No. 653,093. Patented July 3, 1900.

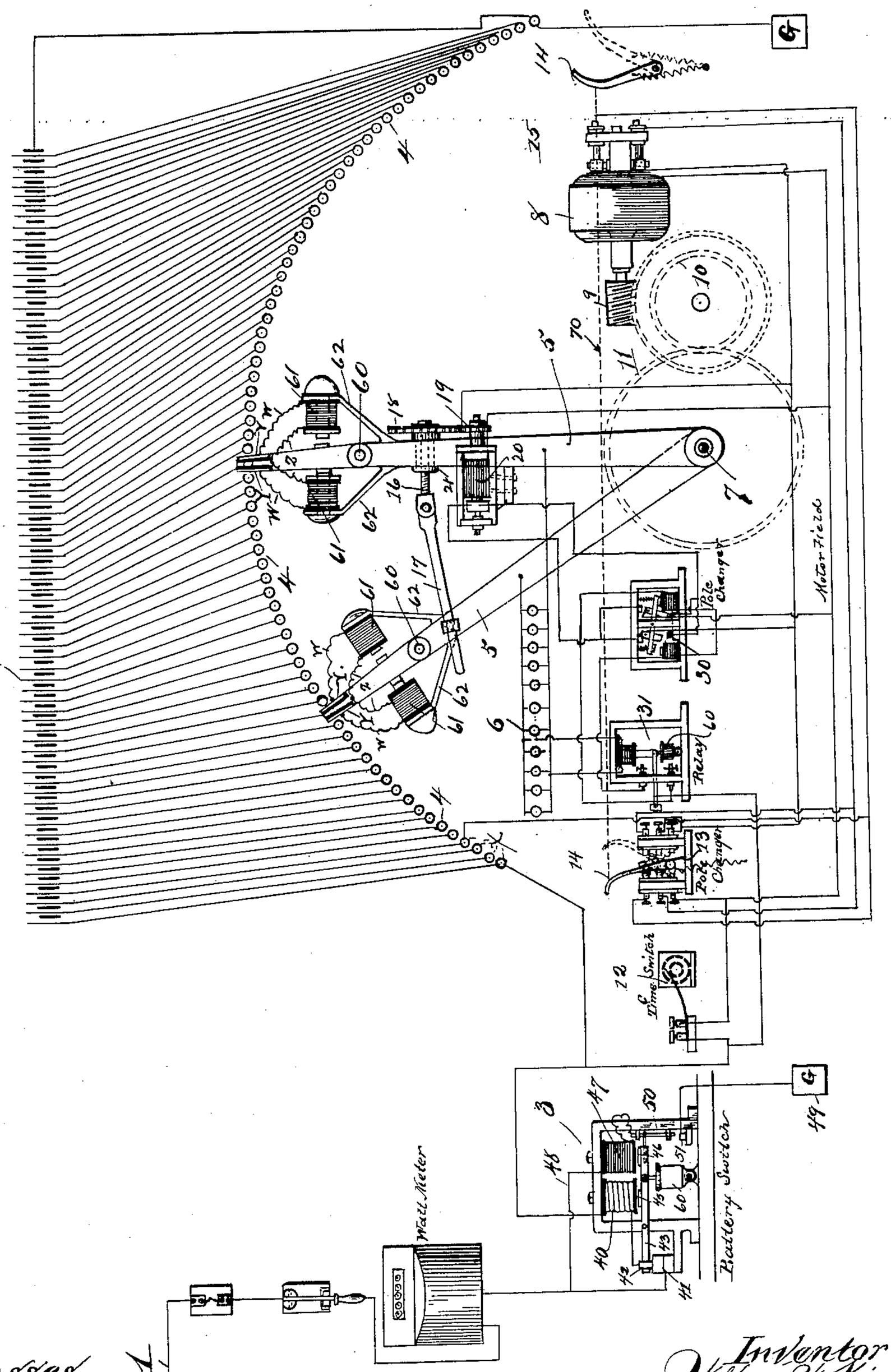
W. W. KING.

APPARATUS FOR SUPPLYING CURRENTS OF PREDETERMINED VOLTAGE FROM MAIN LINES OF HIGHER VOLTAGE.

(Application filed Oct. 30, 1899.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.



Witnesses
A. N. Gibert
C. H. Olds.

Inventor
William W. King
by Wm. H. Monroe
Attorney

No. 653,093. Patented July 3, 1900.

W. W. KING.

APPARATUS FOR SUPPLYING CURRENTS OF PREDETERMINED VOLTAGE FROM MAIN LINES OF HIGHER VOLTAGE.

(Application filed Oct. 30, 1899.)

(No Model.) 2 Sheets—Sheet 2.

Fig. 2.

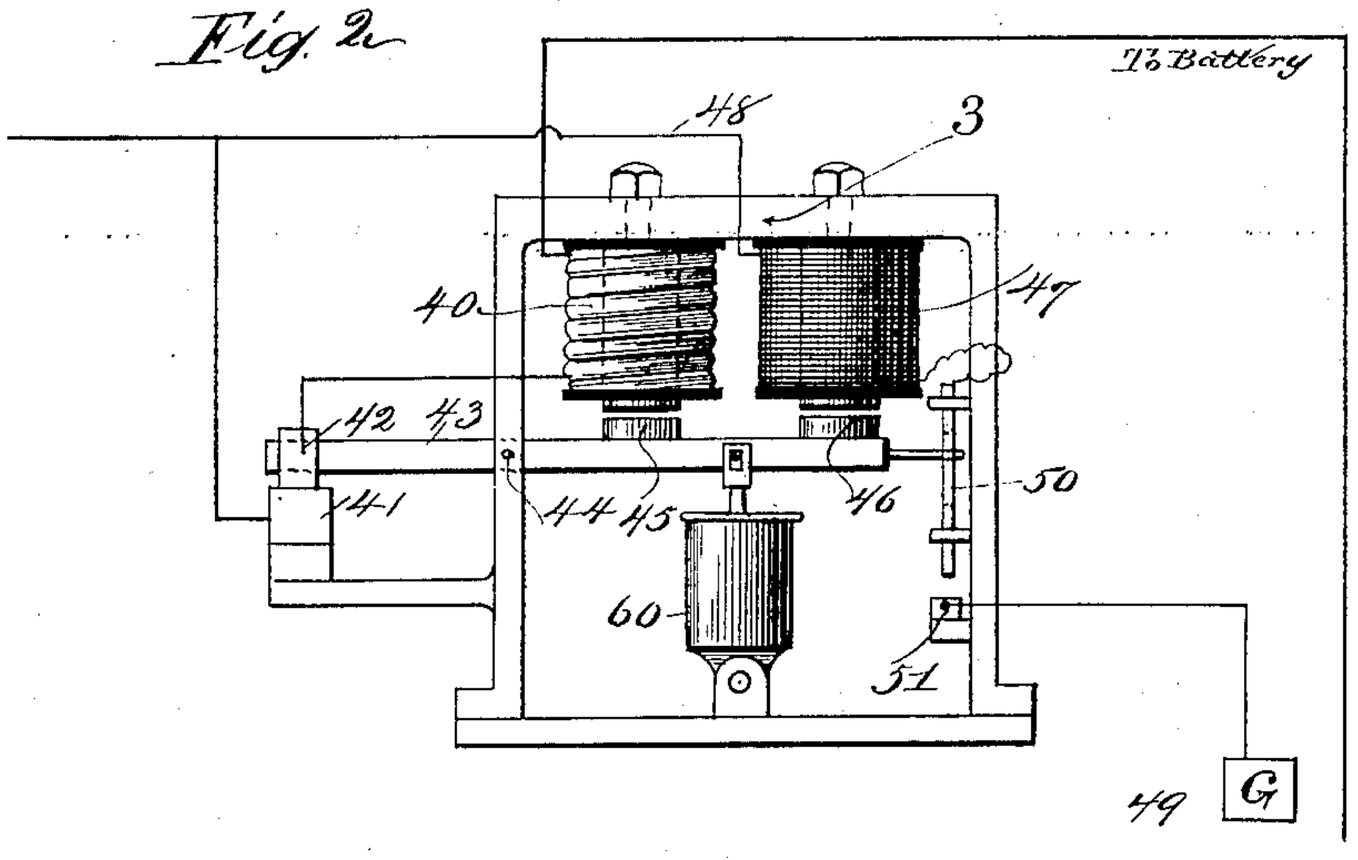


Fig. 2a.

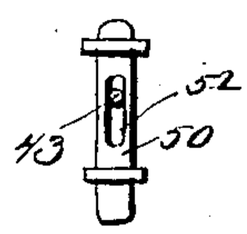
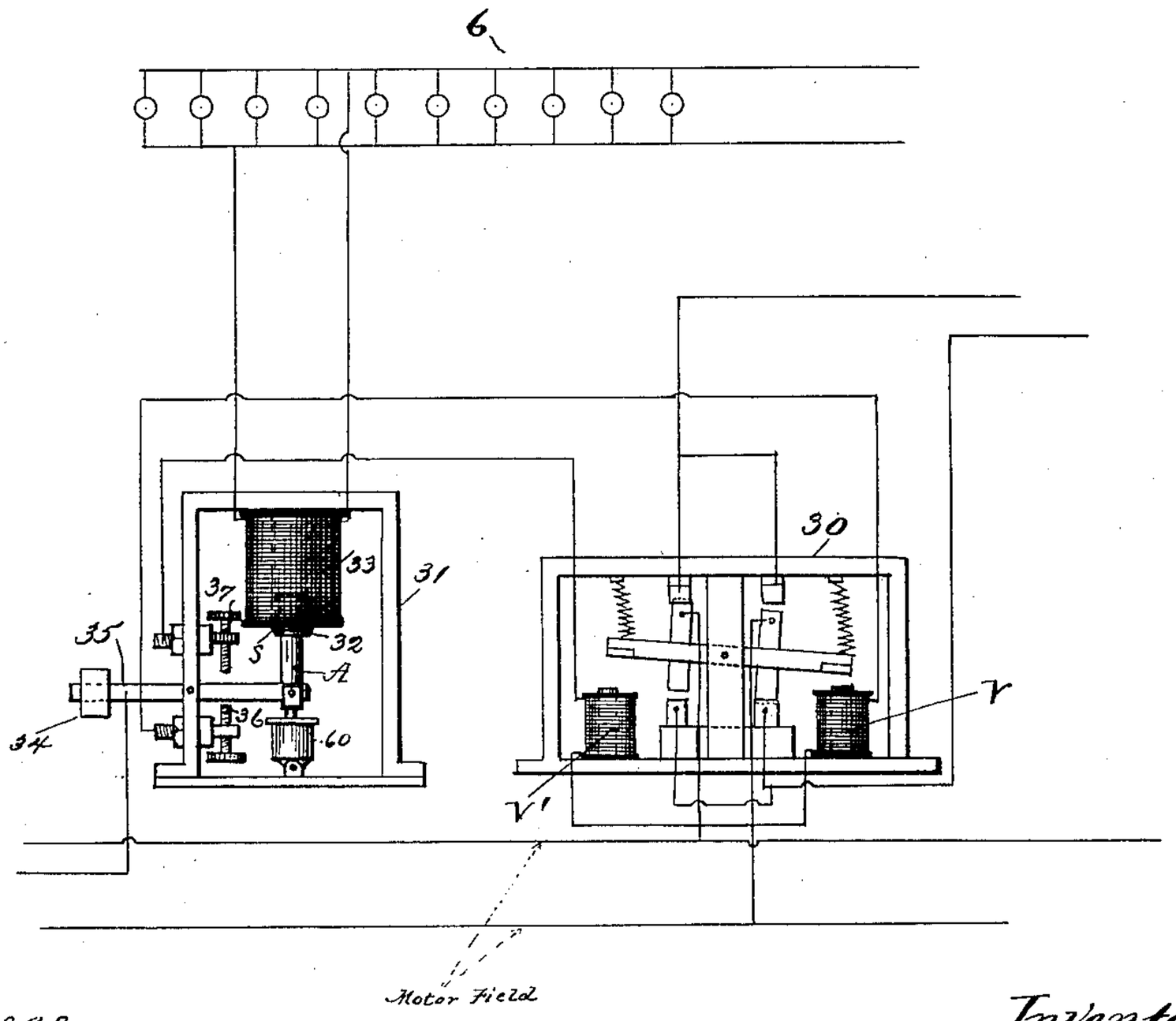


Fig. 3.



Witnesses
A. H. Gebert.
C. H. Olds.

Inventor
William W. King
by Wm. H. Monroe
Attorney

UNITED STATES PATENT OFFICE.

WILLIAM W. KING, OF HUNTSBURG, OHIO.

APPARATUS FOR SUPPLYING CURRENTS OF PREDETERMINED VOLTAGE FROM MAIN LINES OF HIGHER VOLTAGE.

SPECIFICATION forming part of Letters Patent No. 653,093, dated July 3, 1900.

Application filed October 30, 1899. Serial No. 735,186. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM W. KING, a citizen of the United States, and a resident of Huntsburg, county of Grange, State of Ohio, have invented certain new and useful Improvements in Apparatus for Supplying Currents of Predetermined Voltage from Main Lines of Higher Voltage, of which I hereby declare the following to be a full, clear, and exact description, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to improvements in apparatus for utilizing the trolley-current of a suburban railway-line to supply an electric-lighting system in a town or building adjacent to the trolley-line.

The object of my invention is to supply the lighting system with the precise voltage required for the lamps independently of the voltage maintained in the trolley-line.

My invention consists in the combination and arrangement of devices as exemplified in the accompanying drawings and as hereinafter described, and pointed out in the claims.

In the accompanying drawings, Figure 1 is a diagrammatic plan of the system, showing the relations of different devices thereto. Figs. 2 and 2ª are details of the battery-switch, and Fig. 3 is a detail of the relay and pole changer.

In the views, 1 represents the trolley-line or feeder; 2, a system of storage-cells.

3 is a battery-switch which is designed to so operate as to maintain a constant voltage in the storage-cells until they are fully charged and also to disconnect the cells from the trolley-line when the cells are fully charged or any stoppage occurs in the feed-line. At 4 are seen contact switch-points, through which and through the pivoted arms 5 the current is conveyed from the cells to the lighting system shown at 6.

It will be seen that each cell is provided with its corresponding contact-point 4, and as many cells will coöperate to charge the lighting-circuit as are included between the switch-arms 5.

The contact-points 4 are arranged in an arc about the pivotal point 7 of the switch-arms, which are caused to move at predetermined periods the distance of one contact-point at a time toward the extreme right and then back to the extreme left of the arc of contact. This movement is continuously performed, and the result obtained is the uniform discharge of each cell in the battery, the same length of time being afforded to each cell for supplying current to the lighting system, and each cell has a uniform length of time for recuperation from the trolley-line. I accomplish this movement by means of the motor 8 through worm-and-spur gearing 9, 10, and 11, as shown partly in dotted lines in Fig. 1. The current which operates the motor passes first through the time or clock switch 12, by means of which the movements of the motor are controlled. The switch-arms are allowed to rest upon each contact during the prescribed length of time, the motor being at rest; but the motor is again started when the time expires and the arms are in contact with the next cell-contact, which is repeated as long as any cells remain. The commutator of the time-switch is constructed in such a manner by varying the width of the insulating-blocks between the sections that the time that each cell supplies current to the consumption-circuit will be equal for all the cells of the battery. The clock-switch is made to gain or lose time in twenty-four hours, in order that the same set of cells will not be supplying the consumption-circuit at the same hour each day. The peak of the load or maximum consumption, which comes at about six p. m. every day in most lighting plants, will be fed by one set of cells one day and by another set the next day. By this means after a certain number of days the maximum load will have been connected to all the cells of the battery in succession. The current after leaving the time-switch passes through the pole-changer 13, the switch-lever 14 of which is thrown by the switch-arm 5 at the extremity of its arc, thus reversing the motor, which will operate to return the arm to the opposite end of the arc 4, where it will engage a similar lever directly connected with the lever 14, which again reverses the motor. The arm 14 should be

preferably spring-actuated in part. The connecting-link 70 between these levers is shown in dotted lines in Fig. 1.

Since it would be difficult to maintain a constant degree of voltage in the cells 2, an automatic adjustment between the two feeding-arms 5 is essential whereby a varying number of cells may be included between them, and the voltage of the lamp-circuit may thereby be maintained constant. To accomplish this result, a separate motor 15 is employed, mounted upon one of the arms which rotates the adjusting-screw 16, whereby and with the assistance of the connecting-link 17 between the arms (one of which is loose upon the pivot-shaft) the arms are separated or brought together. Gears 18 and 19 connect the armature 20 with a spool or sleeve 21, internally threaded to receive the screw.

The motors are both operated by currents supplied from a few cells of the battery, as at *x*, Fig. 1.

The direction of the rotation of the armature 20 is controlled by means of the pole-changer 30, and the pole-changer is in turn automatically controlled by means of the relay 31, which is operated by a shunt from the lamp-circuit. The construction of this relay and pole-changer is more clearly seen in Fig. 3. In this figure the core 32 of the magnet 33 is a soft-iron tube lined with a brass sleeve S. The armature is a soft-iron rod A, which extends a slight distance into the core. In this form of magnet the armature is repelled when there is a current through the magnet-coils. When the lamps are supplied with a normal voltage, the armature is repelled sufficiently to be balanced by the counterweight 34 upon the lever 35; but when the voltage increases in the lamp-circuit the armature will be repelled and make contact with the lower contact-screw 36, thus closing the battery-circuit through one of the magnets *v* of the pole-changer 30, thus exciting the motor to rotate the screw and bring the arms closer together until the voltage is reduced again to normal. When, however, the current in the lamps is reduced below the normal, the current in the magnet 33 will be reduced below the normal and the armature will rise until contact is made between the upper screw 37 and the lever 35, thus placing in the battery-circuit the other magnet *v'* and reversing the polarity of the motor, which will then rotate the screw to separate the arms 5 and include one or more new cells until the voltage becomes raised again to normal. When the lamp-circuit is of normal voltage, the lever, with its counterweight, will hang horizontally between the contact-screws without making contact with either, and the motor will be at rest.

In Fig. 2 is seen a detailed view of the battery-switch 3, in which its mode of operation is clearly disclosed. In this view 40 is a magnet through which the line-circuit passes and is made of coarse wire to be fully able to carry the current. Thence it passes directly to the battery of storage-cells. The pole-piece of this magnet is polarized, and hence will repel the armature 45 when the battery is fully charged and also if there should be any stoppage in the feed of the current from the main line. Before reaching this magnet, however, it passes through the contact-points 41 and 42, one of which is upon the lever 43, pivoted at 44 and provided with two armatures 45 and 46. The armature 45 is adapted to engage the circuit-magnet 40 and the other the magneg 47 upon a shunt-circuit 48, which runs to ground at 49 through the sliding switch-bar 50. The operation of this device is as follows: The current flows through the magnet 40 until the battery-cells are fully charged, when the battery being filled the magnet 40 will cease to attract and the lever 43 will fall until the switch-bar 50 makes contact with the point 51, which completes a shunt-circuit to earth through the magnet 47 of fine wire, which immediately attracts the lever and again raises it until the contacts 41 and 42 again engage.

The movements of the lever are regulated by the dash-pot 60 so as to be slow enough to permit the batteries to discharge, or partially so, between each movement, and the switch-bar 50 is slotted at 51, so as to give the lever some movement before it engages the bar either way. The dash-pot can be usefully employed also in the relay before mentioned to accomplish the same results as in the battery-switch.

The extremities of the switch-arms 5 are pivotally secured to the arms at 60 and are given a very quick movement from one cell-contact to the next as the arms move by means of magnets 61 on either side, secured to short arms 62, which pull over the switch-point immediately as soon as contact is made with the following contact-point before time has elapsed sufficient to short-circuit a cell. The arrangement is readily seen in Fig. 1, where Y Y are contact-plates insulated from the end of the switch-arm and W W are wires connecting the contacts with the magnets on their respective sides of the arm 5. Wires Z Z connect the arm with the magnets.

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

1. In a device for the purpose set forth, the combination with a storage battery and cell-contacts, and a lamp-circuit and lamps, of two switch-arms having a common pivotal point, and normally including between them a definite number of cells supplying the lamp-circuit, means automatically controlled by the lighting-circuit whereby the said switch-arms are set constantly in motion over the entire series of contacts, and automatically-controlled means for including between the switch-arms a greater or less number of cells

than those normally required, as the tension on the lamp-circuit varies, substantially as described.

2. In a device for the purpose described, a storage battery and series of cell-contacts, in combination with, two switch-arms arranged to normally include between them a definite number of cells supplying the lamp-circuit, means automatically controlled for varying the number of cells included between them as required to supply voltage to the consumption-circuit, and means for moving the said arms over the entire series of contacts in succession, substantially as described.

3. In a device for the purpose set forth, the combination with storage-battery cells, and contacts therefor, of duplicate switch-arms, means for passing them at predetermined speed over the entire switchboard, means for automatically separating the arms to include between them the number of cells required to feed the consumption-circuit, and means for preventing the breaking of the circuit when the switch-arms move from one contact to another, substantially as described.

4. In an apparatus for the purpose specified, the combination with a line-circuit of a high degree of tension, and a lamp-circuit of lower tension, of a battery of storage-cells a battery-switch constructed and arranged to automatically maintain a constant voltage in said cells, a series of contact-points connected respectively with each storage-cell, two switch-arms adapted to move in unison over the contact-points, the said switch-arms being so placed upon the contact-points as to include between them the contacts of cells having in aggregate the voltage required in the lamp-circuit, means derived from the battery-circuit for adjusting automatically the distance between the arms whereby the lamp-circuit can be maintained of constant voltage in spite of variations in the cell-voltage, and means for automatically moving said switch-arms over the entire series of contact-points at regular intervals, one point at a time, and from one extreme end of the series to the other whereby all the cells are charged and discharged in succession, and the times for charging or discharging each cell shall be maintained equal in all, substantially as described.

5. The apparatus for the purpose described a line-circuit and adjacent lamp-circuit of lower voltage than the line-circuit, a series of storage-cells and cell-contacts connected with the line-circuit, a battery-switch between the line and storage-cells, switch-arms engaging said cell-contacts and connecting the storage-cells and lamp-circuit, separated to include a predetermined number of cells and adapted to move from end to end of the series of contacts, a motor, a pole-changer and a time-switch for the arms, in the battery-circuit, a motor and mechanism deriving movement therefrom whereby the switch-arms are separated or drawn together, and a relay and pole-changer for said arms, the said relay deriving its power from the lamp-circuit, and the pole-changer from the battery-circuit substantially as described.

6. In a switch-arm, the combination therewith of a movable point therefor, with means for quickly throwing the point from one contact to another at the moment of engagement with both said contacts, consisting of a contact-plate, secured to the movable point but insulated therefrom, and a magnet opposite the advancing side of the movable point and secured to a projection from the switch-arm, and an armature upon the movable point, the said magnet being connected electrically with the said insulated plate and switch-arm, substantially as described.

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

WILLIAM W. KING.

Witnesses:

WM. M. MONROE,

C. H. OLDS.