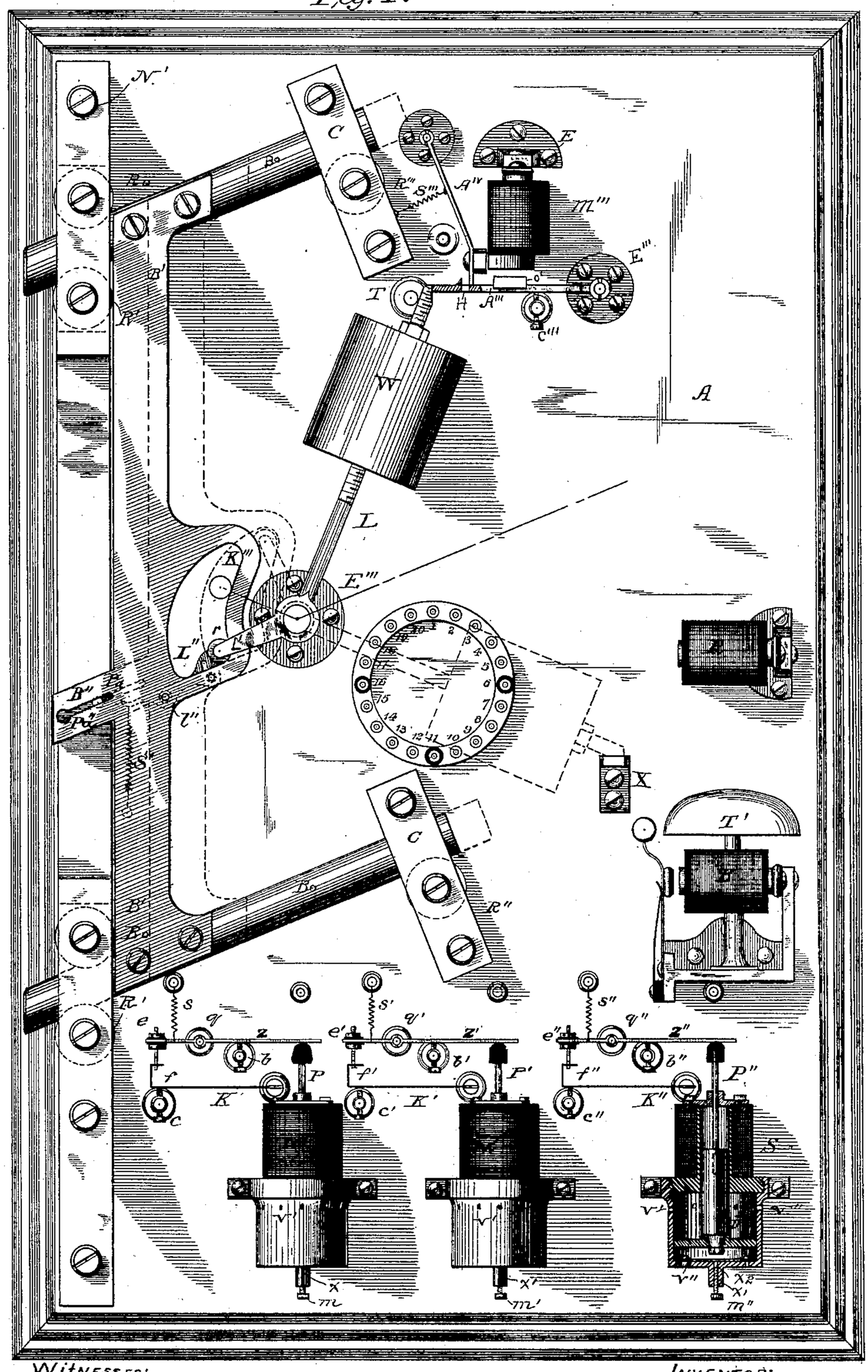
(No Model.) 4 Sheets—Sheet 1.

C. J. KINTNER.

ELECTRO MAGNETIC SAFE LOCK.

No. 372,027. Patented Oct. 25, 1887.

Fig. 1.



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Inventor:
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(No Model.) 4 Sheets—Sheet 2.

C. J. KINTNER.

ELECTRO MAGNETIC SAFE LOCK.

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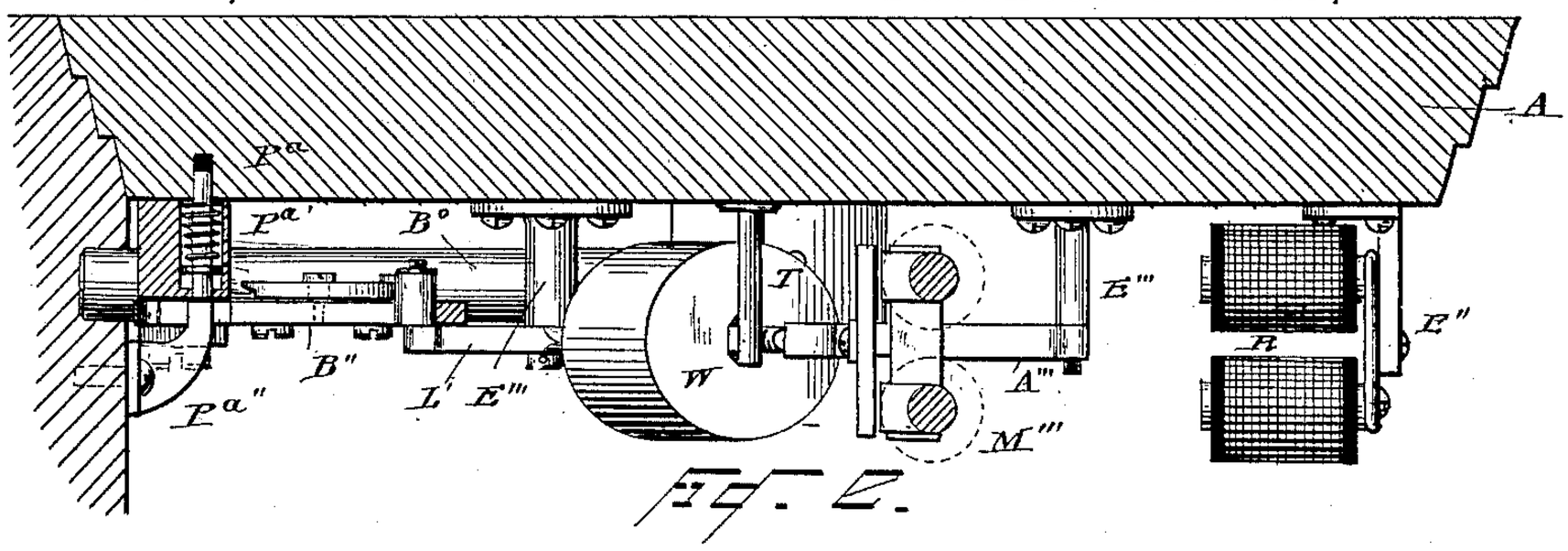


Fig. 2.

Fig. 3

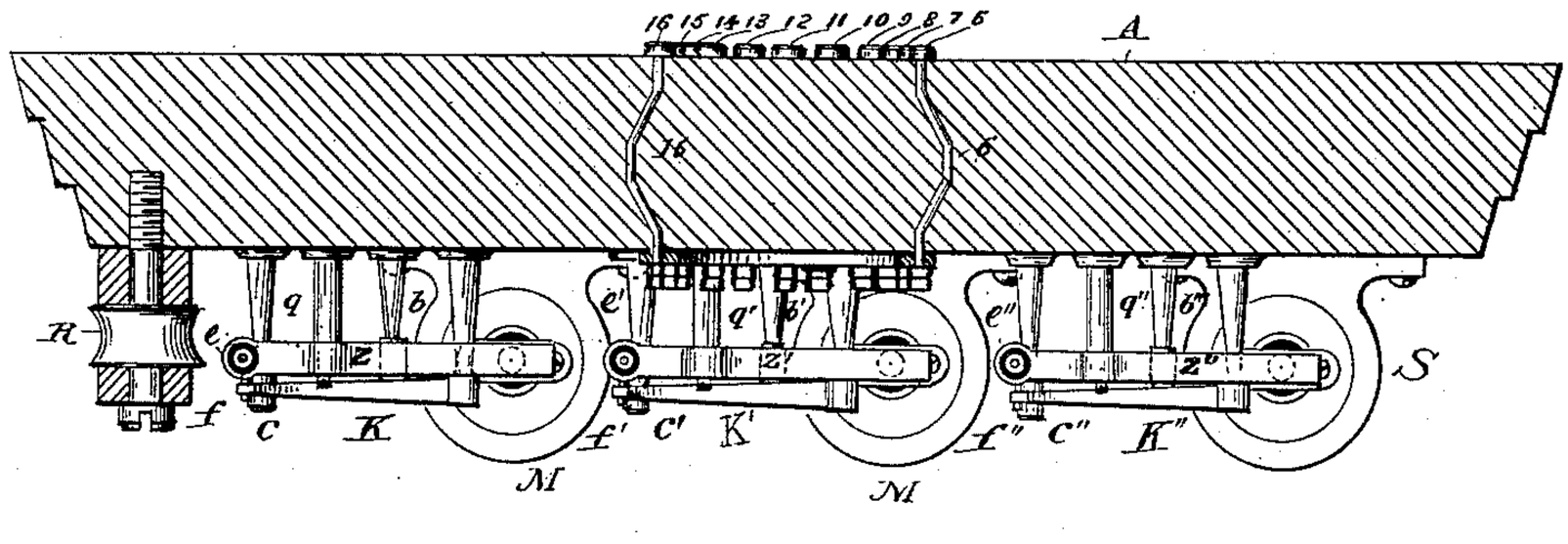


Fig. 4.

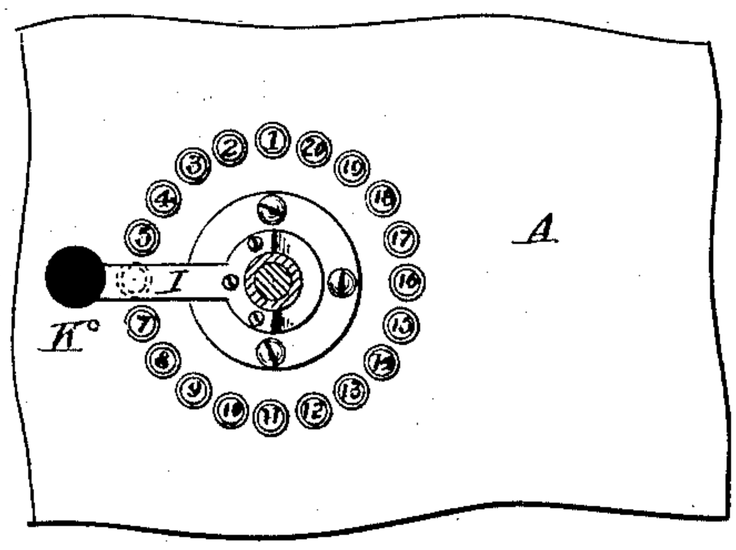


Fig. 5.

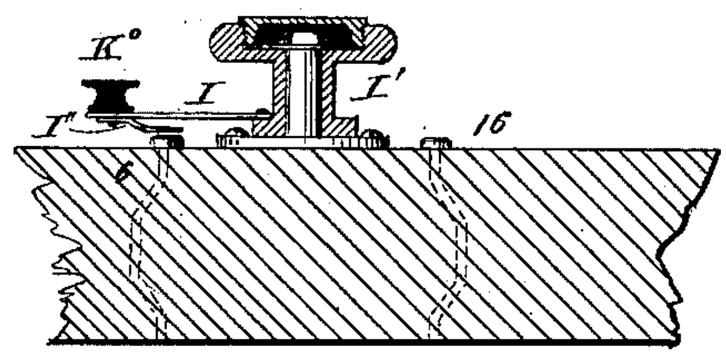


Fig. 6.

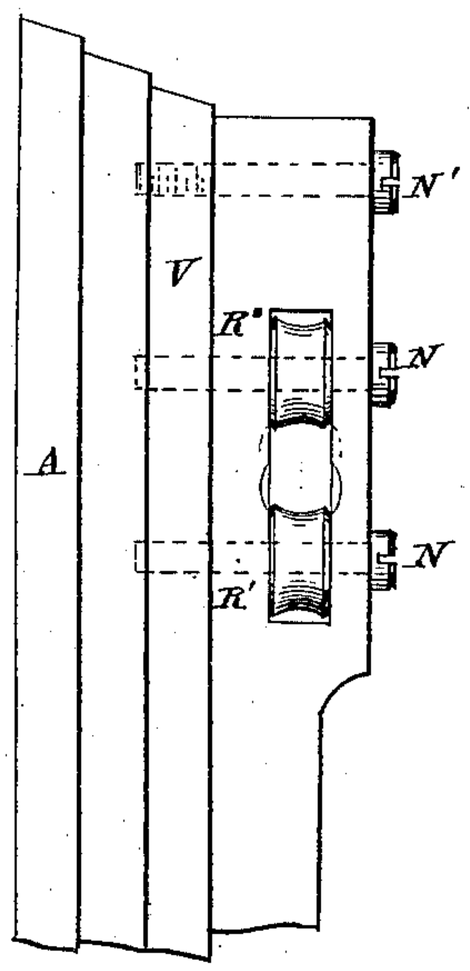
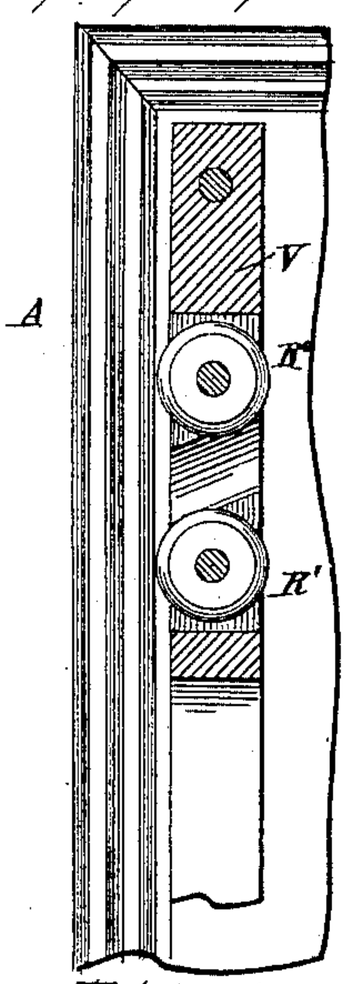


Fig. 7.



WITNESSES

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(No Model.) 4 Sheets—Sheet 3.

C. J. KINTNER.

ELECTRO MAGNETIC SAFE LOCK.

No. 372,027. Patented Oct. 25, 1887.

Fig. 8.

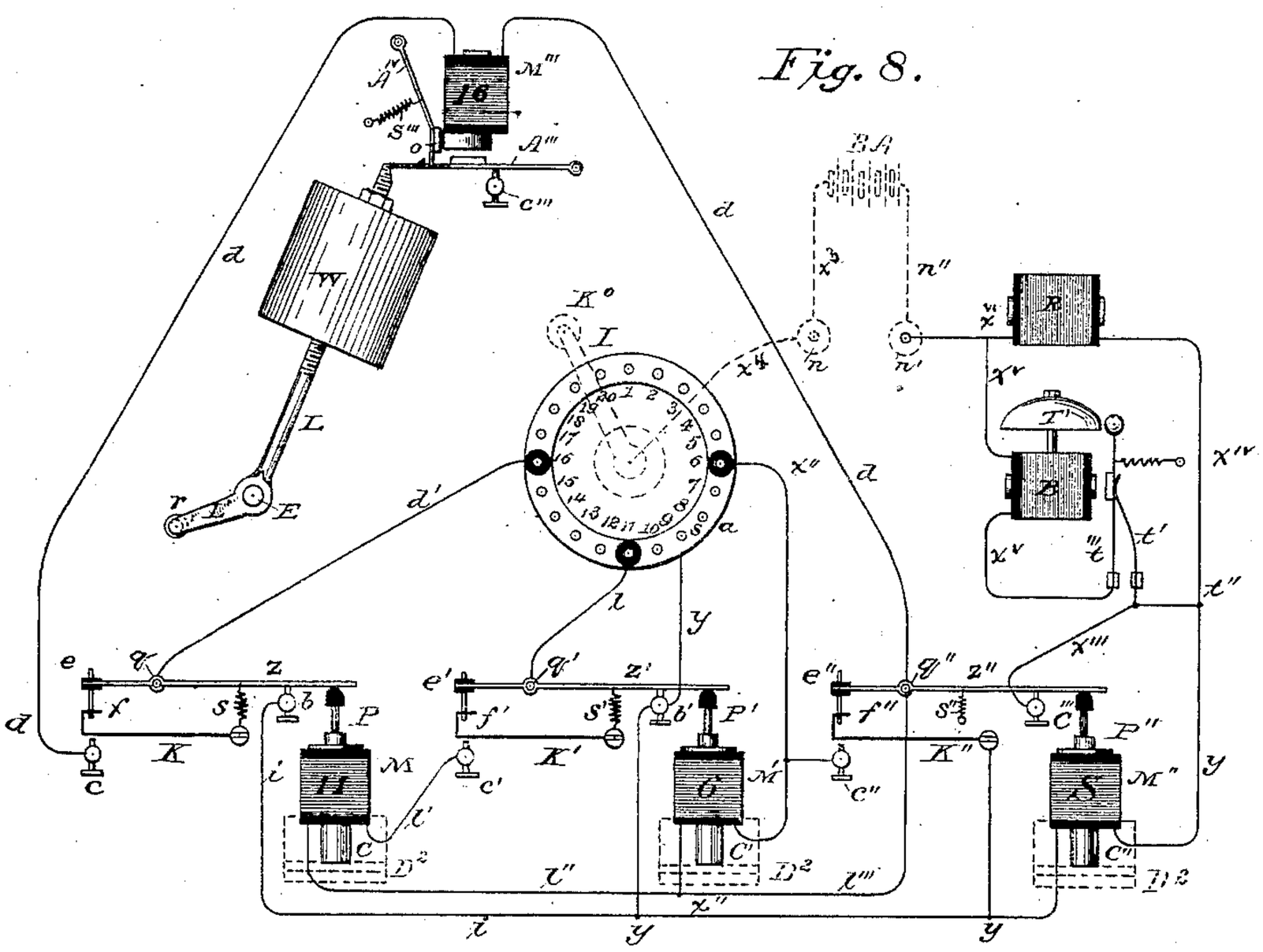
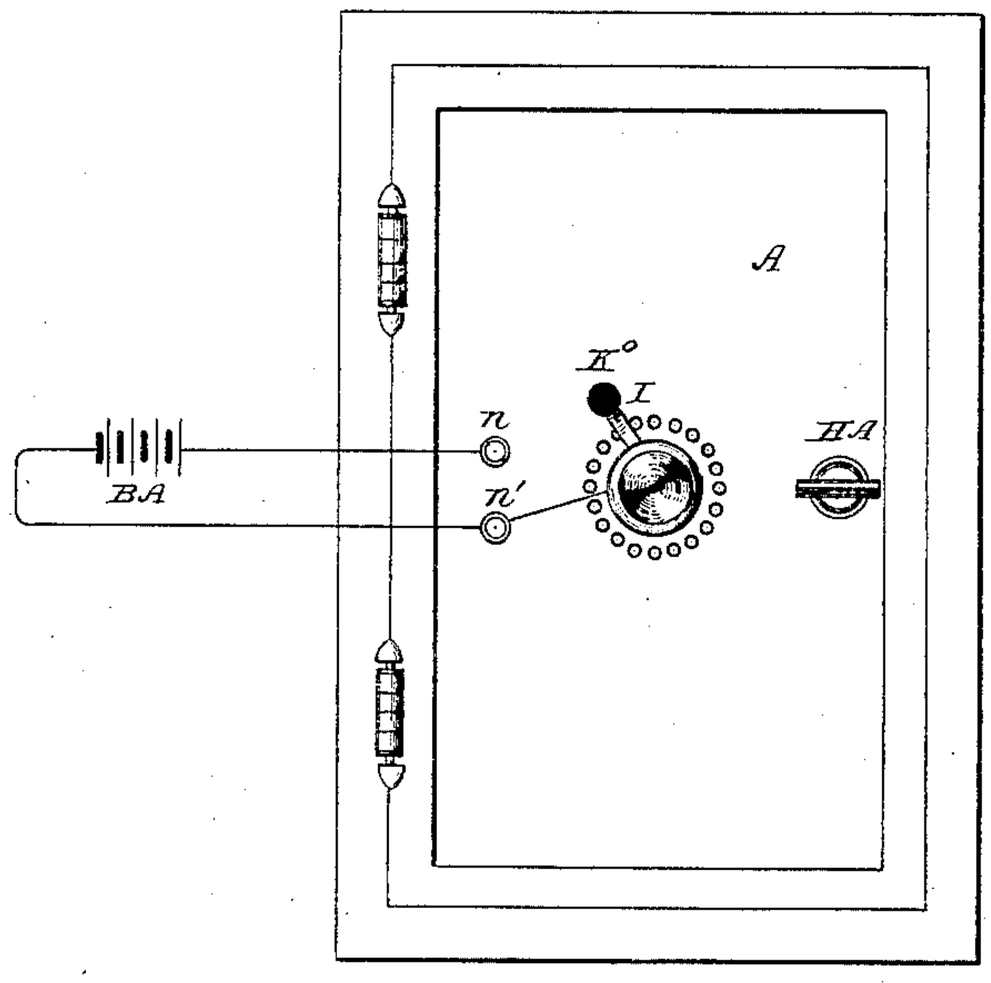


Fig. 9.



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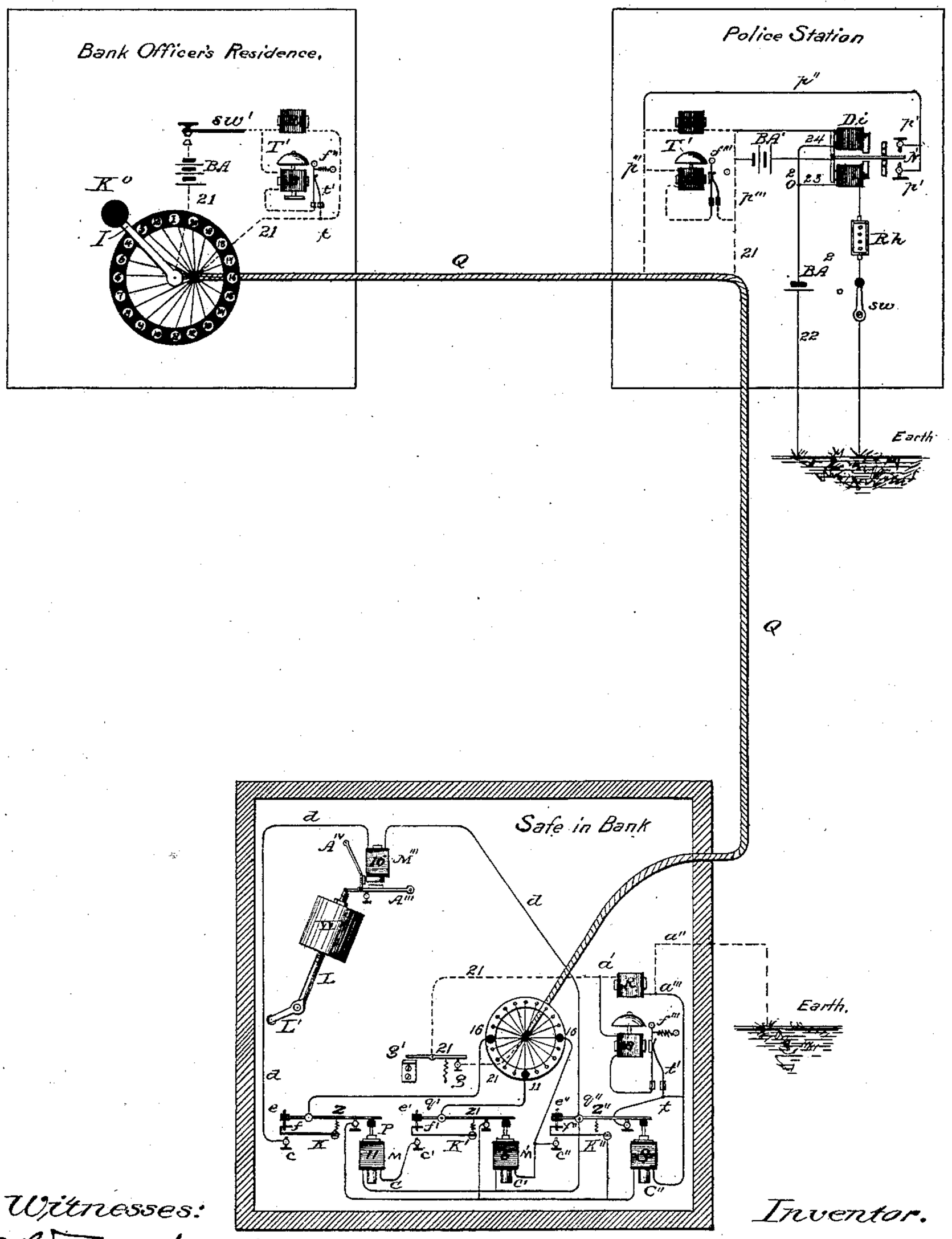
ELECTRO MAGNETIC SAFE LOCK.

No. 372,027. Patented Oct. 25, 1887.

Fig. 10.



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UNITED STATES PATENT OFFICE.

CHARLES J. KINTNER, OF PHILADELPHIA, PENNSYLVANIA.

ELECTRO-MAGNETIC SAFE-LOCK.

SPECIFICATION forming part of Letters Patent No. 372,027, dated October 25, 1887.

Application filed May 16, 1887. Serial No. 238,439. (No model.)

To all whom it may concern:

Be it known that I, CHARLES J. KINTNER, of Philadelphia, Pennsylvania, have made a new and useful invention in Electro-Magnetic Combination-Locks for Safes and Vaults, of which the following specification, taken in connection with the accompanying drawings, constitutes a full and exact description.

My invention relates particularly to a new form of combination-lock-controlling apparatus, such that all the bolts, bolt-drawing and bolt controlling apparatus are located inside the safe or vault and controlled through the agency of electricity, there being no mechanical connection whatever with the exterior portion of the safe or vault.

It also relates to a new and improved system of controlling the operation of the bolts from the cashier's or bank officer's residence in such manner as to evade the necessity of modern time locks and mechanisms and furnish at the same time as much if not more security to the safes or vaults as existing time-locks.

It also relates to an improved apparatus located at the police-station or bank officer's residence, whereby, on tampering with the circuits either at the bank officer's residence, the safe or vault, or any intermediate portion of the circuit, an alarm will be given at the police-station.

It also relates to certain details, hereinafter noted, and particularly pointed out in the claims which follow this specification.

Referring now to the drawings forming part of this specification, Figure 1 represents a side elevation of the interior of safe or vault door, showing the bolts in locked position and also the electro-magnets and apparatus which control the circuits for releasing or drawing said bolts. Fig. 2 is a cross-section of Fig. 1 through the door on a broken or zig-zag line, showing the bolt-drawing weight and its immediate connections. Fig. 3 is a similar cross-section through the door, displaying the top of the circuit-controlling magnets and circuit-controlling springs and the insulated conductors embedded in the door, with their exterior contact-points. Fig. 4 is a detail showing the contacts on the exterior of the safe and the circuit-controlling arm therefor. Fig. 5 is a cross-section of Fig. 4, showing two of the contacts and the pivoted contact-arm for controlling the circuits. Fig. 6 is a detail of a portion of the edge of the door, showing the bolt-guiding rollers; and Fig. 7, a cross section of Fig. 6, showing similar parts. Fig. 8 is a general diagram showing the circuits, connections, lock-controlling magnets, and weight for drawing the bolts, all that portion shown in solid lines being located within the safe, while all that portion shown in dotted lines is located on the exterior of the safe. Fig. 9 is a side elevation of the safe, showing the door closed, with the controlling-battery attached. Fig. 10 is a diagrammatic view of my system, designed to evade time-locks and detect burglars, showing a repetition of Fig. 8 at the bottom of the sheet and a conducting-conduit containing a series of conductors in a cable connecting the bank with the police-station and ultimately with the cashier or bank officer's residence, where the combination-controlling dial, such as shown in Fig. 4, is located.

I will now refer to the drawings in detail, then describe the mode of operation of the complete apparatus, after which I will describe, briefly, the existing state of the art in electrical combination-locks, pointing out the advantages which I claim for my system, and finally set forth the features which I propose to claim as of my invention.

A represents the safe-door. Attached to its inner side, as seen in Fig. 1, are shown sliding bolts B° of the usual pattern, but adapted in this instance to slide by the action of gravity into position when released and freed as much as possible from friction by rollers R' R° at top and bottom. (Better seen in Figs. 6 and 7.) These rollers are merely guiding-rollers, and are so arranged as to allow the heavy strain upon the bolts to come against the bearing-frame, and are held in place by screw-bolts N N, which pass through a bolt-sustaining strip, V, and extend into the door, aided in their sustaining function by bolts N' N'. On a pair of eye-bars, C C, are located additional rollers R'' R''', and both bolts are rigidly attached together by a bolt-frame, B', which has near its middle a projecting lug, B'', having a hole near its outer end of sufficient size to receive a spring-pressed pin, P^a, (see Figs. 1 and 2,) when the door opens, thereby holding the bolts from sliding down until said pin is released or pressed out of position—a

condition which takes place only when the door is closed, and an additional pin, $P^{a'}$, (see Fig. 2,) attached to the inner face of the safe, is forced into opening and P^{a} forced back, as seen. When the bolts are released and allowed to run forward by their own weight, the pin $P^{a'}$ playing in the slot $P^{a''}$. The bolt-frame B′ has near its center a cam-shaped opening, K‴, which has the joint function, with the weight W, bell-crank lever L, and roller *r*, of drawing the bolts and permitting them, when pin $P^{a'}$ is released, to run into place and be firmly locked by the pivoted click-piece L″, pivoted at *l*″, and having a retaining-spring, S′.

The full lines show the bolts, locking parts, and weights in proper position when the safe is locked, and the dotted lines show them in position when the safe is open.

M‴ is the locking-magnet, whose armature-lever A''' is attached to the door by a screw-mounted stand, E‴, and rests normally on an adjustable back-stop, *c*‴. It has near its left-hand end an opening, H, adapted to receive the lower end of locking armature lever A^{iv} when repelled.

o is a permanent magnet attached to the armature-lever A^{iv} and held normally by its attraction against the poles of the electro magnet M‴, thus locking the armature lever A''' down, as shown.

S‴ is a retractile spring attached to A^{iv}, but so adjusted as not to draw said lever away from the poles of magnet M‴ under ordinary circumstances. When, however, a current is sent in the proper direction through magnet M‴, its poles being polarized similarly to the respective ends of the magnetic keeper or armature *o*, it is repelled, and hence allows spring S‴ to withdraw it. At the same time armature *o*′ is energized and drawn up, the lower end of armature lever A^{iv} now passing through the opening H. This action releases the bolt-drawing lever L and permits the weight W to leave its back-stop T and fall freely. The opposite or short arm-raising roller *r* passes along the curve of slot K‴, but has no appreciable effect upon the bolt-frame until the weight has obtained sufficient momentum to cause it to strike near the upper inclined end of said slot with a heavy blow, which causes the bolts to be quickly and surely drawn, and the weight W and bolts B^{c} to assume the position shown in dotted lines, the pin P^{a} slipping into place when the door is opened and holding them until the door is again closed, the weight W having in the meantime been lifted by hand into locking position, the armature-lever having been so manipulated by hand as to admit thereof.

M, M′, M‴, and S are the combination controlling and safety magnets, all of which are identical in their general details and functions, except that S performs the duty of a safety controlling-magnet, as will be hereinafter described.

The magnets M, M′, and S have solenoid or suction cores *c c*′ *c*″, to the lower ends of which are attached dashers or pistons D^{2}, sliding in dash-pots fixed, as shown, to the door, and having vent-holes *v v*′ *v*″ to allow the air in the upper part of said dash-pots to escape freely when the cores are drawn up. In the lower part of said dash-pots are puppet-valves *v*″, one or more in each dash-pot, and air-vents *x x*′ x^{2}, with vent screws *m m*′ *m*″, adapted to regulate the flow of air into and out of the several dash-pots. These dash-pots are so arranged and adjusted that when the magnets are energized the cores are drawn up very quickly, but run back very slowly on demagnetization under the influence of spring-pressed levers *z*, *z*′, and *z*″ acting on push-rods P P′ P″.

e e′ *e*″ are adjustable nuts for regulating the throw of the parts *f f*′ *f*″, and hence the circuit-controlling springs K K′ K″.

The levers *z z*′ *z*″ are pivoted at *q q*′ *q*″ to parts attached to the door, and rest normally upon back-stops *b b*′ *b*″ under the influence of adjusting-springs *s s*′ *s*″. The relations of these parts will be fully described in connection with the description of a diagram shown in Fig. 8, which I will now describe at length. In this figure all the parts shown in solid lines are located entirely within the safe, the bolt mechanism operated by W L L′ not being shown, but also located similarly as shown in Fig. 1. The parts shown in dotted lines are located entirely outside of the safe, as seen also in Fig. 9, side elevation, in full lines outside the door.

sa is what I call a "safety-ring," of conducting material, attached to the door, but insulated therefrom. From the outside of the door leading through it to this ring is a series of conductors, 1 2 3 4, &c., to 20, all cast into said door in zigzag shape, as shown in Fig. 3, so as to prevent attacks upon the door by drills or tools. All of these conductors are insulated with asbestus, glass, or some good insulating material which will withstand the high heat resulting during the process of casting the door-plate. They have on their exterior surface a circular sequence, as shown in Fig. 4, and all except the numbers designed for operating the combinations (in this instance 6, 11, and 16) are electrically connected to the safety-ring *sa*, which latter is insulated from the door. Nos. 6, 11, and 16 are insulated from the ring, as shown in Fig. 8, by inserting rubber washers under the contact-nuts, and each of these conductors is afterward connected with its particular combination-circuit, as will be described.

The safety-ring *sa* is connected by a conductor or wire, *y*, to binding-post *b*′, and thence through said wire to the safety-magnet S, conductors *y* x^{iv} x^{v} back to battery, and its function will be fully described hereinafter.

Each of the combination-magnets M′ M M‴ has an independent circuit *x*″ *l d*′, each of which, except *x*″, is normally open at the points *c*′ and *c*, but also normally closed through shunt-routes about the said magnets M and

M‴ to the safety-magnet S by wires *y* and *i* from levers *z′ z*, respectively.

T¹ is a well-known form of trembler-bell located inside the safe, having an actuating-magnet, B, equal in resistance to a shunt-resistance, R, in a derived circuit around said bell-magnet. The function of this bell and resistance is twofold—viz., to make a noise inside the safe while working the circuits, and also to automatically vary the resistance so rapidly that galvanometer tests cannot be made from a point on the outside of the safe for the purpose of picking the lock.

B A is the battery connected from binding-post *n* by wires x^3 and x^4 to the circuit-closing or dial arm I. (Seen in Figs. 4, 5, 8, and 9.)

In place of battery B A it may be desirable to substitute a magneto-machine attached directly to the door and adapted to be rotated by hand. In fact, I prefer such a machine as being more constant and less liable to get out of order, it being understood of course that such a machine must generate direct or straight currents, such as will actuate neutral electro-magnets like those shown and described.

H A (seen in Fig. 9) is a handle having a shouldered button adapted to take into the face of the door like a cam when rotated to the right, and thereby insure the action of the pin $P^{a\prime\prime}$ upon the spring-pressed pin P^a, Fig. 2, so as to certainly release the bolts and allow them to run securely into locked position.

I will now proceed to describe as briefly as possible the mode of operation of my improved lock, having special reference in such description to Figs. 1 and 8. In the drawings the numbers 6, 11, and 16, in sequence, constitute the combinations necessary to open the safe, and the circuit running from the battery B A must be closed through these numbers in their order before the bolts can be drawn. Suppose the safe is locked as shown, and the weight W held in the position shown in the drawings. Proceeding to operate the combinations, turn the handle or dial I in either direction until the spring I″ is over the number 6. (See Figs. 5 and 8.) Press the knob K°. A current is then sent from battery B A by wire x^3 to binding-post *n*, wire x^4, handle I, spring I″, contact 6, through its insulated wire to wire *x″*, magnet M′, binding-post *x″*, wire *l‴* to point *q″*, lever *z″*, binding-post *c‴*, wire *x‴* to binding post *t*, where it divides, one half going by spring *t′* to armature-lever *t‴*, wire x^v, magnet B, wire x^v to binding-post x^{vi}, the other half going by wire x^{iv} to resistance R and to the same binding-post, where both currents join and go thence by wire *n″* to the opposite pole of the battery B A. This energizes magnets M′ and B, and causes the core C′ (see Figs. 1 and 8) to be drawn up, thus causing the push-rod P to rise and lift the lever *z′*, turning it about point *q′* against the retractile force of spring *s′*, allowing the spring K′ to come into firm and continuing contact with the contact-screw *c′*, thus making a new circuit from the second contact-point, 11, as will be described. The magnet B causes the bell T′ to ring as long as this circuit is closed. In rising the cores of the magnets M, M′, and S are drawn quickly up, the plungers attached to said cores, as seen at D^2 in magnet S, Fig. 1, being allowed to ascend quickly by reason of the air-vents *v*, *v*, and *v′*, together with the tappet-valves seen in the bottom of the dash-pot, but on returning these valves *v″* are closed; hence the plunger will return comparatively slowly, as desired, the speed with which they return being regulated solely by the stress upon the retractile springs *s s′ s″* and the regulation of the vent-valves *x x′* x^2 by set or valve screws *m m′ m″*. It will thus be seen that after having energized magnet M′, if the hand or dial I is swung quickly to the next number of the combination, as 11, before the core C′ has had time to resume its normal condition, and thus break contact between *c′* and spring K′, and knob K° is again depressed, a new circuit will be closed from battery B A as follows: by wire *x‴* to binding-post *n*, thence by wire x^4, arm I, spring I″, Fig. 5, to contact 11, through the insulated wire embedded in the door to wire *l*, thence to *q′* by *z′*, to springs *s′* and K′, by contact-screws *c′* to wire *l′* and magnet M, by wires *l″ l‴* to *q″* by *z″*, and finally to contact *c‴*, and back by the same route as before to the battery. This energizes magnet M and causes its core and dasher or plunger and push-rod P to be forced up, and lever *z* to be tilted about its pivot *q*, causing spring K to be brought into a firm and continuing electrical contact with the point *c*, thus closing a new circuit to the unlocking-magnet or last combination-circuit. The arm I should be then turned quickly to the point 16 and knob K° depressed as before, and a new circuit is made from the battery, as before, through arm I, spring I″, contact point 16, through the embedded insulated wire to wire *d′*, and thence to pivot *q*, lever *z*, spring *s* and K, contact *c*, wire *d*, unlocking magnet M‴, wire *d*, pivot *q″*, lever *z″* to contact *c‴*, and back to battery by the divided circuit, as in both previous instances. This energizes magnet M‴ and causes its poles to be so magnetized as to repel the permanent magnet *o*, attached to the locking-lever A^{iv}, and at the same time draw up the armature-lever A‴, the end of the locking armature-lever A^{iv} passing through the opening H in armature-lever A‴. This releases the weighted lever L and allows W to fall.

By examining Fig. 1 it will be seen that no effect is had by the short arm L′ and roller *r* upon the bolt-frame until the weight W has fallen some distance—say half the space it passes through, as shown in broken lines—thus giving said weight a heavy striking force to quickly draw the bolts, which it does, the weight assuming the position shown in dotted lines. As the bolts are drawn to their extreme backstroke and the door opened, the head of the spring-pressed pin P^a slips into

place and locks them in this position, so that when the weight W is lifted by hand to again lock it in the position shown in Fig. 1 the bolts cannot run down until the door is closed, which action releases pin P^a and allows them to run into place, as before disclosed, the click-spring catch L″ springing into position behind the roller *r*, as seen in Fig. 1.

It will be noted that the vent-screws *m m′*, Fig. 1, may be adjusted so as to allow the dashers to run back at any rate of speed desired, and I prefer that not more than five seconds should elapse between the time of leaving one contact and making another, so as to leave as little time as possible for finding the succeeding numbers. Of course the bank officer who is familiar with the combination can pass from one number to the others quite rapidly, so that he may make his combination rapidly; but if he delays unnecessarily long between any two numbers he must go back to the starting-point and begin over, for the dashers will run down and break the circuits.

I will now describe the function and operation of the safety-magnet S. All of the contacts from 1 to 20, inclusive, except those forming the combination—in this instance 6, 11, and 16—run to what I call a "safety-ring," *sa*, and from thence by a common conductor, *y*, to post *b′*, by wire *y* to the safety-magnet S, wire *y* to point *t″*, where the current splits, as heretofore described, and passes by two paths to post x^{vi} and back to battery, so that if arm I and spring I″ is pressed upon any contact except a combination-contact in its proper sequence the safety-magnet is energized and core C″ drawn up, and with it dasher D^2 and plunger-rod P^{11}, tilting lever *z″* about its pivot *q″* and breaking the common outlet to all the combination-circuits at the point *c‴*, but making at the same instant of time a new circuit at the point *c″* for said combination-circuits around their respective magnets, shunting all of them, so that after S is once energized all the twenty circuits become safety-circuits until the dasher P′ returns to its normal position and all of said circuits will be closed through the magnet S, as follows: For number 6, by wire *x″*, contact *c″*, spring K″, wire *y*, magnet S, back by the common route to battery. For circuit 11, by wire *l*, lever *z′*, contact *b′*, wire *y*, magnet S, as before, to battery. For circuit 16, by wire *d′*, lever *z*, post *b*, wire *i*, wire *y*, magnet S, back to battery. It will thus be seen that after once having operated magnet S the operator must wait for its core and dasher to assume a normal position before he can act on any combination-number, and that he can only do by actuating the numbers 6, 11, and 16, in their regular order. It will also be noted that the circuits from 11 and 16 to their proper magnets M M‴ are normally open at *c′* and *c*, but are also closed through shunts to the posts *b′* and *b* by wires *i* and *y* to the safety-magnet S and back to battery, so that all the circuits, save that of number 6, are safety-circuits until 6 is first closed, and then the others successively, which successive action breaks the shunts at *b′* and *b*. By this arrangement I effectually guard against testing for the numbers consecutively, as it will be seen that it will be absolutely necessary to close the circuits in their proper sequence to open the safe, and if this is once deviated from the operator must await till the safety-magnet runs down and begin again with the original number—as 6, in this instance—before he can proceed to unlock the safe. Each closure of the circuit actuates the trembler-bell T^1 by its magnet B and creates a disturbance such that no sounds can be detected in the operation of the mechanism, and also automatically varies the resistance at each break of the circuit between *t′* and *t‴*, so that no galvanometer tests can be reached as to the relative resistance of the safety and combination circuits.

I will now describe that portion of my invention designed to avoid time-locks and detect burglars in their attempt to burglarize the safe.

Fig. 10 shows a diagrammatic view of the whole apparatus. The safe or vault is located within the bank or store, as shown at the bottom of the figure. On the inner side of the door is arranged the lock-controlling mechanism, similar in every respect to that already disclosed, except that the arm I is located at the bank officer's house instead of on the safe-door. The conducting-wires, however, numbering in this instance twenty, and one return-wire, are all so intermingled before being cast into the door or carried outside as to lose their identity, which is known only to the builder of the safe, who keeps a correct secret record of every safe built and the order which the wires assume as they emerge from the door. After leaving the door they are either carried to a switch-board having a binding-post for each wire with a characteristic number or mark, also recorded in the maker's secret key-book, or they are at once twisted up into a cable or carried from the switch-board to such cable, and inclosed in a metal or other water-tight conduit, and carried thence underground, if desired, to the police-station, where the return-wire 21 is looped off, as shown, and made to include directly in its circuit a trembler-bell, T′, with a shunted resistance similar in every respect to the bell T′ at the safe. The wire 21 is then again carried to the conduit, and with the other twenty wires to the cashier's or bank officer's house where the order of the wires is restored by the builder, running from 1 to 20, and 21 is carried through an additional trembler-bell, T′, to switch *Sw′*, to battery B A and arm I, which is normally in contact with some one of contacts 1 to 20. It will thus be seen that the cashier or bank officer may open the safe from his house and from no other point by simply making the combination-contacts in sequence, as before, and closing key or switch *Sw′*, when the magnets M′, M, and M‴ at the safe will be actuated successively, the wire 21 being a common return-wire for all of the cir-

cuits 1 to 20, inclusive. It will also be seen that each closure of the circuit by the switch *Sw'* will ring all three bells as long as the circuit remains closed, and thus give warning at the safe, the police-station, and the cashier's house that the circuit is being tampered with.

g' is a spring-pressed lever located in the return-circuit 21, and so situated that when the last magnet, M''', of the combination is energized the weight W which draws the bolts will strike it and break the return-circuit at the point *g*, and thus cause all the bells to stop ringing and warn the cashier that he has found his combination and his safe is unlocked. The wires entering the safe may be taken in between the door and its jamb, or in any desired manner. To apply this mechanism to existing safes it would of course be necessary to construct them in this manner.

I will now describe the burglar-alarm apparatus.

At the police-station or at the cashier's house, or both, if desired, is located a differential galvanometer, D*i*, having a delicate needle, N', located in the magnetic meridian, pivoted, as shown, to the yoke of the magnet, and having its free end resting in the middle of one of three notches, but adapted to remain in either of the three notches shown, when forced in one direction or the other by the coils of the galvanometer. From the earth a wire, 22, is taken through a small battery, B A^2, to a point, o^2, where it is divided into two circuits, 23 and 24, 24 passing around one coil of the differential galvanometer, and joining direct to the common return-wire, 21, and passing thence to a point, *a'*, of said wire 21, located inside the safe and going through magnet B and resistance R to another branch, *a''*, to ground, making an independent earth-circuit. The other branch, 23, passes around the other coil of the differential galvanometer and thence through a rheostat, R*h*, by switch *Sw* to ground. The rheostat R*h* is so adjusted that when the safe is closed, and hence lever *g'* resting on its contact *g*, the needle N' will remain in its central position when placed there, as shown. In other words, both coils of D*i* balance and no effect is had upon the needle N' by battery B A^2 as long as the resistances are equal. It will be observed that the bells T' T' at the safe and police-station and cashier's house have adjustable springs *f''' f'''*, which are so adjusted that they will not operate for a small battery-current, and only when current enough is sent to energize any one of the magnets M, M', or M'''; but the galvanometer D*i* will respond on the slightest variation of the exterior circuit and cause the needle N' to sway in one direction or the other and close a local circuit from battery B A' of sufficient power to work the bell at the police-station, through the circuit *p' p''*, magnet B, and cause said bell to continue ringing until the balance is restored and the needle N' placed in its central position, as shown. When the safe is open during the day, the switch *Sw* should be opened to prevent the bell from ringing continually. As soon as the safe is closed, the needle will cause the bell to sound an alarm, when the switch should be turned on and the needle again centered, after which the bell will stop ringing, so that the differential galvanometer D*i* and its circuits form a complete check on the operation of the safe-lock and indicate to the police or the cashier at his house when it is closed or open.

I do not limit myself to the use of the specific details herein described, as it is obvious that many of the details might be modified in various ways. I have disclosed what I consider the best apparatus designed by me to accomplish the results sought, and I desire it understood that the apparatus herein described is of a generic nature and embraces a wide departure in the art of controlling and regulating bank and safe locks. Prior to my invention in this art safe-locks had been controlled through the agency of electricity through the use of double spindles passing through the door. Time mechanisms have been devised for closing electrical circuits at predetermined times and thereby placing the lock in condition to be opened; but so far as I am aware no one has controlled a lock solely by electrical agencies without some mechanical connection passing through the door; nor has any one to my knowledge operated safe-locks from a distance, thereby leaving the safe intact and inapproachable by burglars.

I will now state some of the advantages of my improved system.

First. The bolts and all mechanical connection being entirely within the safe, it leaves no point of attack for burglars.

Second. Safe and vault doors may be made of any thickness desired, and the conductors cast or built therein, and hence avoid the attack of burglars and the use of dynamite.

Third. The lock is absolutely noiseless in its action and cannot be picked.

Fourth. Any number of combinations may be made with twenty wires, and a lock with four or five combinations can be unlocked in as many seconds, while with the old style of tumbler-lock a four-combination lock often takes as many minutes, and it is very annoying to have to remember how many times to turn to the right or left successively. With my lock I go direct to the number and close the circuits successively.

Fifth. I can control my lock from three or more different positions, if desired—as from the cashier's house, the president's house, or the police-station—by taking off derived circuits from the police-station in multiple arc, one set running to each officer's house, and a battery and dial located at each house adapted to ring the bell at the police-station.

Sixth. Burglars and a bank officer cannot by collusion rob a safe without also forming a collusion with the police.

Seventh. If one starts wrong in seeking the combination, he can never hope to find it, for

having once operated the safety-magnet, his future actions are of no avail, as will be understood from the foregoing description.

Eighth. The burglar-alarm at the police-station is an effectual check upon the cashier, and if he fails to close the safe at the usual hour the police are warned, inasmuch as the bell does not ring. They are also warned if he does close it and the bolts fail to go squarely into place, for the reason that the bell will not ring, as lever *g'* will not go into operative connection, and hence the bell will not ring at the usual hour. If it is closed all right and locked, then the galvanometer rings the bell, and the police must balance up the galvanometer and cause it to stop ringing by rheostat R*h* and switch S*w*, so that there can be no such thing as failure to lock the safe without warning the police except by gross carelessness.

Ninth. Another and important advantage is that by locating the combination-dial at the cashier's house I am enabled to open the safe at any time of the day or night—a feature which renders my apparatus much more desirable than time-locks, which cannot be opened after they are once closed until the predetermined time has elapsed. Of course any tampering with the circuit alarms the police, and if the cashier wished to open the safe at any time other than stated hours he would be required to notify the police and go with them and the president or authorized officer to the bank or safe. This is a very important advantage, and particularly so when we remember how much annoyance is caused by time mechanism getting out of order and delaying banks in their regular business.

Tenth. The combination can be changed in a moment's time by disconnecting the combination-wires from their particular contact-screws and removing the insulating-washers shown in Figs. 1 and 3, then inserting these washers under any desired sequence of numbers and substituting for the former the safety-circuits by screwing the metal nuts directly down on the safety-ring.

My invention also possesses an advantage over existing combination-locks in that it can be operated in the dark as well as by day, inasmuch as the combinations can be set by the sense of touch.

I do not claim, broadly, in this application a series of electrical circuits running from the exterior to the interior of the safe and means for controlling the action of the bolts if a prearranged sequence be observed in the closure of such circuits and additional means for preventing the operation of the bolts unless such order be observed; nor do I claim the broad method based upon such apparatus, although shown and described in this application. I reserve such features for a separate application bearing serial number 237,803, filed May 11, 1887, where I have made such claims.

I do not claim, broadly, in this application a series of electrical circuits running from the exterior to the interior of the safe with electro-magnets and automatic bolt-withdrawing mechanism for controlling the bolts; nor do I claim in this application either the apparatus for or the method of controlling an electrical lock by causing a proper sequence of electrical circuits to close successive circuits at normally open points within the safe, and preventing such operation unless the proper sequence of circuits be closed, all of such matters being claimed in another application filed by me on the 6th day of July, 1887, and bearing serial number 243,598.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a safe or analogous device, the combination of a sliding bolt or bolts free to slide by their own weight into locking position when the safe-door is closed, with a weighted bolt-drawing lever and an electro-magnet having a locking-armature for such bolt-drawing lever, all so arranged that when the magnet is energized the bolts are drawn automatically, substantially as described.

2. In a safe or analogous device, a bolt or bolts resting at an inclination and normally tending to slide into locking position when the safe-door is closed, in combination with a bolt-drawing lever and an electro-magnet having a locking-armature for such bolt-drawing lever, substantially as described.

3. The combination, in an electric combination-lock, of a series of electrical circuits leading to the interior of the safe, and all except one passing normally through a safety device, with circuit-changers for successively changing the path of the current, if the circuit be properly closed, so as to control the bolts, substantially as described.

4. In an electro-magnetic safe-lock, the combination of a series of circuit-changing devices located inside the safe, and means, substantially as described, for causing said circuit-changing devices to be actuated successively, substantially as described.

5. In a safe-lock, the combination of bolts adapted to slide into place when the door is closed by the action of their own weight, with means for automatically withdrawing said bolts when desired, and additional means consisting of an electro-magnet and connections, substantially as described, for controlling or releasing said bolt-withdrawing means, substantially as described.

6. The combination, in a lock, of a series of electro-magnets or solenoids having circuit-connections, as described, and a series of retarding devices, each adapted to hold a circuit closed for a predetermined time only, substantially as described.

7. The within-described method of operating the bolt mechanism of a safe from a point outside the building containing such safe, which consists in setting up a prearranged order of electrical currents at such outlying point and causing the same to actuate bolt-controlling mechanism located within the safe,

whereby the bolts are automatically withdrawn, substantially as described.

8. In a system for the protection of safes or vaults against burglaries, the combination of a series of electrical circuits running from a point located outside the building to the inside of the safe, and including electro-magnets also located within the safe, which electro-magnets control the bolt mechanism, all of said electrical circuits having a common return-circuit, substantially as described.

9. In a system for the protection of safes or vaults, the combination of a series of electro-magnets located inside the safe for controlling the operation of the bolts, with a series of electrical circuits leading from the said electro-magnets to a distant point from which it is desired to operate the bolts and circuit-connections, such that the operation of the bolts may be had from said distant stations, substantially as described.

10. In a system for the protection of safes and vaults, a series of bolt-controlling electro-magnets located within the safe, and a series of electrical circuits running from said electro-magnets to a distant station from which it is desired to operate the bolts, said circuits being arranged in sequence inside the safe, but having a disorganized order as they pass outside the safe and again rearranged at the distant station in the same sequence as inside the safe, in combination with suitable circuit-connections and means for operating the bolts, substantially as described.

11. In a system for protecting safes and vaults from burglary, a series of bolt-controlling electro-magnets located inside the safe, in combination with a series of electrical conductors running from said electro-magnets to the outside of the safe and to one or more outlying stations, and alarm-bells and connections, as described, for operating the bolts and sounding an alarm at the same time, substantially as described.

12. In a system for the protection of safes and vaults from burglaries, the combination of a series of circuits and a balanced return-circuit all leading from within the safe to a distant station, the latter including a differential electro-magnet and connections for operating an alarm, substantially as described.

13. The combination, in a system for the protection of safes and vaults, of means for controlling the operation of the bolts from a distant station, and means within the safe for indicating to the operator at the distant station when the bolts are withdrawn, substantially as described.

CHARLES J. KINTNER.

Witnesses:
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JAS. F. KELLY.