(No Model.)

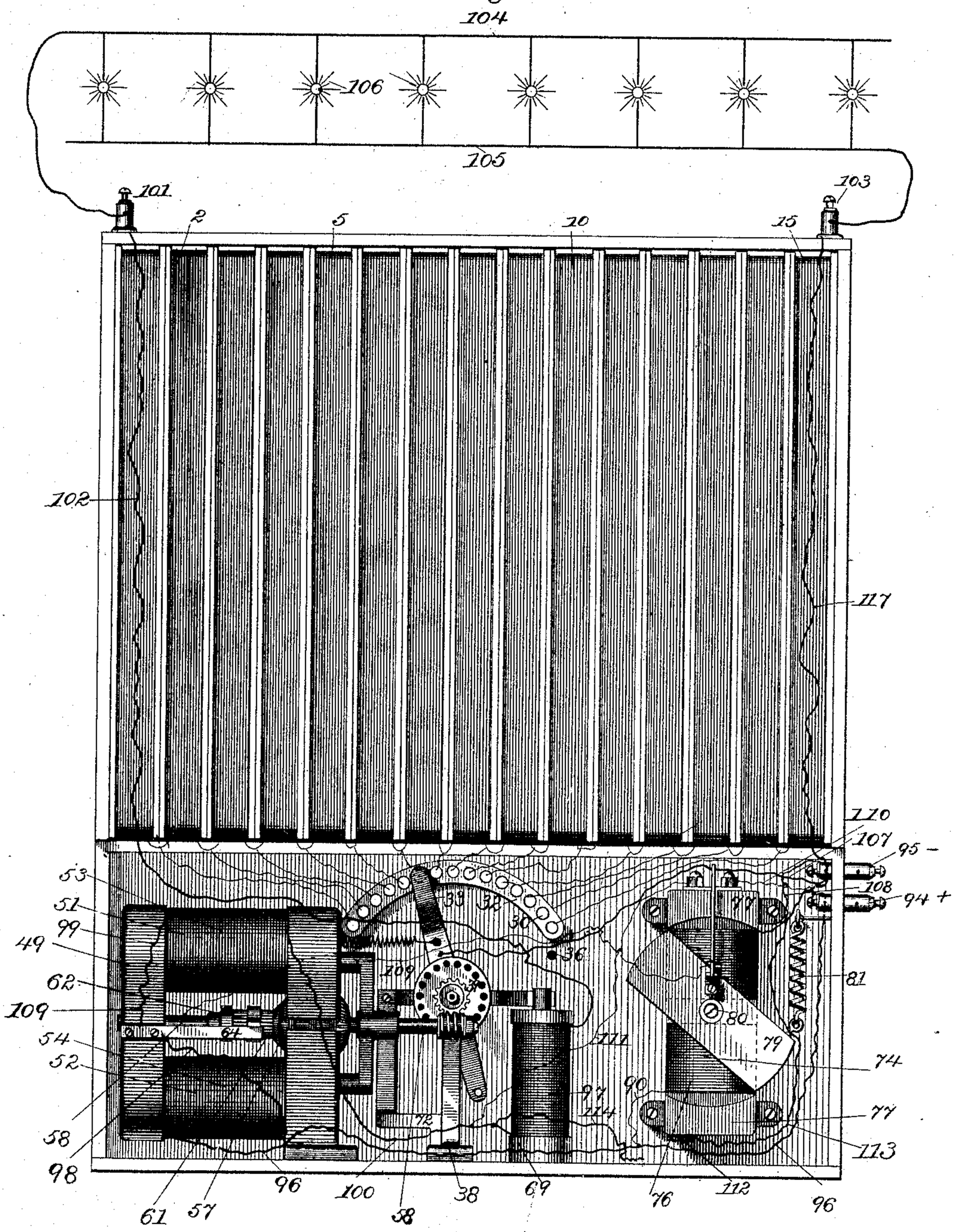
5 Sheets—Sheet 1.

R. H. MATHER.

ELECTRICAL DISTRIBUTER.

No. 354,606. Patented Dec. 21, 1886.

Fig. 1.



Witnesses

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(No Model.) 5 Sheets—Sheet 2.

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ELECTRICAL DISTRIBUTER.

No. 354,606. Patented Dec. 21, 1886.

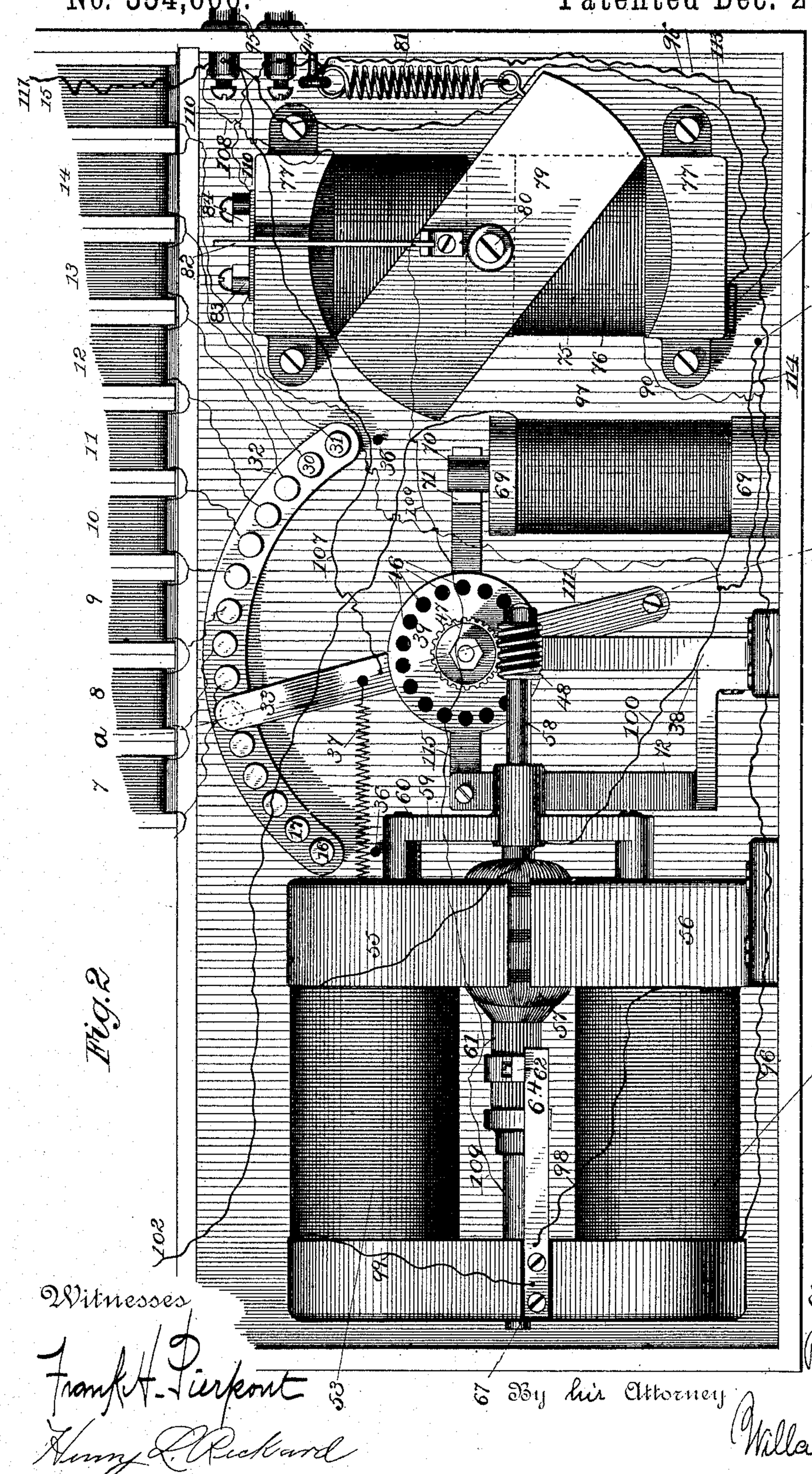

Fig. 2

Witnesses
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(No Model.) 5 Sheets—Sheet 3.

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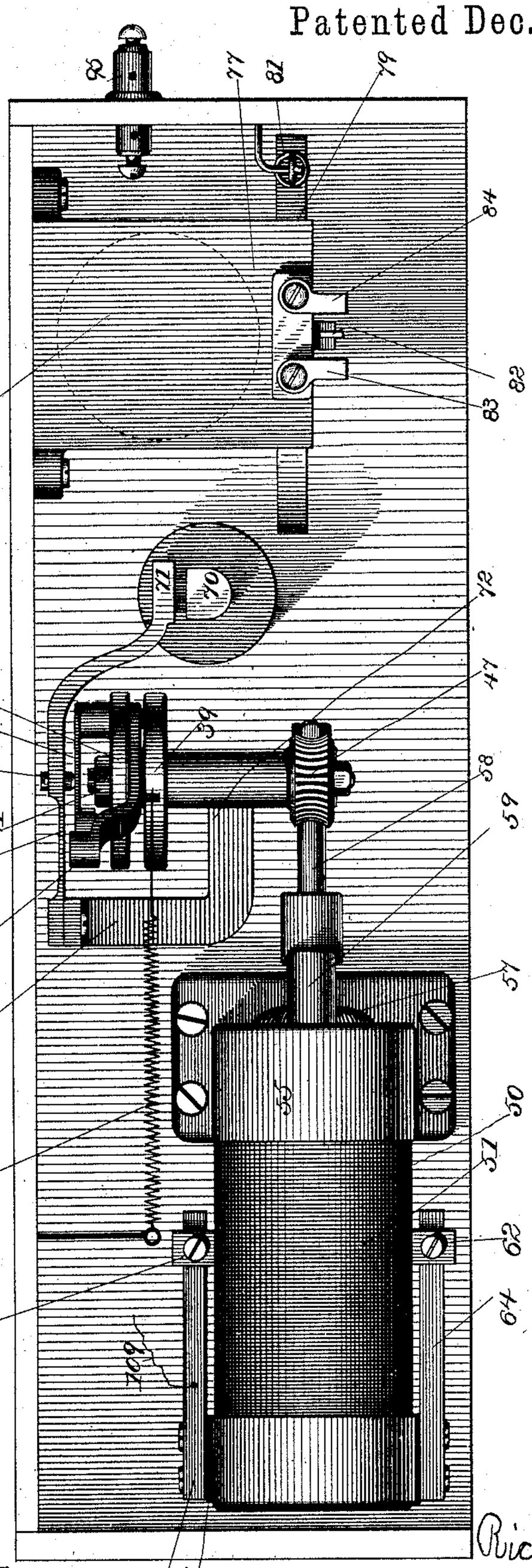
ELECTRICAL DISTRIBUTER.

No. 354,606. Patented Dec. 21, 1886.

Fig. 3



Witnesses

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(No Model.) 5 Sheets—Sheet 4.

R. H. MATHER.

ELECTRICAL DISTRIBUTER.

No. 354,606. Patented Dec. 21, 1886.

Fig. 5

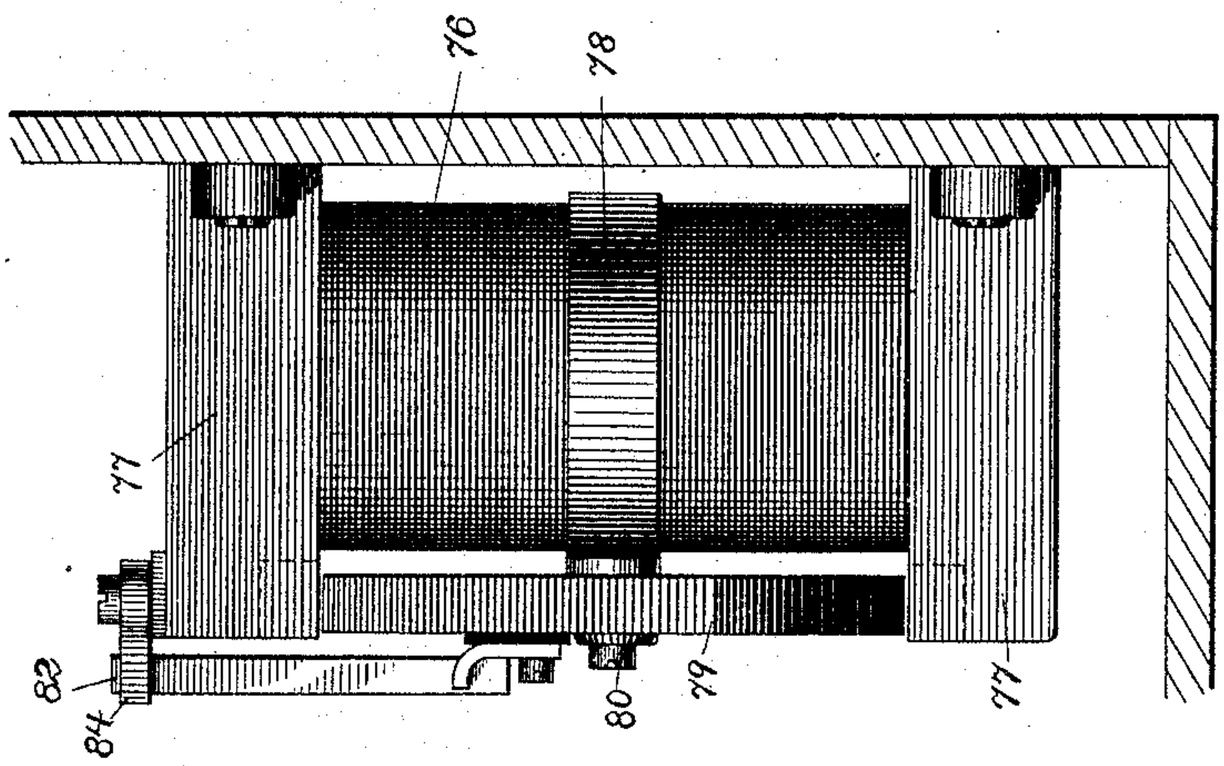
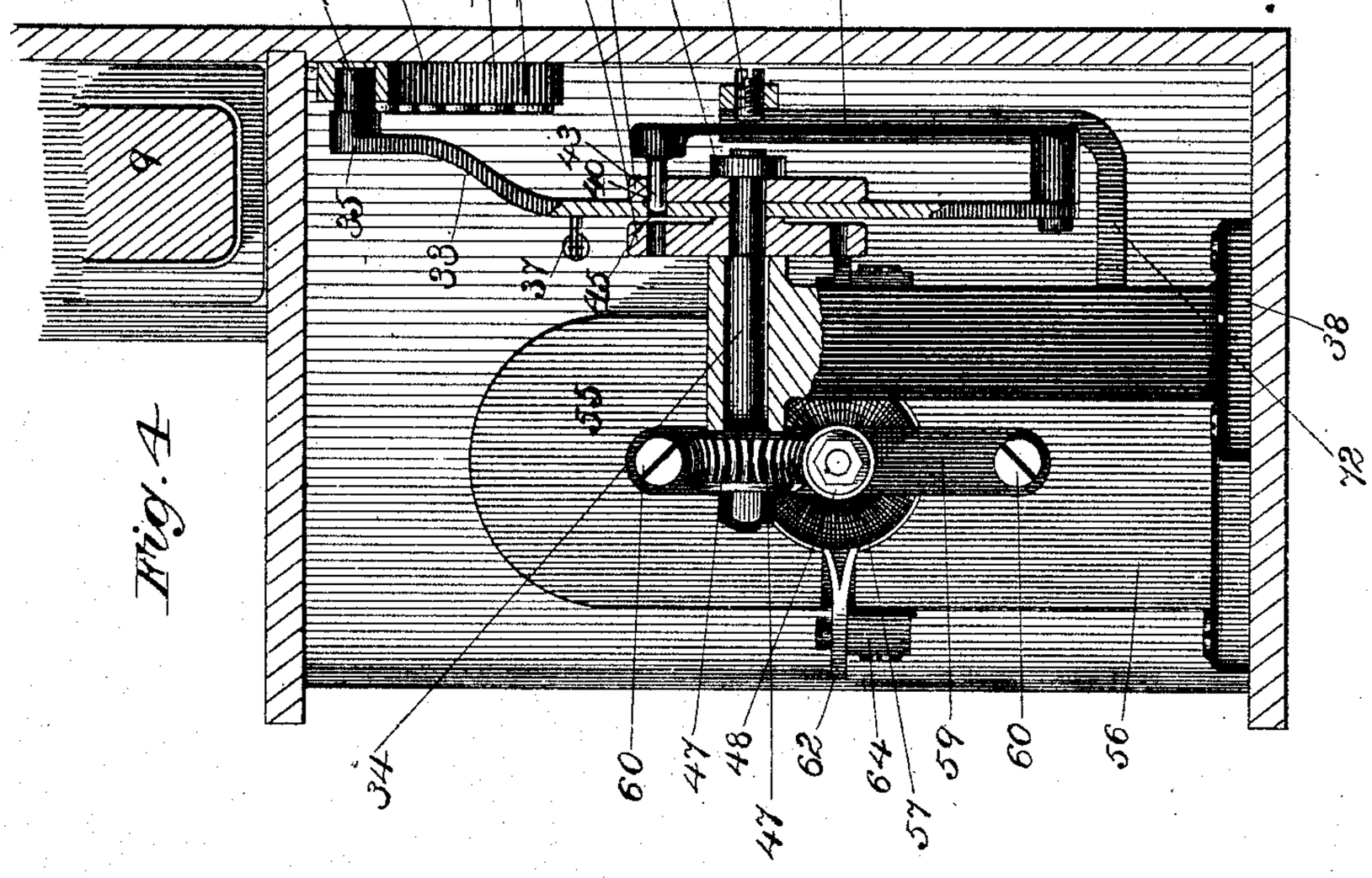


Fig. 4



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(No Model.) 5 Sheets—Sheet 5.

R. H. MATHER.

ELECTRICAL DISTRIBUTER.

No. 354,606. Patented Dec. 21, 1886.

Fig. 6.

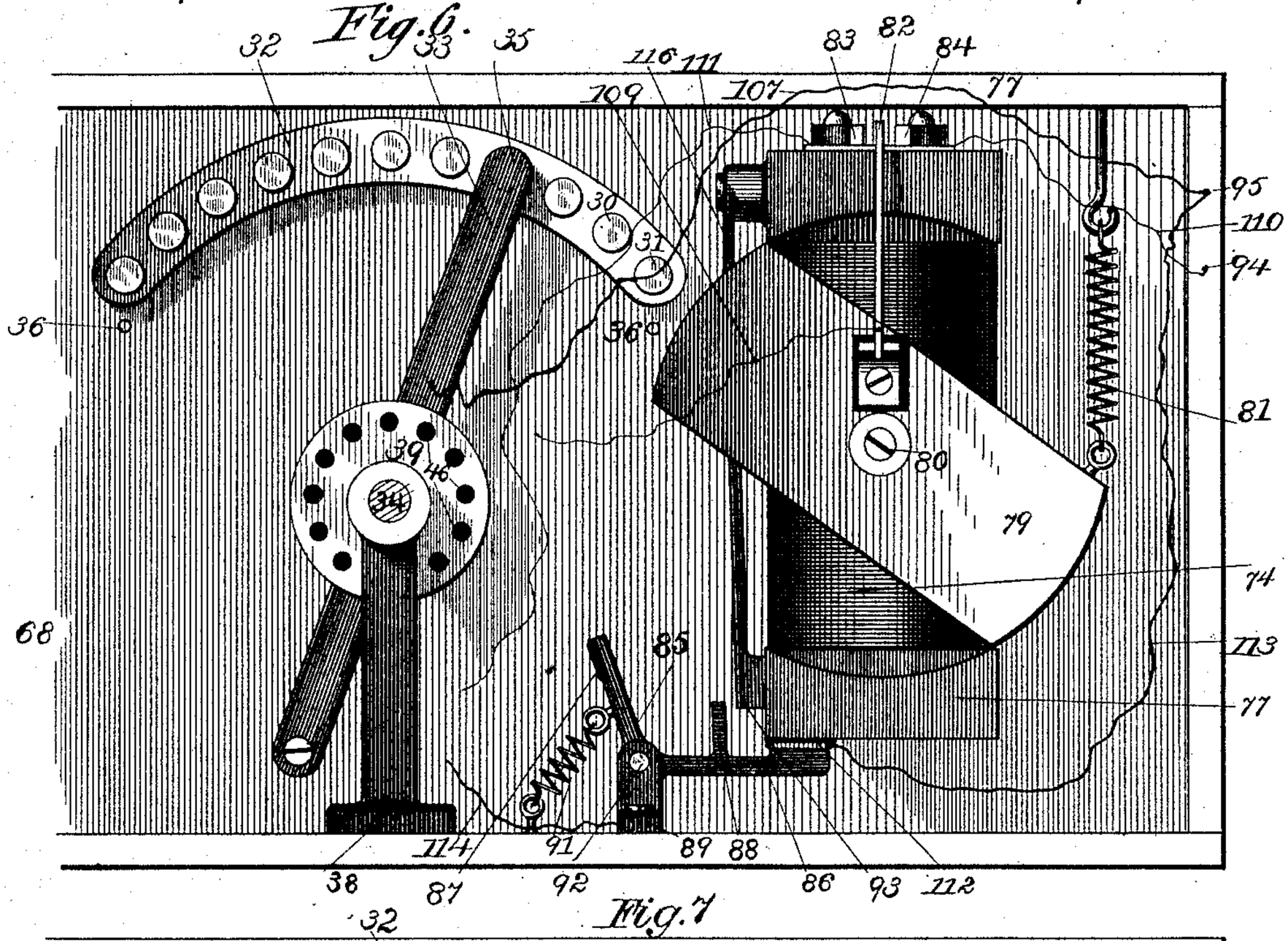
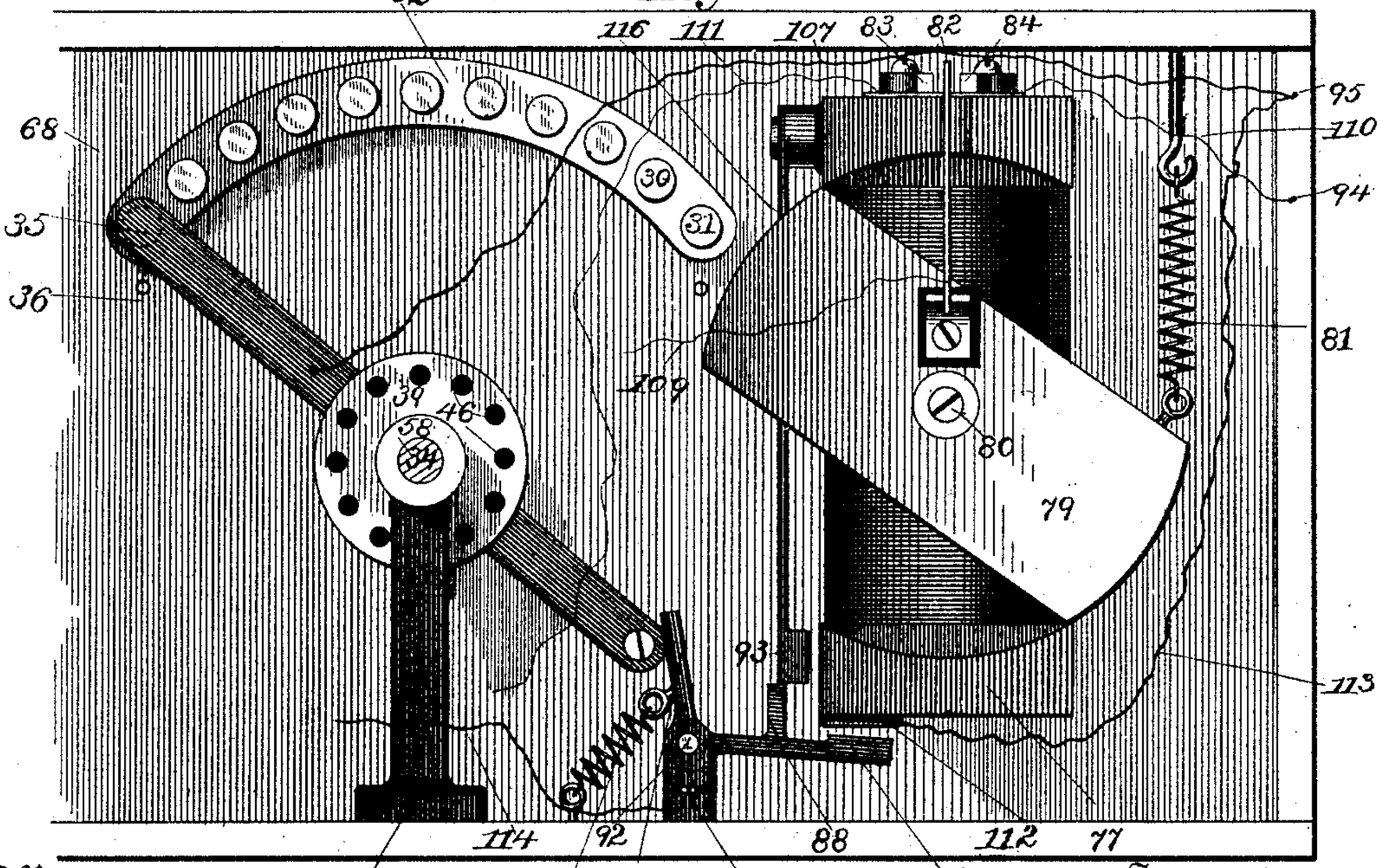


Fig. 7.



Witnesses

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UNITED STATES PATENT OFFICE.

RICHARD H. MATHER, OF WINDSOR, CONNECTICUT.

ELECTRICAL DISTRIBUTER.

SPECIFICATION forming part of Letters Patent No. 354,606, dated December 21, 1886.

Application filed July 15, 1886. Serial No. 208,070. (No model.)

To all whom it may concern:

Be it known that I, RICHARD H. MATHER, of Windsor, in the county of Hartford and State of Connecticut, have invented certain new and useful Improvements in Electrical Distributers, of which the following is a specification, illustrated by the accompanying drawings.

This distributer is designed to be inserted in an electric circuit of constant current for the purpose of producing in a second circuit, which is fed from the first, a constant electro-motive force.

In view of the fact that variable electro-motive force is in practice usually associated with constant current, and that constant electro-motive force is in like manner associated with variable current, this invention may be said to be designed to be inserted in an electric circuit of variable electro-motive force and constant current for the purpose of producing in a second circuit, which is fed from the first, a constant electro-motive force and variable current.

More particularly, the object of this invention is to facilitate the operation of incandescent lamps or other translating devices, which are arranged in parallel and require a constant electro-motive force in the same circuit or in a part of the same circuit with electric-arc lamps or other translating devices, which are arranged in series and require a constant current. This object I accomplish by connecting the lamps or other translating devices in parallel with an artificial resistance, which is automatically varied in proportion to the variable number of lamps or other translating devices which are in operation in such a manner as to preserve a constant resistance between the terminals of the distributer.

The principal features of said invention are a rheostat, an electric motor operating the same, an electro-mechanical movement for causing the engagement and disengagement of said motor with said rheostat, a relay controlling said motor, a short-circuiting device, and suitable connections and interconnections, as hereinafter explained.

Figure 1 in the drawings is a front view of my improved distributer with connections and with incandescent lamps in circuit, the cut-out being omitted. Fig. 2 is a front view of the distributer, omitting the cut-out and a portion of the resistances of the rheostat. Fig. 3 is a plan view of the same, the resistances and cut-out being omitted. Fig. 4 is a section on *a a* in Fig. 2. Fig. 5 is a side view of the relay-magnet. Figs. 6 and 7 are front views of the cut-out and contiguous parts, showing connections.

In the drawings, the numerals 1 to 15, inclusive, indicate the several resistance-coils of a rheostat, arranged in any convenient position, and connected in the usual manner with each other and with an equal number of brass studs or other contacts, 16 to 31, inclusive, which are arranged, for convenience, in the arc of a circle, and are countersunk or otherwise insulated in plate 32. The aggregate resistance of these coils is such as is involved in the operation of the distributer, as hereinafter explained, and the greater the number of said coils the smoother will be the action of the rheostat. Within reach of said studs a contact-arm, 33, is mounted loosely upon a central arbor, 34. This arm, which extends in both directions from arbor 34, is provided at one end with a suitable head or contact-surface, 35, which is movable over all said contact-studs successively, and is wider than the distance between any two adjacent studs, while the other end of said arm is utilized as a support for a parallel spring, 42, hereinafter described. Said arm is also provided with a spring, 37, which tends to hold the same in the position shown in Fig. 7. Two pins or other suitable stops, 36, are placed in such positions as to prevent arm 33 from passing off said studs in either direction.

Arbor 34 is mounted rotatably in a supporting-standard, 38, which is of any convenient form, allowing the arbor to extend in both directions from the standard. A perforated disk or collar, 39, is fixed immovably upon arbor 34, between standard 38 and arm 33. A second collar, 40, is fixed rotatably upon said arbor, between arm 33 and the adjacent terminal nut or fixed collar 41. A metallic spring, 42, supported, as above mentioned, from one end of cross-arm 33 in a position approximately

parallel thereto, is armed with a terminal pin, 43, which rests normally in the position shown in Fig. 4, partly in a hole, 44, through collar 40, and partly in a hole, 45, through arm 33. Pin 43 is capable of moving longitudinally in said holes 44 and 45, which are continuous with each other. The several perforations 46 through collar 39, are of the same diameter as holes 44 and 45, and are in such positions that each of said perforations may successively become continuous with holes 44 and 45 during a single revolution of collar 39. At the other side of standard 38 a worm-wheel, 47, is mounted upon arbor 34, and is immovable relatively thereto. Worm-wheel 47 is in constant engagement with a worm, 48. The latter is carried by the armature-shaft 58, hereinafter described, of a reversible electric motor, 49. This motor has a field-magnet, 50, consisting of two parallel limbs, 51 and 52, which are wound with coils 53 and 54, respectively, in the usual manner, while 55 and 56 are pole-pieces of said field-magnet, and are adjacent to armature 57. The latter is mounted in the usual manner upon shaft 58, which is journaled in magnet 50 and in yoke 59. This yoke is fastened to field-magnet 50 by bolts or screws 60 and 60.

The commutator 61 is mounted upon shaft 58 in the usual manner, between limbs 51 and 52 of magnet 50. Brushes 62 and 63, allowing the armature 57 to rotate in either direction, are held in proper positions of contact with commutator 61 by their respective holders 64 and 65, which are fastened to opposite sides of field-magnet 50 by bolts or screws 66, and are separated from that magnet by intermediate insulating-plates, 67 and 67. This motor is attached to any suitable frame or box, 68, containing or supporting the rheostat, already described. Attached to the same support is an electro-mechanical movement, which is designed to control the engagement and disengagement of said motor with said rheostat by locking together said perforated collar 39 and contact-arm 33, and by unlocking the same by means of spring 42 and pin 43. This movement consists of an electro-magnet, 69, wound with helix 97, and having a pole or pole-piece, 70, and an armature, 71, which is mounted upon a spring, 115. At a point remote from pole 70 this spring is screwed or otherwise firmly attached to a rigid support or standard, 72, in such a position that an adjustable contact-screw, 73, passing through spring 115, will at all times present itself to spring 42, and will deflect the same by pressure thereon whenever armature 71 is attracted into a position of contact with pole-piece 70. Attached to the same support is the relay-magnet 74, consisting of a spool or bobbin of soft iron, 75, upon which is wound in the usual manner the helix 76 of insulated copper wire. This helix is wound to that degree of electro-magnetic efficiency which is hereinafter specified. The ends of spool 75 are enlarged and extended in pole-pieces 77 and 77, which are cylindrically concave toward each other at the front side of magnet 74. Spool 75 is further provided with a central annular projection, 78, upon which the armature 79 is mounted between pole-pieces 77 and 77 by a central pivot or screw, 80.

Armature 79 is a magnetic plate, which is perforated in the middle for screw 80, and is rounded off at the ends upon the same cylindrical curve as are the concave surfaces, which are presented thereto by the pole-pieces 77 and 77. Armature 79 is provided with a spring, 81, which tends to turn the same upon pivot 80 away from pole-pieces 77 with a degree of force which is hereinafter specified. A strip of copper, 82, in a normal position parallel to the axis of spool 75, is mounted, in a rigid and insulated manner, upon armature 79. This copper strip is free to move laterally between two contacts or plates of conductive material, 83 and 84, whenever motion is imparted to armature 79. Contacts 83 and 84 are fastened upon one end of spool 75, on opposite sides of the normal position of strip 82, and at such a distance therefrom that one or the other of said contacts must be touched by said strip whenever the latter reaches a predetermined amplitude of deflection from its normal position. These contacts are insulated from spool 75 and from each other. The electro-magnetic efficiency of helix 76 and the traction of spring 81 are such relatively to each other that contact-strip 82 is held in equilibrium in the position shown in Figs. 1 and 2 whenever that helix is energized by a normal current; but it is deflected to a position of contact with one or the other of said contact-plates whenever the current energizing that helix is increased or diminished, as hereinafter described.

The best form of short-circuiting device which I have contemplated, in connection with the present invention, is shown in Figs. 6 and 7 in two several positions relatively to the contiguous parts of the invention, as already described. This device comprises a bent lever, 85, having a long arm, 86, a short arm, 87, a small arm, 88, derived from arm 86, and a terminal head of arm 86, which is armed with a piece of copper for the purpose of making electrical contact with the insulated copper contact-piece 112 upon the lower pole-piece 77 of spool 75. This lever is pivoted at the junction of arms 85 and 86 upon a suitable insulated standard or bracket, 89, in such a position that arm 85 may engage contact-arms 33, as hereinafter described. Arms 85 and 33 are insulated from each other. Lever 85 is provided with a spring, 91, which tends to turn the same upon pivot 92 as a fulcrum to the position shown in Fig. 6, in which arm 86 is in contact with contact-piece 112. For the purposes of this cut-out the magnet 74 is provided with an insulated lateral armature, 93, which is mounted upon a spring, 116, in position to engage arm 88, in the manner shown in Fig. 7, and hereinafter described. The incandescent lamps 106, or other translating devices

arranged in parallel in place of said lamps and fed from this distributer, as hereinafter described, must be understood to be such as to require for their normal operation an aggregate current not exceeding the normal current supplied to the distributer by the generator, and an electro-motive force not exceeding the minimum electro-motive force which is supplied from the same source.

The electrical connections involved in this invention are as follows: Binding-posts 94 and 95, being respectively connected by main circuit-wires (not shown in the drawings) with the positive and negative poles of a generator, are the terminals of the instrument. The positive terminal 94 is connected with coil 54 by coarse wire 96. Coil 54 is connected with brush-holder 64 by coarse wire 98. Brush-holder 64 is connected with coil 53 by coarse wire 99. Coil 53 is connected with helix 97 by the coarse wire 100. The last-mentioned helix is connected with binding-post 101 by coarse wire 102. The resistances 1 to 15, and the contact-studs 16 to 31 of the rheostat, are connected with each other in the usual manner, as already stated, and as indicated in Figs. 1 and 2. The main wires 104 and 105, running to the lamps 106, are respectively connected with binding-posts 101 and 103. The negative terminal 95 is similarly connected by coarse wire 117 with binding-post 103, and by coarse wire 107 with contact-arm 33. The terminals 94 and 95 are also connected with each other through helix 76 by means of the fine wires 108 and 90 and a portion of wire 96. Terminal 94 is connected with contact-plate 84 by fine wire 110. Contact-strip 82 is connected with brush-holder 65 by fine wire 109. Contact-plate 83 is connected with wire 100 by fine wire 111. Contact-piece 112 is connected by a large wire, 113, with the negative terminal 95, while the standard 89 is similarly connected by large wire 114 with wire 100. In short, the lamps and resistances are connected in parallel. The relay-magnet is a shunt to both. The locking-magnet is connected in series with the field-magnet of the motor, while the armature of the motor when in use is in a derived circuit about one limb of the field-magnet of the same.

This invention further presents all such other features and particulars of construction as are necessarily involved in the mode of operation, as illustated by the drawings, and as hereinafter described.

Such being the construction and connections of my improved electrical distributer, the mode of its operation is as follows: When the connected generator supplies no current, the contact-strip 82 is deflected and pressed against contact-plate 83 by the force of spring 81. Contact-arm 33 is deflected to a position of contact with contact-stud 16 by the force of spring 37, as shown in Fig. 7. Armature 93 is held apart from the adjacent pole-piece 77 of magnet 74 by the force of the supporting-spring 116 in the position shown in Fig. 7. Lever 85 is held by the force of spring 91 and the opposing pressure of arm 87 against armature 93, in the position shown in Fig. 7, whereby arm 86 and contact 112 are separate from each other. At the same time contact-arm 33 is in mechanical contact with arm 85, as shown in the same figure. Armature 71 is held apart from its contiguous pole-piece 70 by spring 115. Contact-screw 73 exerts little or no pressure upon spring 42. The locking-pin 42 is in its normal position described above and shown in Fig. 4, and the distributer is inoperative. If, while the several parts of the distributer are in the positions just described, a current be supplied from the generator and all the lamps 106 be turned on, a small portion of that current will pass from binding-post 94 by way or wires 90 and 96 to helix 76, will traverse that helix, and thence pass by wire 108 to binding-post 95. All the remaining portion of the current which is supplied by the generator will pass from binding-post 94 by wire 96 to coil 54, will traverse that coil, will then pass by wire 98 to brush-holder 64, and will there divide into two portions. One of these portions will pass on by wire 99 in the course which is to be delineated below, while the other portion will follow holder 64 and brush 62 to commutator 61, will traverse that commutator and also armature 57 to brush 63, will follow brush 63, holder 65, wire 109, strip 82, plate 83, wire 111, and wire 100 to helix 97. The current which passes on from holder 64 by wire 99 traverses helix 53, and then proceeds by wire 100 to helix 97. The current so lead in two courses to helix 97 will thence pass by wire 102 to binding-post 101. There this current will divide into two portions. One portion will pass by wire 104 through lamps 106, and thence by wire 105, binding-post 103, and wire 117 to terminal 95, and the other portion will pass by resistance-coil 1, stud 16, and the intermediate wire to arm 33, and thence by wire 107 to terminal 95. Consequently motor 49, magnet 69, magnet 74, and lamps 106 are brought into operation with the following result: The attraction exerted by pole-piece 70 upon armature 71, overcoming the resistance of spring 115, causes screw 73 to press upon spring 42 with such force that against the resistance of spring 42 the pin 43 is pushed into one of the holes 49 in collar 39, whereby arm 33 and collar 39 are locked together. The rotation of armature 57, being transmitted by shaft 58, worm 48, worm-wheel 47, arbor 34, collar 39, and pin 43 to contact-arm 33, causes the latter to move by rotation from stud 16 toward stud 31. An increasing number of said resistance-coils is thereby automatically introduced into the circuit through the rheostat, and this operation continues until by reason of the increased resistance in the rheostat-circuit and the correspondingly-increased current through helix 76 the armature 79, acting against the resistance of spring 81, moves strip 82 away from its position of contact with plate

83, and thus interrupts the circuit through armature 57. Then motor 49 stops and remains inoperative so long as contact-strip 82, being held in equilibrium by the opposing forces of magnet 74 and spring 81, remains in the normal position of separation from plates 83 and 84, as shown in Figs. 1 and 2. Arm 33 at the same time remains locked with collar 39. At this point in the operation of the invention the proposed distribution is realized. Those coils which are for the time being in the rheostat-circuit present such resistance in that circuit that almost the entire current which is received by the distributer is forced in the parallel circuit through the lamps, which are thereby raised to their normal brilliancy. If, now, any number less than all of the lamps be turned out, the portion of the current passing through helix 76 is increased, and magnet 74 is energized to such a degree that armature 79, acting against the resistance of spring 81, deflects contact-strip 82 to a position of contact with plate 84. A portion of the current which is supplied to the distributer then passes from terminal 94 by wire 110, plate 84, strip 82, wire 109, holder 65, brush 63, through commutator and armature 61 and 57, and thence by brush 62 and holder 64 to wire 99, where it joins the current which is passing through that wire in the course already delineated. Armature 57 accordingly rotates as before, but in the opposite direction, and contact-arm 33 is thereby caused to move by rotation with arbor 34 toward stud 16. An increasing number of those resistance-coils which were previously introduced into the circuit through the rheostat are now, by the described motion of arm 33, successively cut out of that circuit until, by reason of the diminished resistance therein and the correspondingly-diminished current through helix 76, the armature 79, yielding to the energy of spring 81, carries strip 82 away from its position of contact with plate 84, and thus the circuit through armature 57 is again interrupted. Now the motor stops again, and again remains inactive so long as the interruption continues. At this point in the operation of the invention the proposed distribution of current is again realized, and the lamps which remain in operation receive only that quantity of current which is necessary to sustain their normal brightness. If additional lamps be turned on or off, the current is in like manner again distributed, according to the number of lamps in the circuit, until all the lamps have been turned off. If several lamps be turned off at the same instant, or if from any cause the current which is supplied to the distributer be suddenly increased to such an extent as to endanger the lamps, the current through helix 76 is instantly increased and armature 93 is magnetically attracted to a position of contact with the lower pole-piece 77. Lever 85 is thus released, and by the energy of spring 91 is immediately drawn over to the position shown in Fig. 6, so that arm 86 and contact-piece 112 are brought together. A short-circuit is then established between wire 100 and terminal 95 by the way of wire 114, standard 89, arm 86, contact 112, and wire 113, so that helices 76 and 97 are practically short-circuited. This short circuit so weakens the action of said helices that armatures 71, 93, and 79 are returned to their first positions, respectively, by the energy of their respective springs 115, 116, and 81. Contact-arm 33, being released by the withdrawal of pin 43 from hole 46, is drawn over by the action of spring 37 to a position of contact with stud 16 and stop 36, as shown in Fig. 7, but in passing to that position engages arm 87, and thereby carries lever 85 against the resistance of spring 91 to the position shown in Fig. 7, and described above. Contact-arm 33 then short-circuits the lamps and resistances. Whenever during the operation of the distributer current ceases to be supplied by the generator, contact-arm 33, being released, as just described, and being without engagement with lever 85, drawn over the position last mentioned, short-circuits the lamps and resistances in the same manner. Thus the several parts of the distributer are again in position to operate as first above described.

So far as respects the present case, I hereby disclaim all things which are shown and claimed in my pending application No. 200,929, filed May 3, 1886, for a patent upon an electro-mechanical movement.

I now claim as my invention, and desire to secure by Letters Patent—

1. A reversible electric motor having a rotary armature, an electric relay comprising a pair of contacts, a movable conductor for making and breaking contact with the same, and an electro-magnet actuating said movable conductor, said relay being adapted to reverse said motor by reversing the direction of current through said armature, in combination with a set of resistances which are adapted to be successively introduced into circuit and to be successively cut out of circuit, and with a second movable conductor which is actuated by said motor and is adapted to manipulate said resistances, substantially as and for the purpose specified.

2. An electric relay which is adapted to operate as a two-way switch, a reversible electric motor which is adapted to be controlled by said relay, a rheostat, and a movable conductor which is adapted to operate said rheostat, in combination with intermediate locking mechanism whereby said conductor is brought into engagement with said motor, substantially as and for the purpose specified.

3. A reversible electric motor, an electric relay which is adapted to reverse said motor, a rheostat, and a movable conductor which is actuated by said motor, and is adapted to operate said rheostat, in combination with a number of incandescent lamps or other translating devices arranged in parallel with said rheostat, substantially as and for the purpose specified.

4. A reversible electric motor, an electric

relay controlling said motor, a set of artificial resistances, and a movable conductor which is adapted to operate said resistances, in combination with locking and engaging mechanism between said motor and said conductor, and with a variable number of incandescent lamps or other translating devices arranged in parallel arc, substantially as and for the purpose specified.

5. As a means of effecting an engagement between the movable conductor of a rheostat and the armature-shaft of an electric motor, an arbor mounted in a suitable bearing, a worm and worm-wheel for driving said arbor, a fixed perforated collar, a loose collar and a contact-arm mounted upon said arbor, a pin whereby said arm and collars may be locked together, and a spring which carries said pin, in combination with an electro-magnet and armature thereof which are adapted to press said pin into the perforations of said fixed collar, substantially as and for the purpose specified.

6. A rotary shaft mounted in a suitable bearing, a worm-wheel, a fixed perforated collar, a loose collar, and a contact-arm all mounted upon said shaft, a pin whereby said contact-arm and fixed collar may be locked together, and a spring which carries said pin and is attached to said arm, in combination with a worm upon the armature-shaft of an electric motor, and with an electro-magnet and armature thereof, which are adapted to press said pin into the perforations of said fixed collar, substantially in the manner and for the purpose specified.

7. A rotary shaft mounted in a suitable support, a worm-wheel, a perforated collar, a loose collar, and a contact-arm all mounted upon said shaft, and a spring which is armed with a pin, in combination with a worm upon the armature-shaft of an electric motor, with a set of resistances having contacts within reach of said contact-arm, and with an electro-magnet and armature thereof actuating said pin, substantially in the manner and for the purpose specified.

8. A short-circuiting lever having a conductive arm, an insulated arm, and a stop-arm, a conductive plate for contact with said conductive-arm, an insulated support upon which said lever is pivoted, a spring or its equivalent acting upon said lever, and an electro-magnet whose armature, being supported by a spring, is normally in a position of contact with said stop-arm, in combination with an electro-mechanical movement which is adapted to engage said insulated arm, substantially as and for the purpose specified.

9. An electric relay which operates as a two-way switch, a reversible electric motor which is controlled by said relay, a movable conductor which is actuated from said motor, intermediate mechanism whereby motion is transmitted from said motor to said conductor, a variable number of incandescent lamps or other translating devices, a set of artificial resistances which are connectible in parallel with said lamps or other translating devices, a short-circuiting lever having an insulated arm, a conductive arm, and a stop-arm, an insulated support upon which said lever is pivoted, a conductive plate for contact with said conductive arm, and a spring or its equivalent acting upon said lever, in combination with a spring which supports an armature of said relay in a normal position of contact with said stop-arm, substantially as and for the purpose specified.

10. A reversible electric motor having a rotary armature, means for reversing said motor, a variable number of translating devices, a set of resistances which are connectible in parallel with said translating devices, and a movable conductor which is actuated from said motor and is adapted to operate said resistances, in combination with means for transmitting motion from said motor to said movable conductor, substantially as and for the purpose specified.

11. An electric relay which is adapted to operate as a two-way switch, a reversible electric motor which is controlled by said relay, a short-circuiting device, a rheostat, and a movable conductor which is adapted to operate said rheostat, in combination with intermediate locking mechanism whereby said motor is brought into engagement with said conductor, substantially as and for the purpose specified.

In testimony whereof I hereunto set my name in the presence of two witnesses.

RICHARD H. MATHER.

Witnesses:

WILLARD EDDY,

W. M. KYORKMAN.