

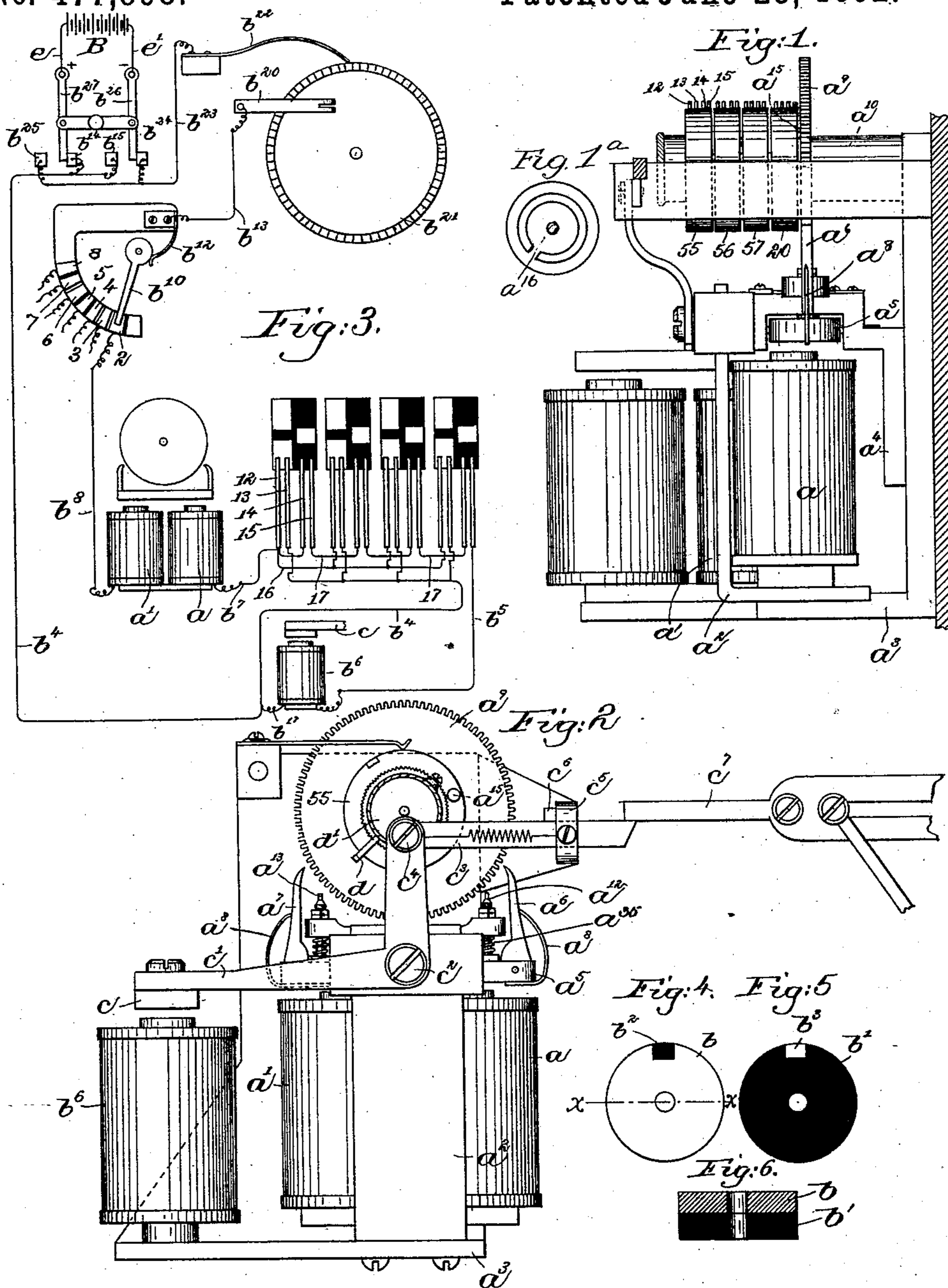
(No Model.)

2 Sheets—Sheet 1.

W. H. HOLLAR & F. S. HOLMES.  
ELECTRIC LOCK.

No. 477,898.

Patented June 28, 1892.



Witnesses.  
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Frank L. Ewing.

Inventors:  
William H. Hollar,  
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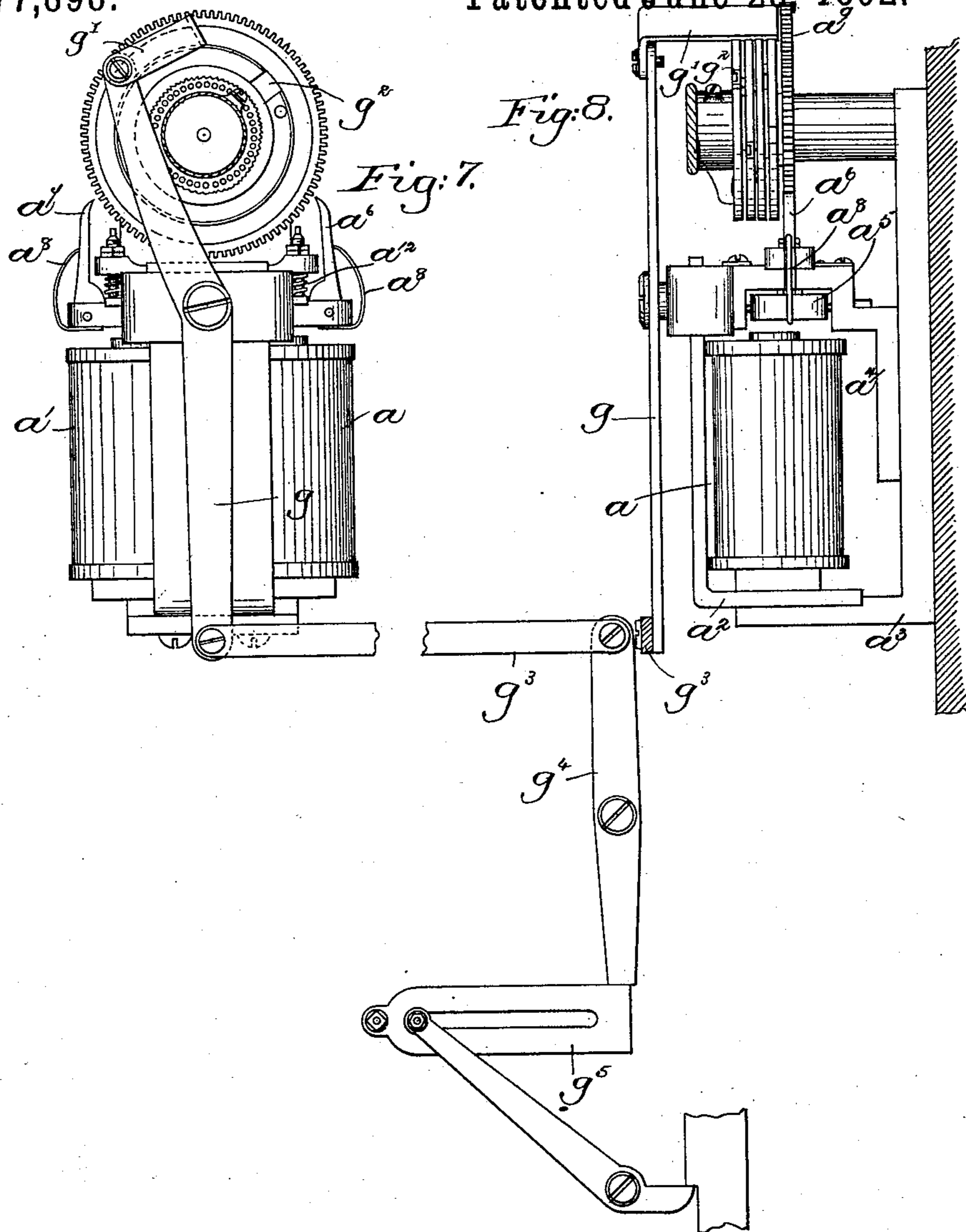
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# UNITED STATES PATENT OFFICE.

WILLIAM H. HOLLAR, OF ELIZABETH, NEW JERSEY, AND FREDERICK S. HOLMES, OF MALDEN, MASSACHUSETTS, ASSIGNORS TO JAMES W. TORREY, OF MERCHANTVILLE, NEW JERSEY.

## ELECTRIC LOCK.

SPECIFICATION forming part of Letters Patent No. 477,898, dated June 28, 1892.

Application filed February 3, 1890. Serial No. 338,956. (No model.)

*To all whom it may concern:*

Be it known that we, WILLIAM H. HOLLAR, of Elizabeth, county of Union, State of New Jersey, and FREDERICK S. HOLMES, of Malden, county of Middlesex, State of Massachusetts, have invented an Improvement in an Electrically - Actuated Combination - Lock and Method for Operating the Same, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

This invention has for its object to provide a novel apparatus and method for controlling combination-locks, such as employed in securing safes or other receptacles.

Our invention consists, essentially, of a series of tumblers, a bolt-locking lever or device operatively controlled by said tumblers, a ratchet-wheel to control the position of the said tumblers, combined with an electro-magnet, its armature, and a pawl or pawls to operate said ratchet-wheel, substantially as will be described.

Other features of our invention will be pointed out in the claims at the end of this specification.

Figure 1 is a side elevation of one form of electrically - actuated combination - lock embodying our invention. Fig. 1<sup>a</sup> is a detail view; Fig. 2, a front view of the lock shown in Fig. 1, looking toward the right; Fig. 3, a diagram of circuits to more clearly illustrate the operation of our apparatus; Figs. 4, 5, and 6, details to be referred to, Fig. 6 being a section on line *x x*, Fig. 4; Fig. 7, a front elevation of a modified form of combination-lock; Fig. 8 a side elevation of the lock shown in Fig. 7.

In accordance with our invention each safe or other receptacle has located within it an electro-magnet, preferably a polarized electro-magnet of any usual or well-known construction, it being herein shown as made of two coils *a a'* and a permanent magnet *a<sup>2</sup>*, to one part of which is secured the said coils.

The polarized electro-magnet is herein shown as secured to a frame *a<sup>3</sup>*, (see Fig. 1,) having secured to or forming part of it a bracket *a<sup>4</sup>*, to which is pivoted the armature

*a<sup>5</sup>*, provided at its opposite ends with pawls *a<sup>6</sup> a<sup>7</sup>*, pivoted on said armature and normally forced forward by springs *a<sup>8</sup>*. The pawls *a<sup>6</sup> a<sup>7</sup>* are adapted to engage the teeth of a ratchet-wheel *a<sup>9</sup>*, mounted on a stud *a<sup>10</sup>*, projecting from the frame *a<sup>3</sup>*, and the said armature is kept in its normal position with the pawls out of engagement with the said ratchet-wheel by a suitable spring or springs *a<sup>11</sup>*, it being herein shown as normally maintained in its central position by spring-actuated rods or bars *a<sup>12</sup> a<sup>13</sup>*, constituting a centering device for the said armature, and at the same time a locking device for the ratchet-wheel, as will be described.

The ratchet-wheel is loose on the stud *a<sup>10</sup>* and is provided, preferably, with a stud or pin *a<sup>14</sup>*, extended into a recess or groove on one face of a tumbler loose on the shaft *a<sup>10</sup>* and marked 20 in Fig. 1, there being four tumblers herein shown. The tumbler 20 has a shoulder *a<sup>15</sup>*, Fig. 1<sup>a</sup>, against which the pin *a<sup>14</sup>* is brought into contact by the rotation of the said ratchet-wheel. The remaining tumblers are provided in similar manner with studs and grooves; but we do not desire to limit ourselves to this specific form of tumbler, as any other usual or well-known form may be employed.

Each tumbler is herein shown as made in two parts, preferably, as disks *b b'*, the disk *b* being of metal and provided with a socket or notch containing insulation *b<sup>2</sup>*, and the disk *b'* being of insulating material and provided, as shown, with a block *b<sup>3</sup>* of metal.

Each tumbler has co-operating with it preferably four wipers or contact-brushes 12, 13, 14, 15, (see Figs. 1 and 3,) the wiper 12 of the first tumbler being connected by wire 16 (see Fig. 3) to the wiper 12 of the remaining tumblers, and the wiper 13 of the first tumbler is connected to a wire *b<sup>4</sup>*, herein represented in Fig. 3 as joined to the poles *b<sup>14</sup> b<sup>15</sup>* of a pole-changer forming part of a transmitting apparatus, substantially such as shown and described in the Letters Patent No. 438,236, dated October 14, 1890. The wiper 15 of the first tumbler is connected to the wiper 14 of the second tumbler by wire 17, and so on, as

clearly shown in Fig. 3, the wiper 15 of the last tumbler being connected by wire  $b^5$  to an auxiliary electro-magnet  $b^6$ , joined by wire  $b^{17}$  to the wire  $b^4$ .

5 The magnet  $a$  of the polarized electro-magnet is shown in Fig. 3 as connected by wire  $b^7$  to the wiper 12 of first tumbler and the magnet  $a'$  by wire  $b^8$  to one strip 2 of a series of strips (marked 2 to 8, inclusive,) and constituting a commutator, with which co-operates a switch-lever or brush  $b^{10}$ , electrically joined by spring  $b^{12}$  and metal arm  $b^{20}$  to a break-wheel  $b^{21}$ , with which co-operates a pen  $b^{22}$ , connected by wire  $b^{23}$  to the poles  $b^{24}$   $b^{25}$ , with which co-operate the levers  $b^{26}$   $b^{27}$  of a pole-changer connected to a battery B, substantially as in an application, Serial No. 338,954, filed by us February 3, 1890, to which reference may be had.

20 The auxiliary magnet  $b^6$  has its armature  $c$  operatively connected to the bolt-operating mechanism, which may be of any desired or usual construction, it consisting, as herein shown, of an elbow-lever  $c'$ , (see Fig. 2,) pivoted, as at  $c^2$ , and a bar or rod  $c^3$ , pivoted to said lever, as at  $c^4$ , the said rod or bar being shown in Fig. 2 as supported by a suitable guide  $c^5$  and provided with a suitable shoulder  $c^6$ , normally abutting against the guide  $c^5$  and constituting a stop for the outward movement of the rod  $c^3$ , the end of the rod  $c^3$  being extended into the path of movement of the rod  $c^7$ , which may be supposed to be connected with the bolt-work of the safe.

35 As represented in Fig. 3, the commutator or switch is supposed to control the unlocking of seven safes or vaults, there being seven circuits connected to the commutator-strips, the wire  $b^4$  forming a common return for all the said circuits. Each circuit contains a polarized electro-magnet for operating the tumblers, which when in position form a circuit either in series or in shunt with the first circuit for operating the lever controlling the bolt mechanism.

45 The combination of all the locks in all the circuits may be alike or the said combinations may be unlike.

The operation of the apparatus is as follows, viz: The operator closes the circuit of the safe or vault with the commutator-strip connected in circuit with said safe, which, as represented in Fig. 3, is the strip 2. The break-wheel  $b^{21}$  is then set in motion by any suitable clock-work mechanism. (Not shown.) When the clock mechanism referred to is started, the levers  $b^{26}$   $b^{27}$  of the pole-changer are represented as brought in engagement with the poles  $b^{24}$   $b^{25}$  and the circuit of the polarized magnets  $a$   $a'$  is closed, the magnet  $a'$  in this instance attracting its armature and engaging the pawl  $a^6$  with the ratchet-wheel  $a^9$  and rotating it one tooth. The circuit of the coils is broken as a tooth of the break-wheel passes out of contact with the pen or brush  $b^{22}$ , and at each break in the circuit the armature  $a^5$  is restored to its normal or central position by

the springs on the rods  $a^{12}$   $a^{13}$ . The break-wheel  $b^{21}$  continues to revolve in one direction until the ratchet-wheel  $a^9$  has been revolved 70 the requisite number of times to bring the stud or pin  $a^{15}$  on the first tumbler (marked 55 in Fig. 1) into contact with the arm  $d$ , (see Fig. 2,) secured to or forming part of a cap  $d'$ , fast on the shaft  $a^{10}$ . This position of the stud is indicated by a suitable pointer on the dial of a transmitting-instrument, as in Letters Patent No. 438,236, referred to. As soon as the stud or pin  $a^{15}$  comes in contact with the arm  $d$  the operator manipulates the pole-changer, as described in the said patent, to bring the levers  $b^{26}$   $b^{27}$  in contact with the poles  $b^{15}$   $b^{25}$ , the break-wheel at the same time being revolved in the opposite direction. With the levers  $b^{26}$   $b^{27}$  in contact with the poles  $b^{15}$   $b^{25}$  the magnet-coil  $a'$  is energized and the armature  $a^5$  attracted by the said coil and the ratchet-wheel  $a^9$  rotated in a direction opposite to that in which it was previously rotated, the circuit being traced 90 from the positive pole of the battery by wire  $e$ , lever  $b^{27}$ , pole  $b^{25}$ , wire  $b^{23}$ , brush  $b^{22}$ , wheel  $b^{21}$ , brush  $b^{20}$ , wire 13, spring  $b^{12}$ , switch-lever  $b^{10}$ , contact-strip 2, wire  $b^8$ , through the coils  $a'$   $a$ , wire  $b^7$ , wipers 12 13, wire  $b^4$ , pole 15, wire  $e'$  to the negative pole of the battery. As the break-wheel  $b^{21}$  revolves under the brush  $b^{22}$ , the circuit is broken, as described, and the ratchet-wheel  $a^9$  is intermittently rotated to move the tumblers until the pin of the second tumbler strikes the shoulder of the first tumbler 55, and so on. In this way the ratchet-wheel  $a^9$  is rotated in opposite directions a sufficient number of times to bring the metal block  $b^3$  of each tumbler in contact 105 with the pens or wipers 14 15 co-operating therewith, and as soon as the tumbler 20 has been revolved into such position that its metal block  $b^3$  remains stationary under the pens 14 15 the circuit of the auxiliary magnet  $b^6$  will be closed, the metal blocks of all the tumblers being at such time in contact with the pens or wipers 14 15.

The circuit of the auxiliary magnet may be traced as follows, (the levers  $b^{26}$   $b^{27}$  being in the position shown in Fig. 3:) from the positive pole by wire  $e$ , lever 27, pole 14, wire  $b^4$ , wire  $b^{17}$ , magnet  $b^6$ , wire  $b^5$ , wiper 15, block  $b^3$  of tumbler 20, wiper 14 to wiper 15 of tumbler 57 by wire 17, thence in a similar manner through all the tumblers to wipers 12 of tumbler 55, wire  $b^7$ , magnet-coils  $a$   $a'$ , wire  $b^8$ , contact-strip 2, switch-lever  $b^{10}$ , spring  $b^{12}$ , wire  $b^{13}$ , brush  $b^{20}$ , break-wheel  $b^{21}$ , pen  $b^{22}$ , wire  $b^{23}$ , pole  $b^{24}$ , lever  $b^{26}$ , wire  $e'$  to the negative pole of the battery. As soon as the circuit of the auxiliary magnet  $f^6$  is closed, which is effected when all the tumblers have been turned into such position that their metal blocks  $b^3$  are in substantially the same horizontal line and in contact with their co-operating wipers 14 15, the armature  $c$  of the said auxiliary magnet is attracted and the lever  $c'$  is turned on its pivot  $c^2$  and the rod  $c^3$  thus withdrawn away from

the rod or bar  $c^7$  of the bolt mechanism, thus leaving the latter free or unlocked, so that it will drop into position to permit the bolt mechanism to be operated and the door unlocked.

5 Instead of operating the bolt mechanism by means of an auxiliary magnet it may be operated mechanically, substantially as shown in Figs. 7 and 8, wherein the bracket  $a^4$  has  
10 pivoted upon it a lever  $g$ , having loosely pivoted to it at its upper end a bent arm or gate  $g'$ , extended over and so as to rest upon the peripheries of the tumblers. In this case each tumbler is provided with a notch  $g^2$ , and when  
15 the notches of all the tumblers have been brought into line with each other by means of the ratchet-wheel  $a^9$ , as above described, the arm  $g'$  falls by gravity into the said notches, and when the armature is again re-  
20 tracted all the tumblers are moved simultaneously by the ratchet-wheel in the direction to turn the lever  $g$  on its pivot and through the connecting-rod  $g^3$  operate the bolt mechanism  $g^5$ .

We claim—

25 1. In an electrically-actuated combination-lock, a series of tumblers loosely connected, a bolt-locking lever or device operatively controlled by said tumblers, a single ratchet-wheel controlling the said tumblers, combined  
30 with an electro-magnet, its armature, and a pawl or pawls to operate said ratchet-wheel, substantially as and for the purposes specified.

2. In an electrically-actuated combination-

lock, the combination, with a bolt-locking lever or device, of an auxiliary electro-magnet 35 and its armature, a series of electric-current-transmitting tumblers, a ratchet-wheel to control the position of said tumblers, an electro-magnet, its armature, and pawl or pawls for operating the said ratchet-wheel, an electric 40 circuit for carrying the current to operate said electro-magnet, and an electric circuit for carrying a current to operate the auxiliary electro-magnet, substantially as and for the purpose specified. 45

3. In an electrically-actuated combination-lock, the combination, with a bolt-locking lever or device, of an auxiliary electro-magnet and its armature, a series of electric-current-transmitting tumblers, a ratchet-wheel to control 50 the position of said tumblers, a polarized electro-magnet, its armature and pawl or pawls for operating the said ratchet-wheel, an electric circuit for carrying the current to operate said polarized electro-magnet, and an electric 55 circuit for carrying a current to operate the auxiliary electro-magnet, substantially as and for the purpose specified.

In testimony whereof we have signed our names to this specification in the presence of 60 two subscribing witnesses.

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FREDERICK S. HOLMES.

Witnesses:

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