(No Model.) 3 Sheets—Sheet 1.

C. J. KINTNER.

ELECTRICAL SAFE LOCK.

No. 372,028. Patented Oct. 25, 1887.

Fig. 1.

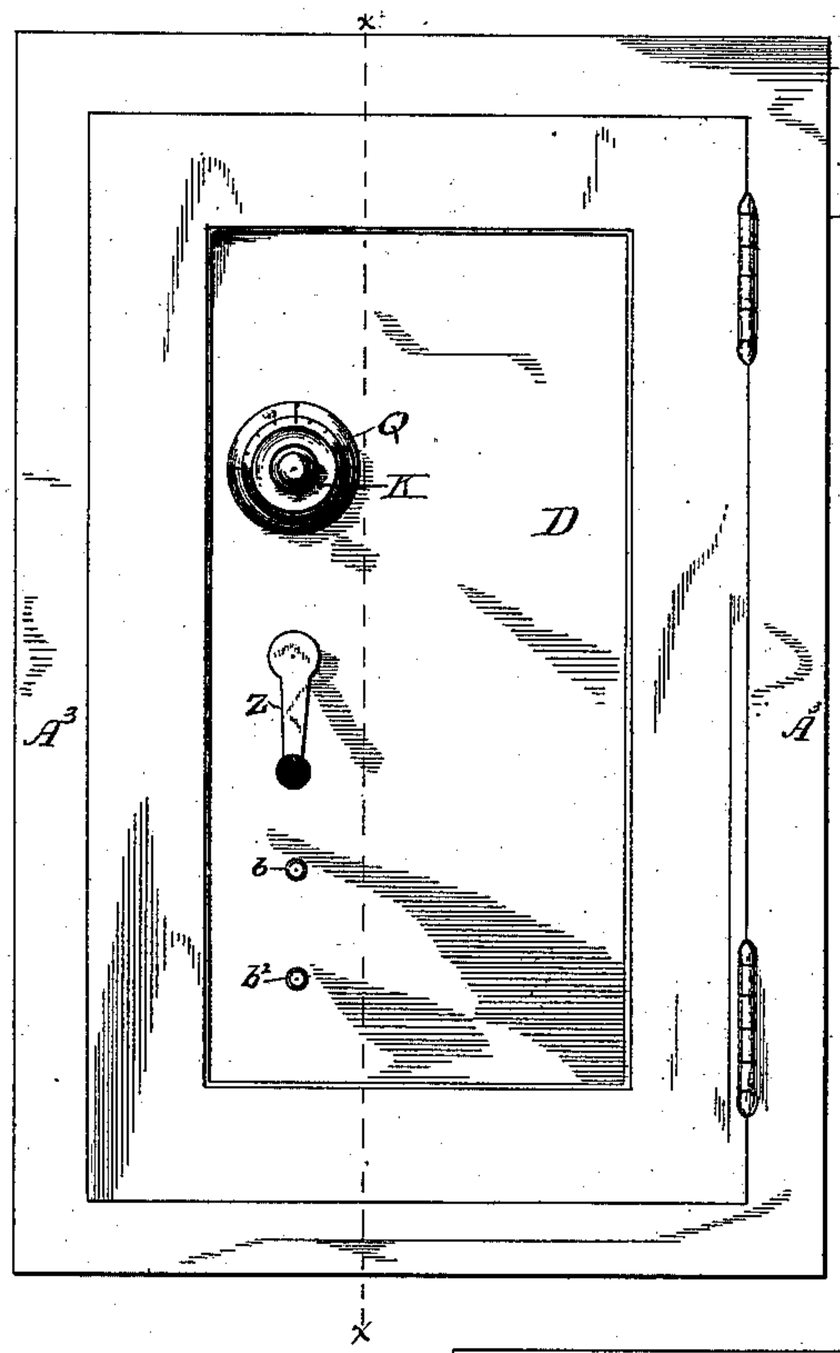


Fig. 2.

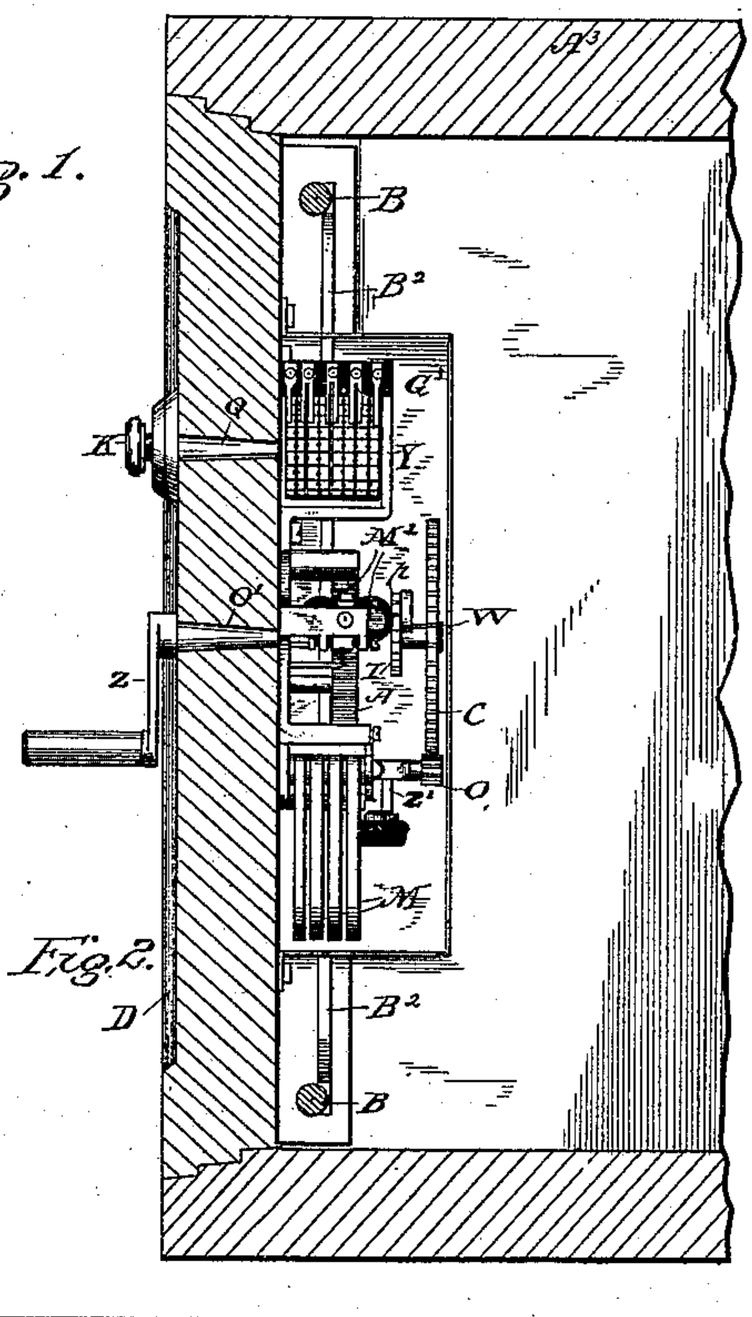
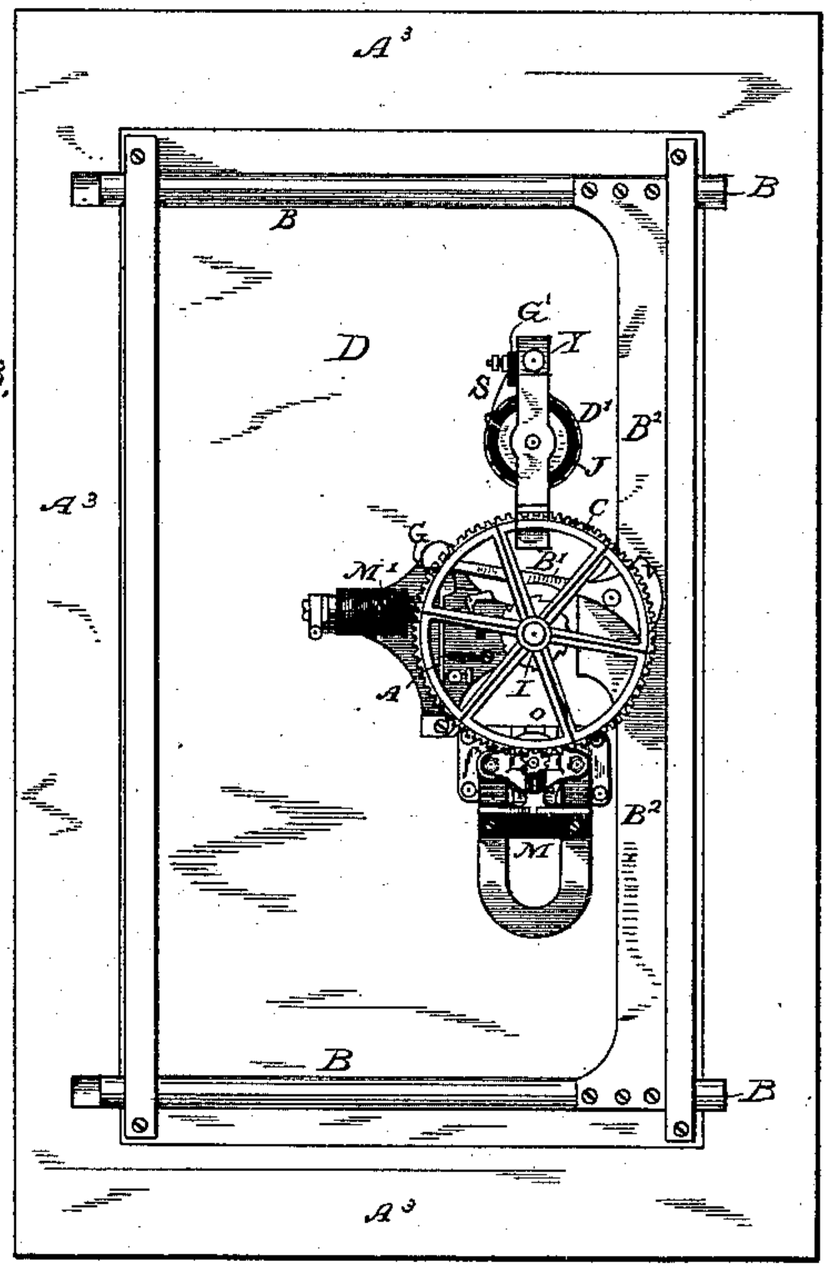


Fig. 3.



Witnesses:
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(No Model.) 3 Sheets—Sheet 2.

C. J. KINTNER.

ELECTRICAL SAFE LOCK.

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Fig. 8.

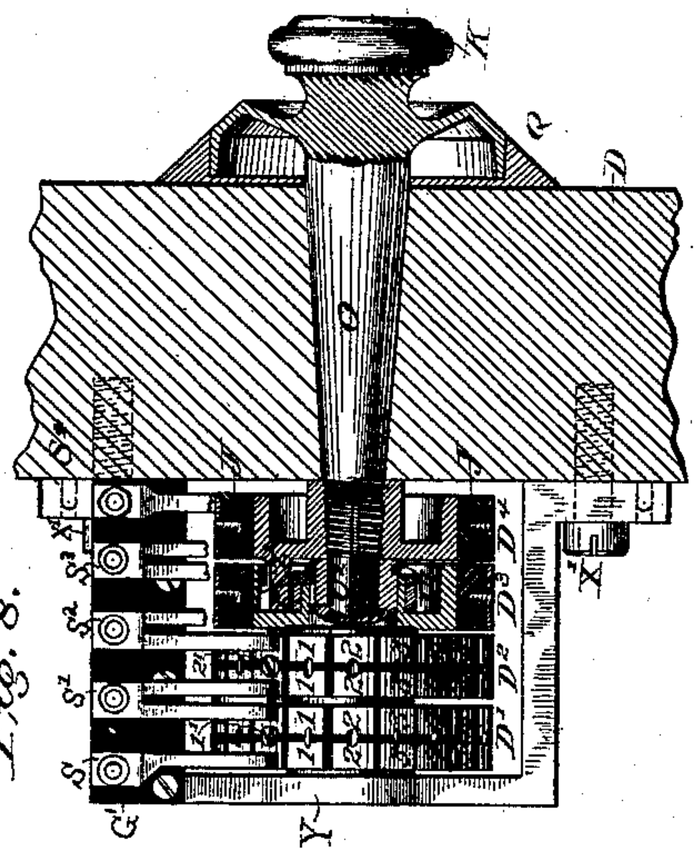


Fig. 9.

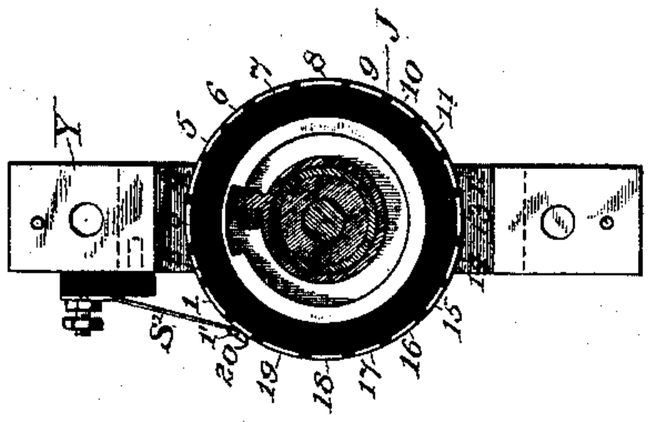


Fig. 4.

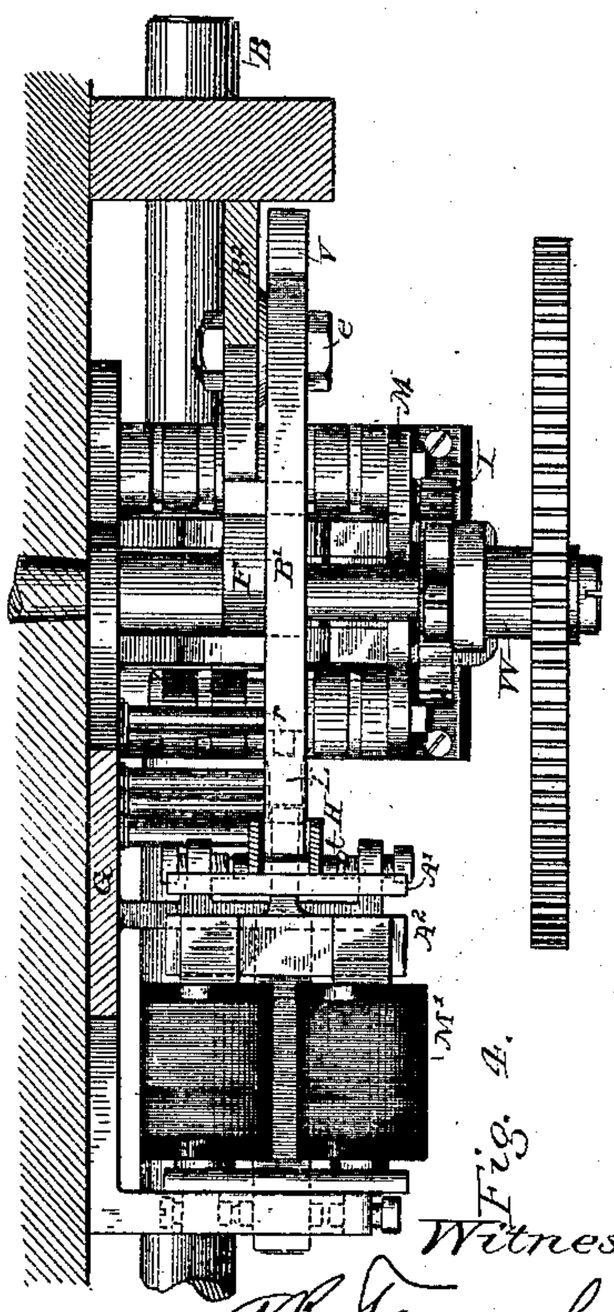


Fig. 5.

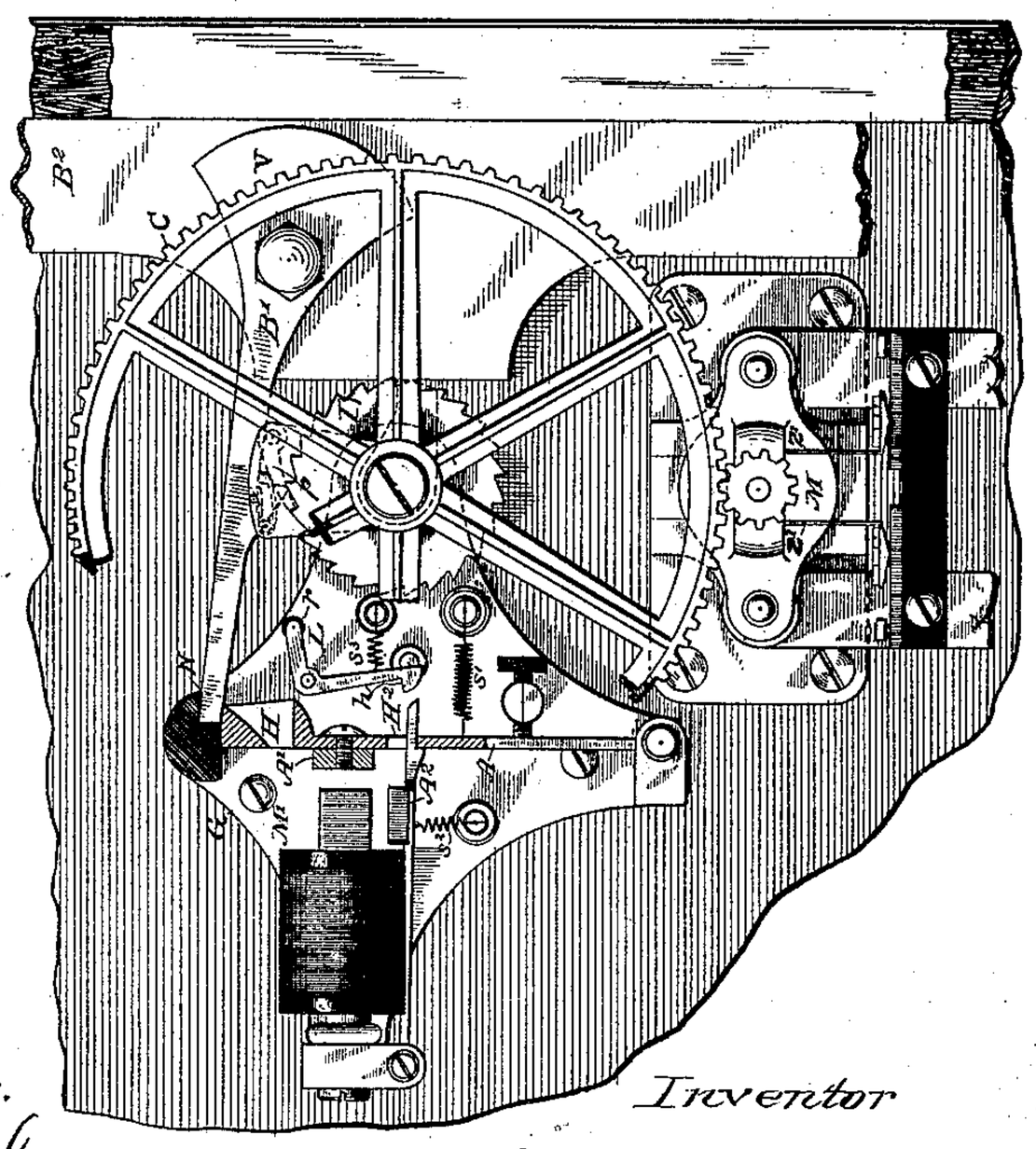


Fig. 6.

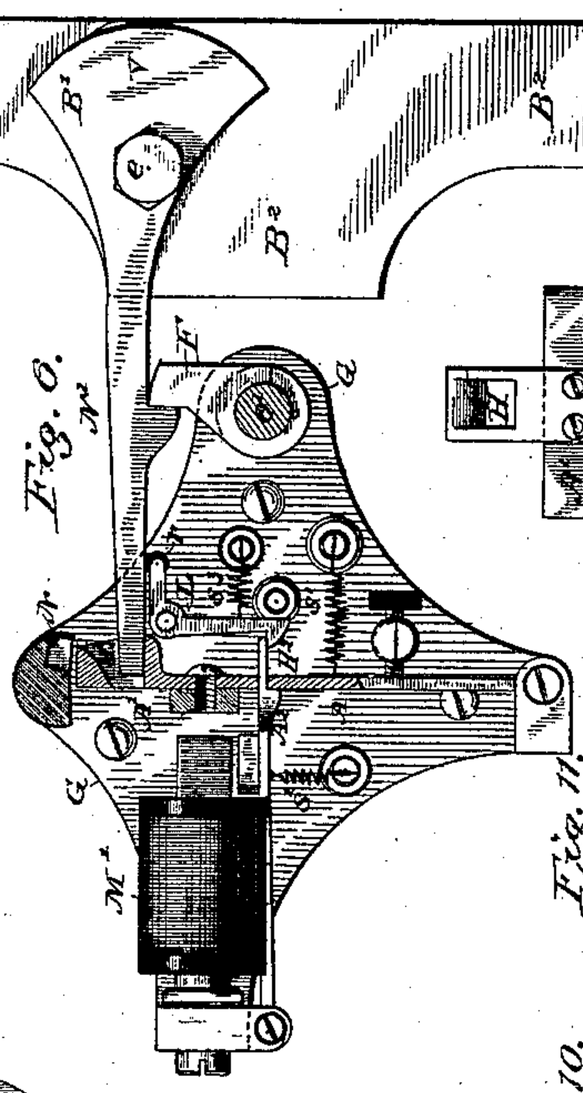


Fig. 13.

Fig. 12.

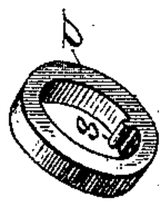


Fig. 7.

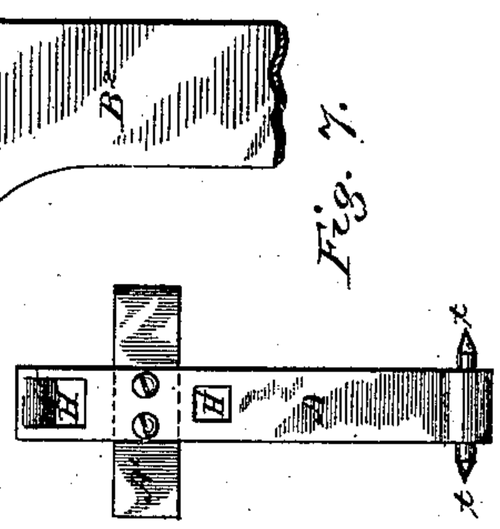


Fig. 11.

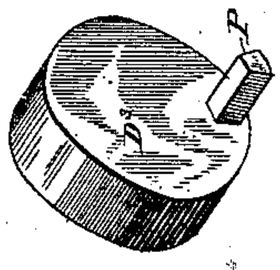
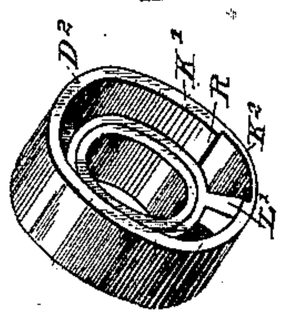


Fig. 10.



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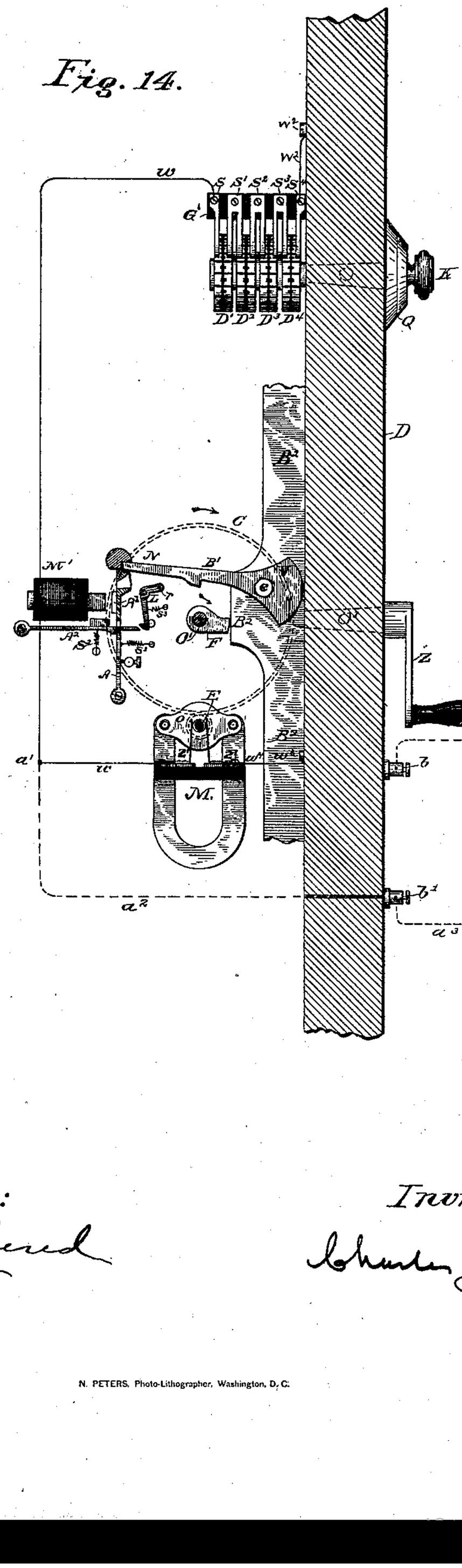
ELECTRICAL SAFE LOCK.

No. 372,028. Patented Oct. 25, 1887.

Fig. 14.



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UNITED STATES PATENT OFFICE.

CHARLES J. KINTNER, OF PHILADELPHIA, PENNSYLVANIA.

ELECTRICAL SAFE-LOCK.

SPECIFICATION forming part of Letters Patent No. 372,028, dated October 25, 1887.

Application filed May 16, 1887. Serial No. 238,440. (No model.)

To all whom it may concern:

Be it known that I, CHARLES J. KINTNER, a citizen of the United States, residing in the city and county of Philadelphia, State of Pennsylvania, have invented a new and useful Improvement in Combination Safe or Vault Locks, of which the following description, taken in connection with the accompanying drawings, is a full and exact specification.

In the drawings, Figure 1 is a side elevation of a safe, showing the door closed, and a well-known form of combination disk and knob, together with the bolt-drawing crank located just below said disk and knob. Fig. 2 is a vertical cross-section of Fig. 1, taken on line *x x*, Fig. 1, and showing the interior mechanism in elevation. Fig. 3 is a vertical elevation of the interior of the door with the lock-controlling mechanism and bolts as seen looking outward from the back of the safe toward the front. Fig. 4 is a plan view of the bolt-drawing apparatus, bolts, and mechanism for rotating the magneto generator, together with the unlocking-magnet and its armature. Fig. 5 is a vertical elevation of Fig. 4, showing the bolt-bar thrown into locking position. Fig. 6 is an elevation of the locking parts only, showing the bolt-bar in position to be drawn, the driving-gear shown in Fig. 5 being removed to better show said parts. Fig. 7 is a detail view of the main locking-armature. Fig. 8 is a plan view of the tumblers or combination-disks, electrical contact springs and plates, and the spindle with its combination-knob, two of the disks being cut away to show their interior construction. Fig. 9 is a cross-section of Fig. 8, showing the electrical contact-plates and contact-springs for making the combinations, and also showing the interior of one of the disks. Figs. 10, 11, 12, and 13 are detail views of parts of the tumblers or combination-disks, being similar to those in common use in the well-known forms of combination-locks, and only shown and described here to better facilitate the construction of my complete apparatus in all its details. Fig. 14 is a diagrammatic view, partly in section and partly in elevation, all that part connected directly with the bolts being shown turned ninety degrees from the interior face of the door to better display the parts, the whole being designed to show the position which the several parts assume when the safe is locked and the bolts in position.

Similar letters of reference indicate corresponding parts in the several figures.

My invention consists in certain improvements in combination-locks and mechanism connected therewith, whereby such locks are controlled through the agency of electricity.

In order that those skilled in the art to which my invention appertains may fully understand the same and be enabled to construct and use it, I will now proceed to disclose it in the following specification, taken in connection with the drawings above referred to, and to this end will particularly point out in the claims at the end of this specification that which constitutes my improvements.

I will first describe the drawings in detail, alluding to each part and its functions, and will then describe the mode of operation of the whole apparatus at length, together with the essential advantages which I claim for the same.

Prior to my invention combination-locks embracing what is known as combination wheels or disks, one for each combination, and capable of assuming respectively as many positions as there are numbers on the exterior disk or dial-plate, were provided each with a notch in its face, into which what is known as the "gate" falls when the combination has been correctly made and all of said notches arranged in line beneath the gate-bar, after which, by turning the combination-spindle slowly to the right, the gate acts mechanically upon a tumbler and turns it so that the bolts can be drawn through the agency of the bolt-handle.

By my invention I do away with the gate entirely and substitute therefor a series of insulated electrical contact-plates ranged around the said disks in succession, one such plate for each number formed on the dial-plate on the outside of the safe. Upon these contact-plates bear contact-springs, which are adapted to complete an electrical circuit, when the combination is correctly made, from the magneto-generator or a voltaic battery through an electro-magnet or equivalent device, and thereby release a locking-bolt and permit the bolts to be drawn.

Referring to the drawings, A^3 represents an

ordinary safe, and D the door thereof, shown closed in Figs. 1, 2, and 3, with the bolts in place.

O is a spindle of conical form, such as is in common use in safe-locks, and has on its exterior end the usual numbered combination-dial, Q, with the knob K for manipulating it. On its inner end is screwed and keyed a disk, D^4. The spindle O extends through this disk, as shown in Fig. 8, into a concentric cylindrical bearing, which latter is integral with a yoke, Y, securely attached by screws X' X' to the inner surface of the door. Before this yoke is put in place the disks D' D^2 D^3 are slipped onto this concentric bearing-extension, the inner one, D', abutting snugly against the yoke Y, but free to turn on said bearing. A spacing-washer, U, Fig. 12, is then slipped on the bearing, its spline *g* fitting in a groove adapted to it, as seen in Fig. 9, thus abutting against disk D', separating it from the succeeding disk D^2, which is now slipped on the concentric bearing, followed by another spacing-ring U, and finally disk D^3, against which abuts a flat ring or washer held in place by a steel open ring, U'. (Seen in Fig. 13 and in places in Fig. 8.) Each of these disks D^4, D^3, D^2, and D' is provided with a pin, P, on its left-hand lateral face, which is free to rotate in a groove, K, of the next left-hand disk and to take against a lug, L', on ring R, journaled loosely on an inwardly-extending portion of said disk, (see Figs. 8, 9, 10, and 11,) and thereby pick up said next left-hand disk and cause it to rotate in the same direction as the preceding disks, so that after the knob K has been rotated three or more times in either direction successively all of the disks will be mechanically connected together, and will therefore rotate together, and all the numbers 1 1 1 1 on said disks will be in line. (See Fig. 8.)

It will be observed that the notches K^2 of disks D^3 D^2 D' (see Figs. 9 and 10) are respectively three times as wide as lugs L' or pins P. This is for the purpose of bringing all of the contact-plates on the disks always to the zero-point on rotating spindle O continuously three or more times in either direction and stopping with dial Q at zero. These features, however, embracing the matter of collecting the disks, are not novel with me, being well known to those skilled in the art, and are only explained briefly here to enable one to make the complete apparatus.

Upon each disk D' D^2 D^3 D^4 is rigidly fixed an insulating-ring, J, of hard gutta-percha, glass, asbestus, or other material which is a good electrical insulator, and will also withstand extreme heat in case of fire. Upon the exterior surface of these rings is inlaid a series of electrical conducting-plates, 1 2 3 4 5, &c., in this instance twenty on each disk, corresponding exactly with the numbers found on the exterior dial, Q, as shown in Figs. 1, 8, and 9.

It will be observed that each plate consists of two parts electrically insulated from each other by screw-holes, and that electrical contact between these parts is made by screws, as shown in Fig. 8, screw-holes being provided between each pair of plates, into which screws 1' 2', &c., may be placed when it is desired to change the combination.

Instead of double plates separated by screw-holes, as shown, each disk may be provided with a continuous metal ring or band on one side and contact-plates on the other, separated, as before, by screw-holes. Upon this ring or band and the plates, or upon the double sets of contact-plates, as described, rests a series of contact-springs, S S' S^2 S^3 S^4, held firmly in sliding contact therewith by screws extending into a block of insulating material, G', similar to that which composes the rings J, and firmly secured to the yoke Y, as shown in Figs. 8 and 9. The two end springs, S S^4, are single, while S', S^2, and S^3 are of double form, for a purpose which will be hereinafter described.

This constitutes all of the apparatus for making the combinations, a complete electrical circuit being made when the combinations are found from the generator M, Fig. 14, by wire *w*, magnet M', wire *w*, springs S S' S^2 S^3 S^4, disks D D' D^2 D^3 D^4 by the proper metal plates and screws thereof, as will be hereinafter described.

I will now proceed to describe the bolt mechanism and the apparatus for releasing the same, together with the generator, circuit-connections, and mechanism for drawing the bolts.

Referring now to Figs. 2, 3, 4, 5, and 6, Z represents a crank on the outside of the safe, attached to a spindle or shaft, O', similar in form to spindle O. (See Figs. 2, 4, 5, and 14.) The double function of this crank and spindle is to rotate the armature of the magneto-generator M and to draw the bolts when the draw-bolt has been released. The armature is rotated by the pinion *o* and cog-wheel C, the latter keyed to sleeve W, which sleeve fits round the extended end of spindle O', and is connected thereto by a well-known form of locking-ratchet, I, and pawl *p*, the ratchet I being attached directly to the shaft or spindle O' and the pawl *p* to sleeve W by an arm, as shown clearly in Figs. 2 and 5. This magneto-generator M may be of any well-known type which gives straight or direct currents such as will energize an electro-magnet, and is attached to the door of the safe by screws, as shown.

Z' Z' are the commutators for changing alternating currents to direct currents, in a manner well understood by electricians.

B' is a draw-bolt pivotally fixed to the bolt-frame B^2 at or near its center of gravity by a pin or bolt, *c*. It is provided near its center with a notch, N', into which the lug F on shaft O' is adapted to take when said shaft is rotated to the left and the draw-bolt is down in the position shown in Fig. 6. The extreme right-hand end of draw-bolts B' (see Figs. 5 and 6) is made sufficiently heavy to act as a

counter-balance to the other end thereof, so as to relieve the armature-lever A from undue pressure when this latter end of said lever is held up by said armature-lever. It should not, however, be sufficiently heavy to entirely overbalance said left-hand end, which bolt should, when released, fall down by its own weight into the position shown in Fig. 6.

M′ is an electro-magnet attached to frame G, and has two armatures, A′ and A^2, the united function of which is to lock the draw-bolt B′ in its upper position, as shown in Fig. 5, so that as long as it remains in this position, no matter in which direction the crank Z may be turned, the lug F, attached to shaft O′ and rotated therewith by said crank, cannot take in notch N′, and hence the bolts cannot be drawn until said draw-bolt is permitted to fall down, as shown in Fig. 6; nor can they be forced back in any other way, inasmuch as the draw-bolt B′ is firmly held by the locking-armatures in the notch N, which is a part of frame G, attached also to the door by bolts, as seen in Figs. 5 and 6. The armature A^2 acts as a locking-lever to A′, so as to make the whole more secure; but it may be omitted, if desired.

L is a bell-crank lever pivoted to the frame G, having a hook, *h*, on its lower arm, and a roller, *r*, on the upper arm, against which the draw-bolt B′ falls when down, so as to cause said bell-crank lever to hook up and retain the locking-armature A^2, for a purpose which will be hereinafter described. Armature-lever A, carrying armature A′, is provided with the usual back-stop, and both it and armature A^2 have the customary retaining springs, although, if desired, adjustable weights may be used instead of the springs S′ S^2 S^3, such weights being well-known equivalents of springs for retaining or withdrawing the armatures of electro-magnets and similar purposes.

H H′ are openings through the armature-lever A—H to permit the draw-bolt B′ to pass through said lever when the bolts are being drawn, and H′ to permit the locking-armature A^2 to pass through said armature-lever A when both armatures are drawn up on energizing magnet M′.

In Fig. 14 I have shown a battery, B A, on the outside of the safe, having one binding-post, *b′*, attached to the zinc pole thereof, and a circuit-connection through the safe-door to an interior binding-post, *a′*, by a wire, a^2, (shown in dotted lines,) and the other or copper pole connected to another binding-post, *b*, fixed directly to the door, and thereby put in metallic connection with binding screw w^2 on the inner side of the safe. This arrangement is merely precautionary to avoid all possibility of a failure on the part of the magneto-generator, which latter may also be arranged on the outside of the safe, if desired, and all the mechanism necessary for rotating its armature may be similarly located, its commutators Z′ Z′ being connected directly to binding-posts *b b′*, thus having only the bolt drawing lug F on shaft *o′* in connection with the draw-bolt, the bolts, circuits, and combination mechanism inside the safe.

The wire from battery B A to binding-post *b′* may go inside the safe between the door and its jamb, but must in every instance be carefully insulated with some non-combustible material—as glass, clay, or asbestus. In this connection I would add that the entire wire-circuit, including that embracing magnet M and armature of the magneto-generator M′, should be insulated with such fire-proof material, so as to withstand extreme heat in the event of fire, and if a dynamo is used its armature and field-magnets should be wound with the same kind of insulated wire.

I prefer to wind the magnet M′ in its construction in layers of wire running always in the same direction—that is, by winding on its core a layer of wire, say, from left to right, and then returning to the starting-point by carrying the wire back parallel to the core, or at right angles to the first layer, and then winding again from left to right, and so proceeding until the magnet is complete. Such a magnet is much more powerful than magnets as ordinarily wound. This feature, however, is not novel with me, and I lay no claim to it.

I will now describe the mode of operation. The combination by which the safe is to be unlocked having been selected by inserting the metallic combination-screws 1′ 2′ 3′ 4′ in the desired screw-holes in disks D′ D^2 D^3 D^4, respectively, Figs. 8 and 9—as, for example, 1′ in plate 2 for disk D′, 2′ in plate 6 for disk D^2, 3′ in plate 10 for disk D^3, and 4′ in plate 14 for disk D^4—and the door of the safe having been closed, with the bolts thrust into position, I will disclose how the safe may be unlocked. Turn knob K several times to the left, not less than three or four, and stop with the index of dial Q indicating 2, the plates of the several disks having been aligned so as to be in line with corresponding numbers on said disks Q. This will bring all of the plates 2 under their springs S S′ S^2 S^3 S^4, and spring S will be in electrical contact with said plate 2, as will also the left-hand half of spring S′. Now turn the knob K slowly to the right two complete revolutions and such a fraction of a revolution as will bring the index of dial Q to indicate the number 6. This will bring plate 6 under the second half of spring S′ and the first half of spring S^2, the disk D′ having remained stationary during this second part of the operation. The electrical circuit is now found to be complete from spring S by plate 2, screw 1′, first half of spring S′, second half of spring S′, plate 6, screw 2′, and first half of spring S^2. D^2 now remains stationary as well as D′. Now turn to the left one complete revolution and advance until the dial of Q indicates 10, when plates 10 will be placed under the second half of spring S^2 and the first half of spring S^3, and the circuit will be completed through said openings and screw 3′, (not shown,) D′ D^2 D^3 now remaining stationary. Finally turn knob K to the right until the index indicates 14,

and plate 14 will now be under the second half of spring S^3 and the single spring S^4, the circuit being complete through said springs, plates, and screw-plug 4′ (not shown) to wire w', Fig. 14, post w^2 by metal of safe door, to binding-post w^3, wire w^4, to commutator Z', through the armature of the magneto-generator, to second commutator Z' by wire w, binding-post a', magnet M′, wire w, to starting-point S, so that if said magneto-generator is rotated or the poles of battery B A are attached to binding-posts b b' a current of electricity will be set up and magnet M′ energized.

To operate the magneto-generator the operator turns the crank Z, attached to spindle O′, Figs. 1, 2, 4, and 14, so as to rotate cog-wheel C and lug or arm F on said shaft in the direction of the arrows. Cog-wheel C meshes with a pinion, o, fixed to the armature of the magneto M, and the rotation thereof generates a current of electricity in magnet M′, thereby causing the armatures A′ A^2 to be drawn up, and allowing the draw-bolt B′ to drop into the position shown in Fig. 6 and cause the bell-crank lever L to lock or hook up the locking-armature A^2, as shown, so that when the generator is stopped said armature will not lock the first-named armature-lever A, and thereby prevent the draw-bolt B′ from being returned to the position shown in Fig. 5, until the end of said draw-bolt has been brought into direct contact with the beveled shoulder of the lever A and forced it back against the tension of spring S′, as will be hereinafter more fully explained. The draw-bolt being now in position shown in Fig. 6, and the generator stopped with the crank Z in such position that lug or arm F is out of direct contact with draw-bolt B′, the operator reverses the rotation of said crank and turns slowly until lug or arm F strikes notch N′ in the draw-bolt. The back ratchet, now failing to rotate the generator, slides freely under pawl P, and the draw-bolt B′ is forced back by lug F, carrying with it the bolt-frame B^2 and bolts B, the left-hand end of said draw-bolt B′ passing now through the opening H of armature-lever A (see Figs. 5, 6, and 7) a sufficient distance to allow the bolt-frame and bolts to come in contact with frame G and stop further rotation, but not far enough to release the lug or arm F on its continued rotation in the direction indicated. The door may now be opened.

To close the safe, first close the door, and then turn crank Z, and hence lug F, one complete revolution in the direction indicated by the arrows, Fig. 14, so that lug F shall leave the notch N′ and be brought in firm contact with the bolt-frame B^2. This will force the bolt-frame B^2, and with it the bolts B, into position, and as lug or arm F continues its rotation and draw-bolt B′ is drawn out of the opening H it will come into contact with said draw-bolt and lift it, thereby bringing the free end thereof into direct contact with the bevel-shoulder of the locking armature-lever A, forcing it toward the pole of magnet M′, and at the same time allowing the bell-crank lever L to release the second locking-armature A^2, but not until the first lever has been forced sufficiently near to the magnet to preclude lever A^2 from falling into the locking position. When the lug F lifts draw-bolt B′ to its extreme height into notch N, both armatures are drawn back by their springs S′ S^2, and the draw-bolt is secured, as shown in Figs. 5 and 14, and the bolts are thrust into place and cannot be drawn until the combination is again formed, it being presumed, of course, that the combination already found was destroyed by turning knob K in either direction, as is usual in existing combination-locks. The whole of this mechanism on the inside of the safe is inclosed in a metal case hinged to the door and accessible only when the door is opened, so that the combination may be changed at pleasure or the parts oiled, if desired. Such a case is shown in section about the mechanism in Fig. 2.

The wires w, constituting the circuit, should, in addition to their non-combustible insulation, be covered with metal strips or other equivalent means to secure them against being tampered with by unauthorized persons when the door is open.

I will now recite some of the advantages which my invention possesses over existing combination-locks.

First. By means of its peculiar construction and of the fact that no intimations can be had at any time during the process of seeking the combination of any of the numbers which make up said combination, I provide a lock which no expert can pick. In all of the existing locks with which I am familiar a burglar can select the numbers of the combination by the sense of touch or hearing, and, having once determined the location, he can easily pick the lock. With my lock this is impossible, as no indication can in any way be had of the numbers until the complete combination is set up.

Second. I utilize one more number or combination-disk than any lock known to me, as in well-known forms of locks one disk, D^4, is utilized to mechanically draw the tumbler, while I use said disk as an additional combination-disk, thus getting increased security with four disks.

Third. The bolt-drawing shaft or spindle in ordinary safes is mechanically connected to the bolt-frame B^2 in such manner that a burglar can wrench it off, while in my lock it is only mechanically connected after the combination is found, it being perfectly free to turn in both directions, the same as the combination-spindle, after the safe is locked.

I am well aware that it is not new with me to operate or control the bolts of safes by a battery-generator of electricity, nor to control the circuit to a bolt-controlling electro-magnet within a safe by two combination-spindles extending through the safe-door, each spindle governing an independent set of contacts in a circuit containing the bolt-controlling magnet,

and I make no claim to such features. I believe, however, that it is new with me to combine with a safe-lock electrical circuits, bolt-controlling magnets, and a dynamo or magneto generator, the circuits being controlled by combination mechanism, and I lay special stress on using such a generator with a safe, in that it can be controlled from the exterior of the safe and will not be destroyed by fire, as would an ordinary voltaic battery on extreme heat.

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

1. A combination-lock consisting of a series of combination-disks, a spindle carrying said disks, electrical contact-plates on the disks, contact springs or surfaces bearing on said plates successively as the disks are rotated, and an electrical circuit embracing an electrical generator and electrical mechanism for controlling the bolts, substantially as described.

2. In a combination-lock, an electrical circuit normally open at two or more points, a spindle carrying disks with contact-plates, the number of disks being equal to the number of normally-open points in the circuit, an electro-magnet in the circuit, and means, substantially as described, for controlling the bolts of a safe or vault.

3. In an electrical combination-lock, a normally-open circuit and bolt-controlling mechanism in said circuit, in combination with a magneto or dynamo generator, all of said parts located wholly within the safe, substantially as described.

4. In a combination-lock, an electrical circuit normally open at two or more points, a spindle and means for controlling the circuit at said points, and an electro-magnet or equivalent device in said circuit, with means for locking the bolts, the whole being under control of an operator at the outside of the safe or structure to be protected.

5. In a safe-lock, a spindle for withdrawing the bolts, a draw-bolt for aiding said spindle in the withdrawal of the bolts, and a locking-lever for holding said draw-bolt out of the path of the spindle, substantially as described.

6. In an electro-magnetic safe-lock, a magneto or dynamo generator located wholly within the structure to be protected, a spindle geared to the armature of said magneto or dynamo generator, means for withdrawing the bolts lying normally out of the path of an arm on said spindle, and an electro-magnet with an armature adapted to control the bolt-drawing apparatus, substantially as described.

7. In an electrical safe-lock, a series of disks for controlling the continuity of a single circuit normally open at a series of points equal in number to the number of disks, a series of contact-plates on said disks equal in each instance to double the number of numbers on the dial of the combination-spindle, means at selected points of each disk for electrically connecting two of the plates, and springs bearing on said disks and plates for completing the continuity of the circuit, in combination with an electrical generator and electro-magnetic mechanism for controlling the bolts, substantially as described.

8. In an electrical safe-lock, a single spindle carrying two or more disks with contact-plates, electrical connections, as described, and electro-magnetic means for controlling the bolts, substantially as described.

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