No. 733,564. PATENTED JULY 14, 1903.

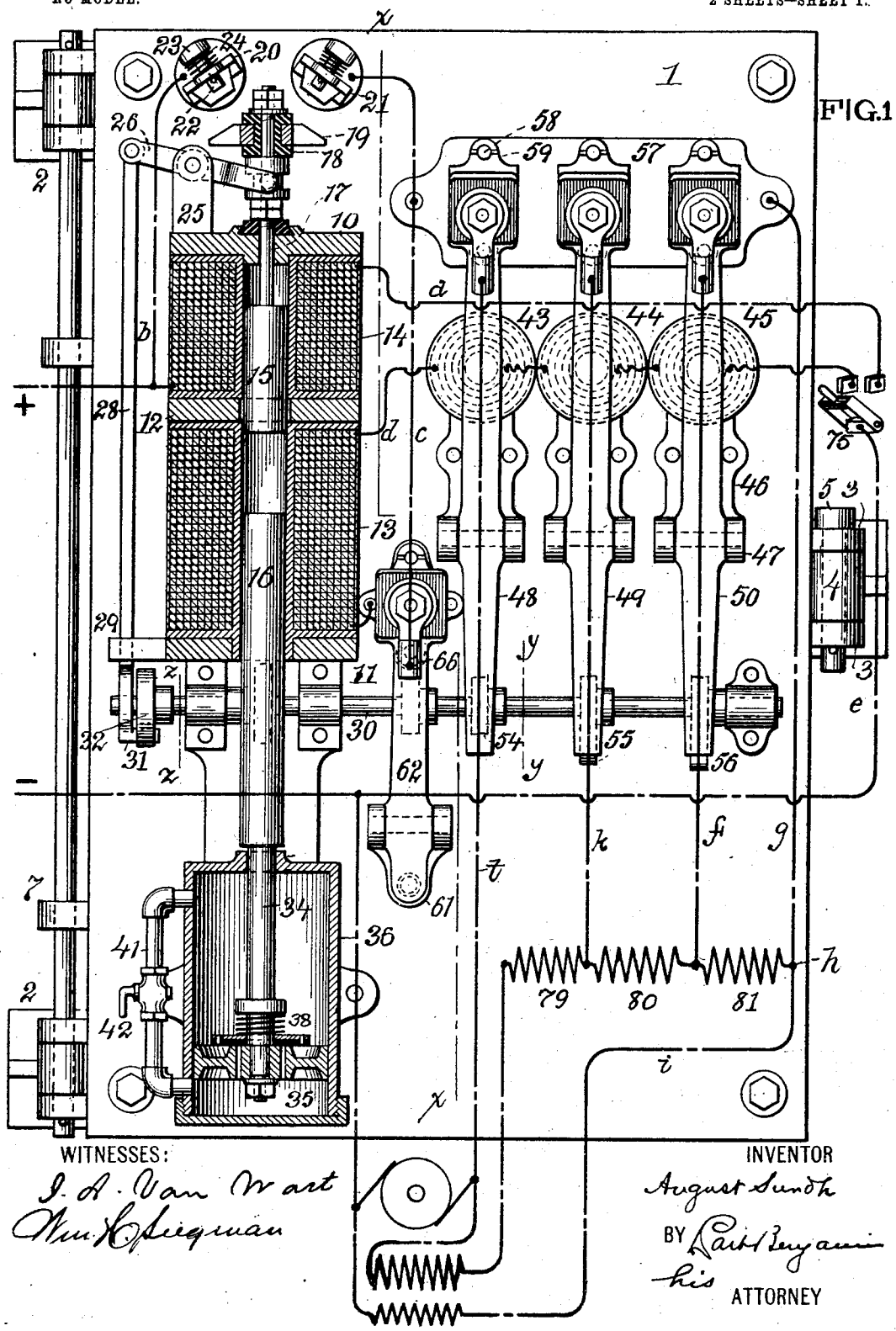
A. SUNDH.

ELECTRIC CONTROLLER.

APPLICATION FILED MAR. 16, 1903.

NO MODEL. 2 SHEETS—SHEET 1.

FIG. 1



WITNESSES:

I. A. Van Wart

Wm. H. Seigman

INVENTOR

August Sundh

BY Laird Benjamin

his ATTORNEY

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 733,564. PATENTED JULY 14, 1903.

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ELECTRIC CONTROLLER.

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NO MODEL. 2 SHEETS—SHEET 2.

FIG.2.

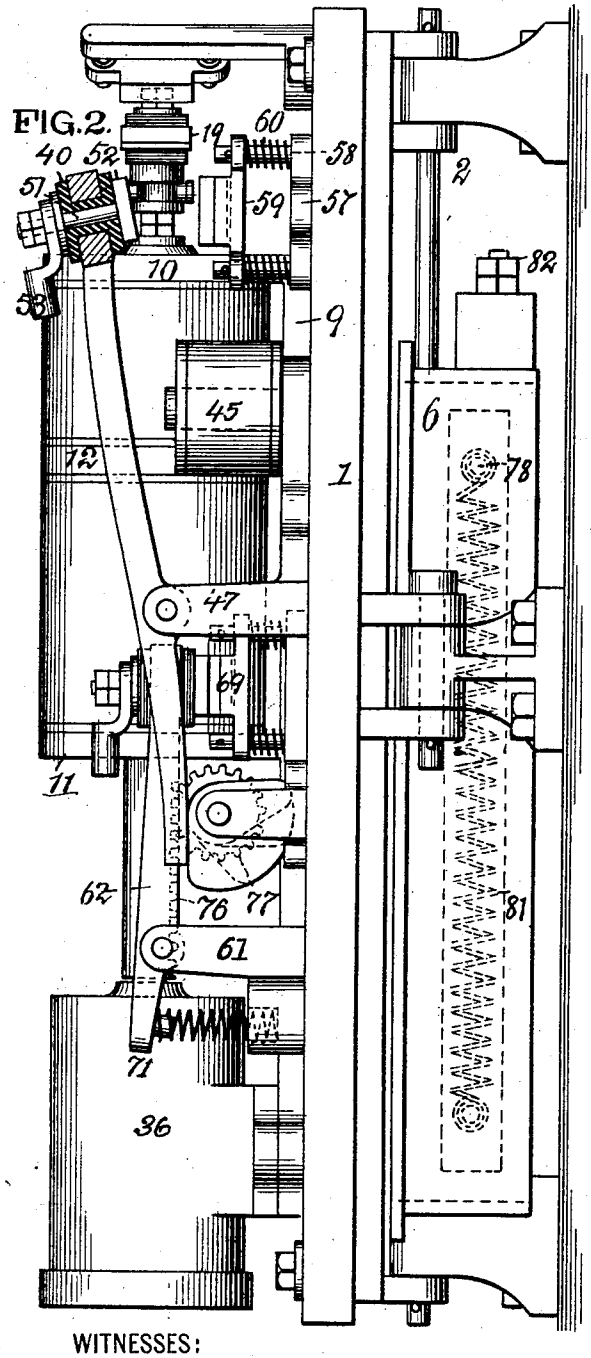
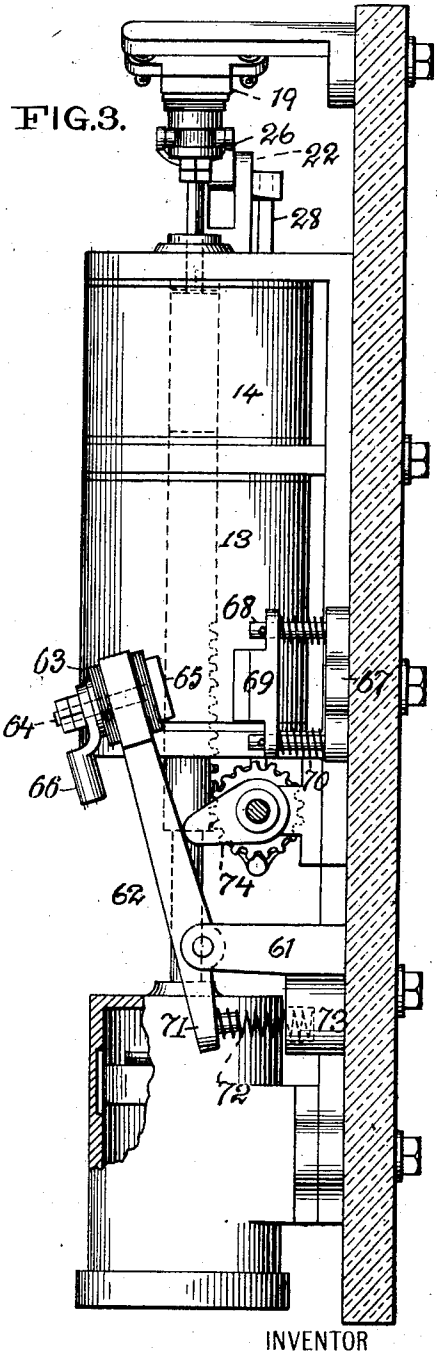


FIG.3.



WITNESSES:

J. A. Van Wart

Wm. X. Sheppard

FIG.4.

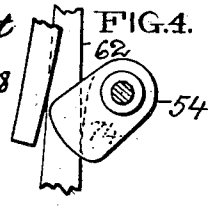
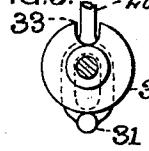


FIG.5.



INVENTOR

August Sundh

BY Louis Benjamin

his ATTORNEY

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 733,564. Patented July 14, 1903.

UNITED STATES PATENT OFFICE.

AUGUST SUNDH, OF YONKERS, NEW YORK.

ELECTRIC CONTROLLER.

SPECIFICATION forming part of Letters Patent No. 733,564, dated July 14, 1903.

Application filed March 16, 1903. Serial No. 148,052. (No model.)

To all whom it may concern:

Be it known that I, AUGUST SUNDH, of Yonkers, Westchester county, New York, have invented a new and useful Improvement in Electric Controllers, of which the following is a specification.

The invention relates to electric controllers; and it consists in the construction and combinations of parts more particularly pointed out in the claims.

In the accompanying drawings, Figure 1 is a front elevation showing the electrical connections in diagram. Fig. 2 is a side view showing one of the circuit-closing levers in section at each end. Fig. 3 is a side elevation and partial section on the line x x of Fig. 1. Fig. 4 is a detail of one of the lifting-cams for the circuit-closing lever, taken on the line y y of Fig. 1. Fig. 5 is a section of the locking device for the upper circuit-closer on the line z z of Fig. 1.

Similar numbers of reference indicate like parts.

1 is the supporting-plate of the apparatus, usually of slate, which is carried by the hinges 2, secured in any suitable manner to a wall or other support. On the other side of the plate 1 are two eyes 3, which receive between them the fixed sleeve 4, also fastened to the wall, so that by inserting the pin 5 through the eyes 3 and sleeve 4 the plate is firmly held in position against the wall, while by removing the pin 5 the plate may be swung on its hinge 2, so as to expose its rear side. On the rear side of said plate is a box 6, which on one edge has lugs 7, through which lugs passes the pivot-rod of the hinge 2. By this construction after the plate 1 has been swung away from the wall the resistance-box 6 may be swung away from the plate, so as to allow of access to the coils in said box.

9 is a plate of magnetic material secured to the back plate 1, having three outwardly-projecting plates 10, 11, and 12, between which plates are supported the two solenoids 13 and 14. In the middle supporting-plate 12 is a central aperture, through which the core 15 of solenoid 14 and the core 16 of solenoid 13 move. Extending upwardly from the core 15 and passing through the upper fixed plate 10 is a rod 17, which at its outer end is provided with a sleeve of insulating material 18, secured thereon, which sleeve is intersected and holds the copper bar 19, the upper edges of which are beveled, as shown. Above this bar and attached to the back plate 1 are the copper terminal plates 20 and 21. Each of these plates is received upon a fixed arm 22, projecting from a lug 23, and between the lug and the plate is interposed a helical spring 24, which normally keeps the contact-plate set out, but which when the plate is pressed upon by the circuit-closing bar 19 allows said plate to yield inwardly. The object of setting the yielding contact-plates 20 21 in inclined position and of beveling the ends of bar 19 so as to correspond to said inclination is to make the contact-surfaces self-cleaning, this being effected by the rubbing action of the inclined faces of the bar against the contact-plates, as said bar on meeting said contact-plates forces them outwardly.

On the upper side of the fixed plate 10 is a standard 25, in which is pivoted a lever 26, one end of which is yoked, and said yoke has a pin which enters a groove formed on a collar surrounding the rod 17. The other end of the lever 26 has pivoted to it a rod 28, which extends downwardly and passes through a guide-arm 29 on the lower fixed plate 11. The arm 28, Fig. 5, has an elongated slot to receive the extremity of the shaft 30, and its extreme end is turned at right angles at 31 to form a latch projection which ordinarily bears against the circumference of the disk 32. In this way the contact-bar 19 is retained in position, touching the fixed contact-plates 20 and 21. When the disk 32, however, is rotated to bring a recess 33 in position to allow the latch end 31 to enter it, the rod 28 is then free to rise, allowing the contact-bar 19 to descend, thus breaking contact with the plates 20 and 21.

The core 16 of the solenoid 13 extends downwardly and has a prolongation 34, which at its lower end carries a piston 35. This piston enters the dash-pot cylinder 36. The piston 35 has air-openings, and on its upper side there is a valve 38, faced with elastic material, which valve is surmounted by a helical spring which bears against a collar on rod 34. The cylinder 36 is provided with a by-pass

41, in which is an adjustable valve 42. The object of the dash-pot construction is to retard the movement of the core 16.

Supported on the back plate 1 and arranged in line are three electromagnets 43 44 45, supported on bracket 46. Each bracket is provided with lugs 47, and in these lugs are pivoted the levers 48 49 50, said levers being of magnetic material. The upper end of each lever, as shown in Fig. 2, has an aperture which receives an insulating-sleeve 40, through which passes the stem 51 of the copper contact-plate 52. To the end of the stem 51 is secured a coupling 53 for a circuit-wire. The lower extremities of the several levers 48 49 50 bear upon cams 54 55 56, which are fast upon the shaft 30, said shaft being supported in suitable bearings attached to the plate 1. The construction of these cams and their placing upon the shaft 30 are such that they operate the levers 48 49 50 successively—that is to say, the lever 50 is first operated, then the lever 49, then the lever 48. The construction of the levers 48 49 50 is such that by reason of the weight of their upper ends they normally tend to drop outwardly, so that their lower ends always bear upon the cams, as shown in Fig. 2. When the levers 48 49 50 are in their extreme outward position, they are in such a part of the magnetic field that the electromagnets 43 44 45 of said poles are not competent to attract them; but when they are moved inward successively by their cams they are brought to a position sufficiently near to said poles to enable said poles to draw them quickly into contact.

Secured on the back plate 1 is a plate 57, on which are three pairs of projecting fixed pins 58. Supported on each pair of pins is a contact-plate 59, between which contact-plate and the plate 57 is interposed a helical spring 60, which normally sets the plate outward. When the levers 48 49 50 are moved inward by their cams and into the attractive fields of the electromagnets 43 44 45, said magnets quickly carry the contact-plates 52 on said levers into contact with the contact-plates 59.

Pivoted in lugs on a bracket 61, attached to the back plate 1, is another lever 62 of non-magnetic material, which at its upper end is provided with an insulating-sleeve 63, Fig. 3, through which passes the stem 64 of contact-plate 65, the other end of said stem having attached to it a coupler 66 for the wire which leads thereto. Also on the back plate 1 is a plate 67, having projecting pins 68, upon which pins is supported the contact-plate 69. Between the contact-plate 69 and the plate 67 and surrounding the pins are helical springs 70, which normally set the contact-plate 69 outward. The contact-plate 69 is in the path of the contact-plate 65 of lever 62. Below the pivot of lever 62 there is a projecting arm 71, to which is connected a helical spring 72, which enters and is secured in a recess in a lug 73, fast on the back plate 1. This spring normally forces the lower end 71 of the lever 62 outward, and so closes contact between the plates 65 and 69. On the shaft 30 there is a cam 74, adapted to bear upon the lever 62 and to move said lever so as to separate contact-plates 65 and 69, as shown in Fig. 3. This cam comes into operation through the rotation of the shaft 30 after the cams 54 55 56 have severally and successively moved their levers into contact with the plates 59. It will be seen, therefore, that through the action of the several cams the timing of the apparatus is such that the levers 50 49 48 successively establish their contacts with the plates 59, and then the lever 62 is moved away from its contact-plate by the action of its cam.

Within the box 6 and supported upon the transverse rods 78 in said box are a number of parallel resistance-coils. Three of such coils are here shown at 79, 80, and 81, Fig. 1. The terminals of these coils connect with binding-posts at 82, Fig. 2. Said coils can be grouped as desired, and of course they may be made in any suitable manner, and instead of being coils they may be simply strips of metal.

The operation of the apparatus and the lead of the circuits is as follows, the parts being in the position shown in Fig. 1: Current comes in at the plus terminal, switch 75 being closed, passes through the upper solenoid 14, and thence by the wires *a* and *e* goes to the main negative terminal. Magnet 14 being thus energized moves its core 15, bringing the contact-bar 19 into contact with the plates 20 and 21. Circuit is then established from the plus main wire through the wire *b* to contact-plate 20 and contact-disk 19, contact-plate 21, and wire *c* to the coupling 66, and so to the contact-plates on the lever at 62. This contact-plate is touching the fixed contact-plate 69, so that current may pass from contact-plate 69 to the pins 68, bracket 67, and so to the lower solenoid 13. From solenoid 13 the current passes by wire *d* successively through the electromagnets 43 44 45, and then by wire *e* to the main negative terminal. As already explained, the latch end 31 of the rod 28, continuing to bear against the circumference of the disk 32, retains the circuit-closing disk 19 in contact with the plates 20 and 21. Meantime the shaft 30 has been rotated through the rising of the core 16. This is effected by means of rack-teeth shown at 76, on the inner side of the protruding portion of said core, which teeth engage with the pinion 77, fast on the shaft 30. By reason of this rotation, as already explained, the lever 50 is first brought by the action of the cam 56 into suitable proximity to its electromagnet 45 to enable that magnet to attract the lever as an armature, and thus quickly to bring its contact-plate 52 against one of the fixed contact-plates 58 on plate 57. Circuit is then free to pass to the

wire *f*, which connects with the upper end of the lever 50. Before this, however, circuit has been established from the contact-plate 21 to the plate 57, and so by wire *g* to the point *h*. At the point *h* circuit divides, part passing through the wire *i*, through the shunt-coil of the motor, and so to the negative terminal, and a part through all the resistances 79 80 81 to the series coil and then through the motor-armature to the negative terminal. Now when the lever 50 has been brought to the opposing contact-plate 58, current passes along the wire *f* to the contact-plate on said lever, then through the resistance-coils 79 80, the resistance-coil 81 thus being cut out, and so to the series coil and motor-armature. The cam 55 then operates the lever 49, and the current passes by wire *k* through resistance-coil 79 to series coil and motor-armature, the resistances 80 and 81 thus being cut out. Then the lever 48 is brought into operation and then the current passes by the wire *t* directly to the motor-armature, all of the resistances and the series coil being cut out. Then the cam 74 comes around and forces the lever 62 away from its contact, thus breaking circuit through the lower solenoid 13 and also through the electromagnets 43 44 45. The levers 48 49 50, however, remain in position to close their contacts by reason of the bearing of the cams upon them. The core 16 has now risen sufficiently high to come into the inductive field of the upper solenoid 14, through which current still continues. The core 16 is held in its elevated position, and therefore this core in turn through its rack and pinion holds shaft 30 in position, which in turn through the cams 54 55 56 holds the levers 48 49 50 to their contacts, as already described, while the cam 74 continues to hold the lever 62 away from the contact-plate 69. This is the condition when the motor is running, and the result is that all of the current which otherwise would pass through the solenoid 13 and the electromagnets 43 44 45 is saved, because all of the levers are held in position mechanically, and the core 16 is retained in position by only the solenoid 14. Now when it is desired to stop the motor the switch 75 is opened. That breaks current through the upper solenoid 14. The core 13 of that solenoid cannot drop yet, because it is held upwardly through the bearing of the latch 31 on the rod 28 against the periphery of the disk 32. The core 16 of the lower solenoid, however, has now nothing to support it, and therefore it drops, carrying with it, of course, the piston in the dash-pot 36; but as that piston descends the valve 38 thereon lifts, allowing air to pass freely through the piston-openings, so that the falling of the core 16 is quite rapid. As the core 16 descends it rotates the shaft 30, thus allowing the levers 48 49 50 to fall away successively from their contact-plates. Also through the rotation of the shaft the cams 74 allow the lever 62 to close contact between the plates 65 and 69; but still no current can go to the solenoid 13 by reason of the rupture of contact at the switch 75. Finally the disk 32 on the shaft 30 brings its recess 33 in front of the latch end 31, so that said latch end can at once drop into said recess, and then the contact-bar 19 can drop, breaking the circuit through the motor.

I claim—

1. An electromagnet, an armature therefor, a shaft, means for rotating said shaft controlled by said armature, a circuit-closing lever, a contact-terminal in the path of said lever, and a cam on said shaft constructed to move said lever to close circuit at said terminal.

2. An electromagnet, an armature therefor, a shaft, means for rotating said shaft controlled by said armature, a circuit-closing lever, a contact-terminal in the path of said lever, and a cam on said shaft constructed to move said lever to close circuit at said terminal and to retain said lever in said closed position when the rotation of said shaft is arrested.

3. An electromagnet, an armature therefor, a shaft, means for rotating said shaft controlled by said armature, a plurality of circuit-closing levers, a plurality of contact-terminals in the path of said levers, and cams on said shaft constructed to move said levers to close circuit at said terminals; the aforesaid parts being timed and constructed to operate said levers to close said circuits successively.

4. Two electromagnets, a circuit-closer controlled by one of said electromagnets and establishing circuit through the other electromagnet, a locking device retaining said circuit-closer in circuit-closing position and means controlled by said first-named electromagnet for releasing said locking device.

5. Two electromagnets, a circuit-closer controlled by one of said electromagnets and establishing circuit through the other electromagnet, a locking device for retaining said circuit-closer in circuit-closing position actuated by said second electromagnet and means controlled by said first electromagnet for releasing said locking device.

6. A plurality of circuit-closing levers of magnetic material, a plurality of contact-terminals in the path of said levers and means electromagnetic and mechanical constructed and arranged conjointly to actuate said levers to move them successively to close circuit at said terminals.

7. A plurality of circuit-closing armatures, a plurality of contact-terminals in the path of said armatures, a plurality of electromagnets controlling said armatures, and a mechanism constructed and arranged to move said armatures successively into the attractive field of their associated electromagnets.

8. A plurality of circuit-closing armatures, a plurality of contact-terminals in the path

of said armatures, a plurality of electromagnets controlling said armatures, a mechanism constructed and arranged to move said armatures successively into the attractive fields of their associated electromagnets whereby said armatures are caused to close circuit at said terminals, means for deënergizing said electromagnets after said circuits have been closed and means for subsequently maintaining said armatures in circuit-closing position.

9. Two electromagnets, an armature for each, the armature of one electromagnet being normally in its attractive field and the armature of the other electromagnet normally out of its attractive field, means controlled by said first-named armature for moving the second armature into the attractive field of its controlling electromagnet and an electric mechanism controlled by said last-named armature.

10. A solenoid, a core, a rotary shaft, means for rotating said shaft by the movement of said core, an electromagnet, a circuit-closing lever of magnetic material disposed in the field of said electromagnet, a contact-terminal in the path of said lever, and a cam on said shaft for moving said lever toward said electromagnet and into contact with said terminal.

11. A solenoid, a core, a rotary shaft, means for rotating said shaft by the movement of said core, a plurality of electromagnets, a plurality of circuit-closing levers of magnetic material disposed respectively in the fields of said electromagnets, contact-terminals in the path of said levers, and cams on said shaft constructed and timed successively to move said levers toward their associated electromagnets and into contact with said terminals.

12. A solenoid, a core, a plurality of circuit-closing levers, a plurality of contact-terminals in the path of said levers, mechanism controlled by said core for successively moving said levers to close circuit at said terminals, means for breaking circuit through said solenoid after said levers have been operated and means for retaining said core in position after said solenoid-circuit has been broken.

13. A solenoid, a core, a plurality of circuit-closing levers, a plurality of contact-terminals in the path of said levers, positively-operating mechanism controlled by said core for successively moving said levers to close circuit at said terminals, positively-operating means also controlled by said core for breaking circuit through said solenoid after said levers have been operated and means for retaining said core in position after said solenoid circuit has been broken.

14. A solenoid, a core, a plurality of circuit-closing levers, a plurality of contact-terminals in the path of said levers, mechanism controlled by said core for successively moving said levers to close circuit at said terminals, means for breaking circuit through said solenoid after said levers have been operated, and electromagnetic means for retaining said core in position after said solenoid-circuit has been broken.

15. Means for producing two electromagnetic fields, an armature movably supported in one of said fields and actuated thereby to move into the other field, means controlled by said armature for neutralizing its actuating-field upon its becoming subject to the holding contact of the field into which it has been moved, an armature in the other electromagnetic field, a circuit-closer controlled by said last-named armature, and means actuated by said first-named armature for locking said circuit-closer in circuit-closing position.

16. The combination of the electromagnets 13 and 14, an armature 16 movably supported in the field of magnet 13 and actuated thereby to move into the holding-field of magnet 14, a circuit-breaker 62 controlled by armature 16 for breaking circuit in electromagnet 13, armature 15 in the field of magne 14, circuit-closer 19 controlled by armature 15, means controlled by armature 16 for locking said circuit-closer 19 in circuit-closing position, means for breaking circuit in magnet 14, and means actuated by armature 16 upon being released by said magnet 14 for releasing said locking device.

17. The combination with the solenoid 13, and its movable core, of the rotary shaft 30, gearing between said core and shaft for causing rotation of said shaft by said core, pivoted circuit-closing levers 48, 49, 50, and cams 54, 55, 56 on said shaft; the said cams being constructed successively to operate said circuit-closing levers 48, 49, 50.

18. The combination with the solenoid 13 and its movable core, of the rotary shaft 30, gearing between said core and shaft for causing rotation of said shaft by said core, pivoted levers 48, 49, 50 and 62, circuit-terminals in the path of said levers and cams 54, 55, 56 and 74 on said shaft; the said levers and cams being constructed and timed so that said levers 54, 55 and 56 are successively actuated by said cams to close circuit and the lever 62 to open circuit.

19. The combination of the solenoids 13 and 14, movable cores 15 and 16, circuit-closer 19 on core 15, rotary shaft 30, gearing between core 16 and said shaft for causing a rotation of said shaft by the movement of said core, disk 32 having recess 33 on said shaft 30, a longitudinally-moving rod 28 having a latch end 32 bearing on the circumference of said disk and adapted to enter the recess 33 therein, a link connection between said circuit-closer 19 and said rod and circuit connections substantially as set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

AUGUST SUNDH.

Witnesses:
I. A. VAN WART,
WM. H. SIEGMAN.

Disclaimer in Letters Patent No. 733,564.

DISCLAIMER.

733,564.—*August Sundh*, Yonkers, N. Y. ELECTRIC CONTROLLER. Patent dated July 14, 1903. Disclaimer filed February 10, 1913, by the assignee, *Sundh Electric Company*.

Enters this disclaimer—

"To such claims which are identified as follow', to wit:

"1. An electromagnet, an armature therefor, a shaft, means for rotating said shaft controlled by said armature, a circuit-closing lever, a contact-terminal in the path of said lever, and a cam on said shaft constructed to move said lever to close circuit at said terminal.

"2. An electromagnet, an armature therefor, a shaft, means for rotating said shaft controlled by said armature, a circuit-closing lever, a contact-terminal in the path of said lever, and a cam on said shaft constructed to move said lever to close circuit at said terminal and to retain said lever in said closed position when the rotation of said shaft is arrested.

"3. An electromagnet, an armature therefor, a shaft, means for rotating said shaft controlled by said armature, a plurality of circuit-closing levers, a plurality of contact-terminals in the path of said levers, and cams on said shaft constructed to move said levers to close circuit at said terminals; the aforesaid parts being timed and constructed to operate said levers to close said circuits successively.

"17. The combination with the solenoid 13, and its movable core, of the rotary shaft 30, gearing between said core and shaft for causing rotation of said shaft by said core, pivoted circuit-closing levers 48, 49, 50, and cams 54, 55, 56 on said shaft; the said cams being constructed successively to operate said circuit-closing levers 48, 49, 50.

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[*Official Gazette, February 18, 1913.*]

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