(No Model.) 3 Sheets—Sheet 1.

W. P. KOOKOGEY.

APPARATUS FOR CHARGING AND DISCHARGING SECONDARY BATTERIES.

No. 395,836. Patented Jan. 8, 1889.

Fig. 1.

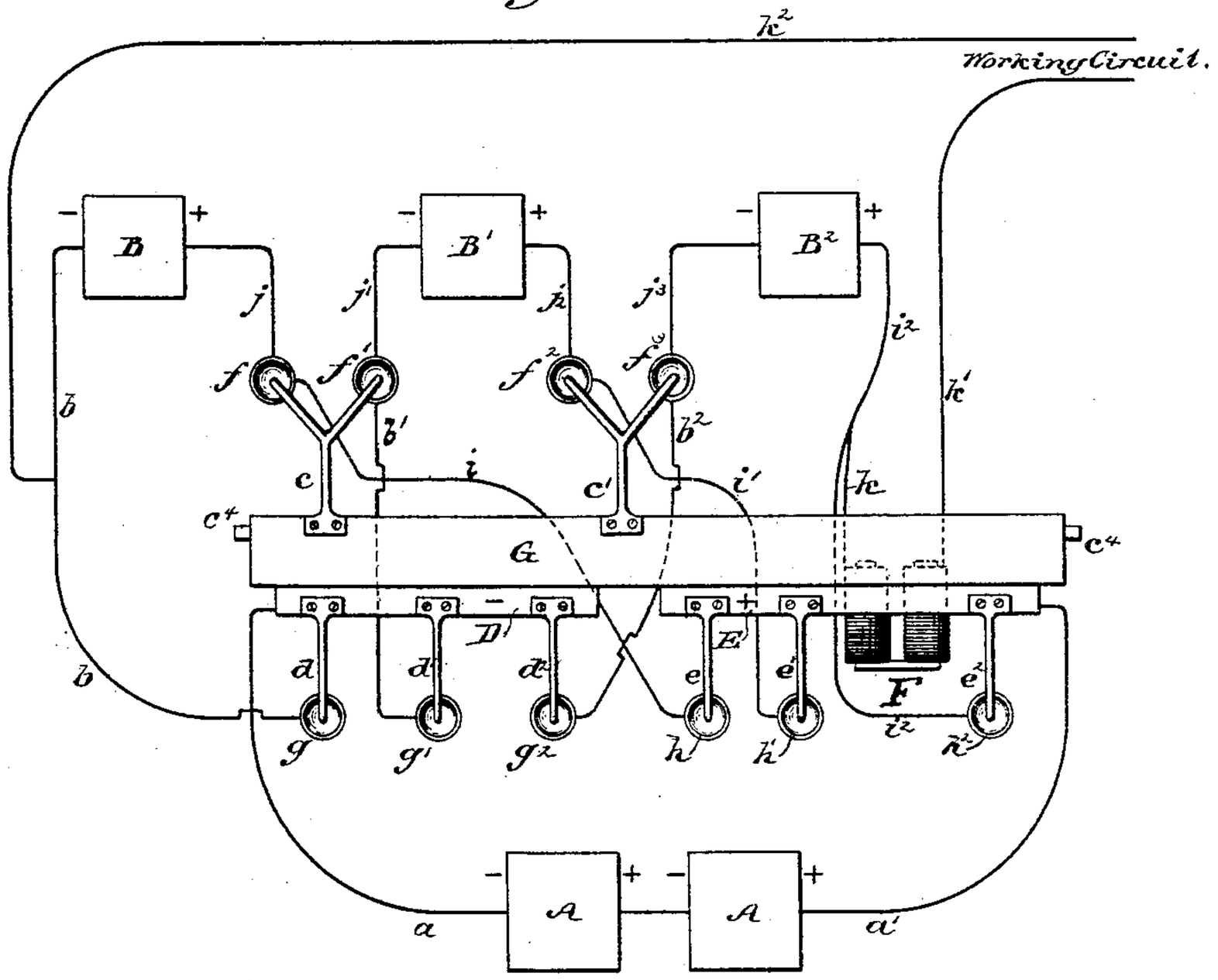


Fig. 2.

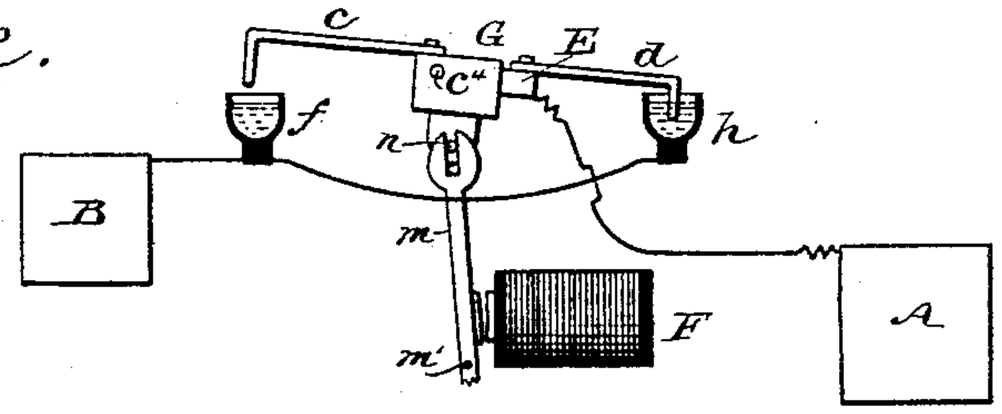
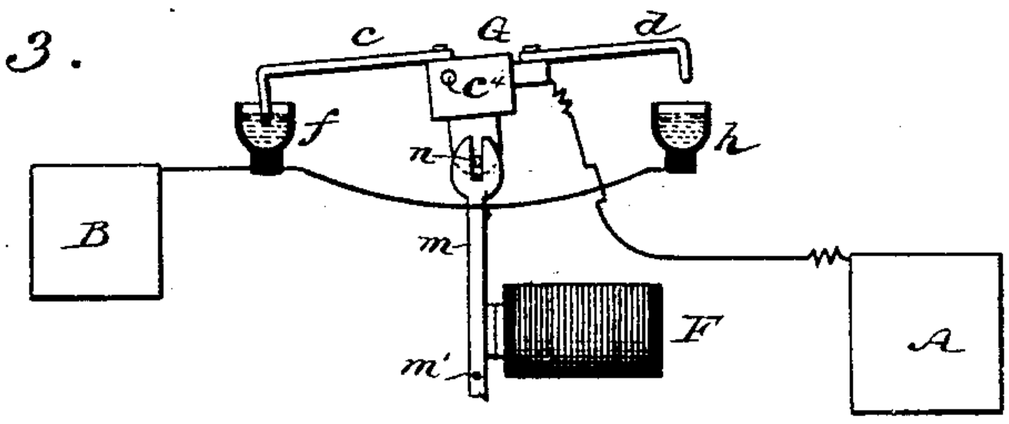


Fig. 3.



WITNESSES:
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BY
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(No Model.) 3 Sheets—Sheet 2.

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Fig. 4.

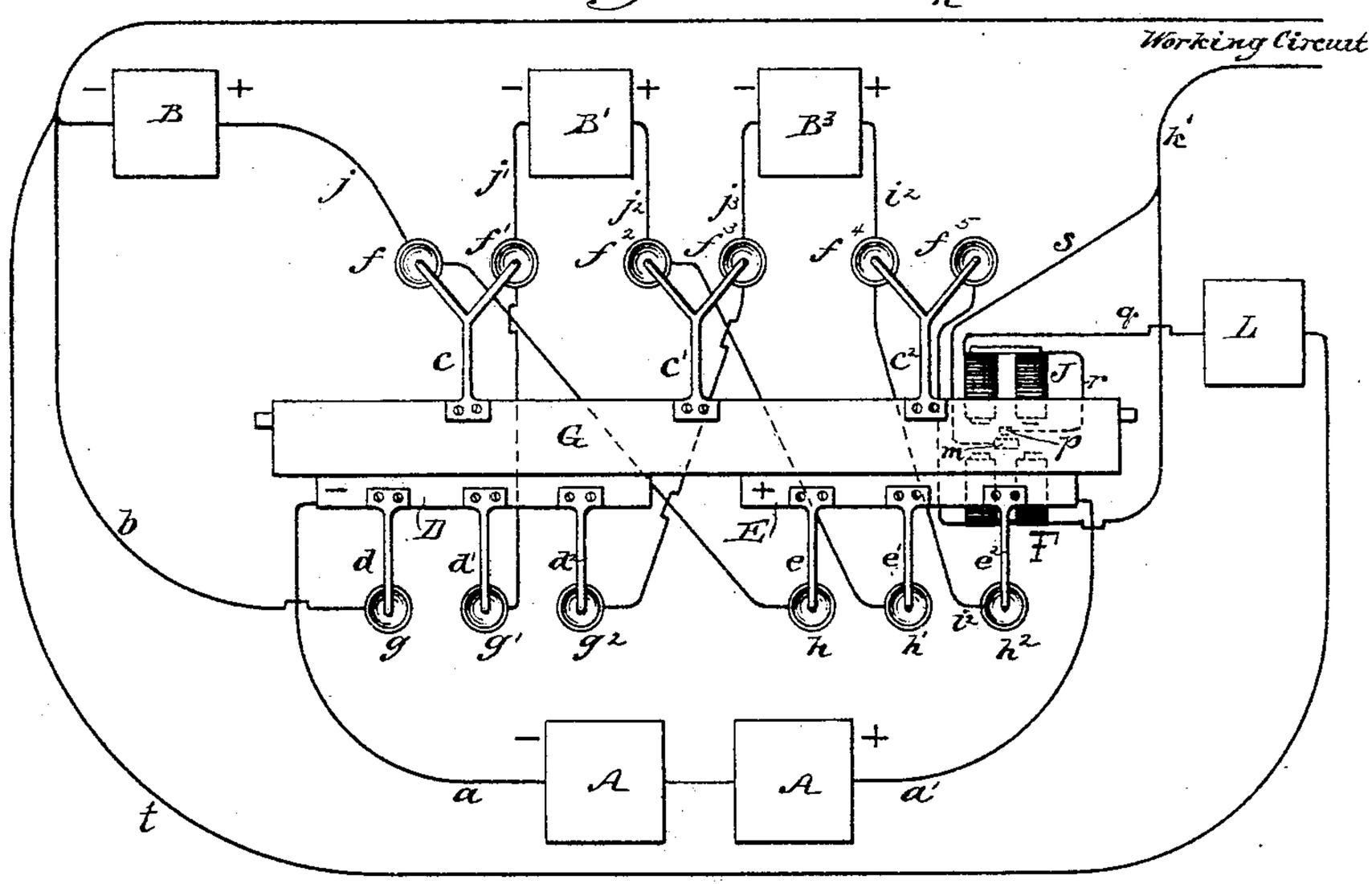

Fig. 5.

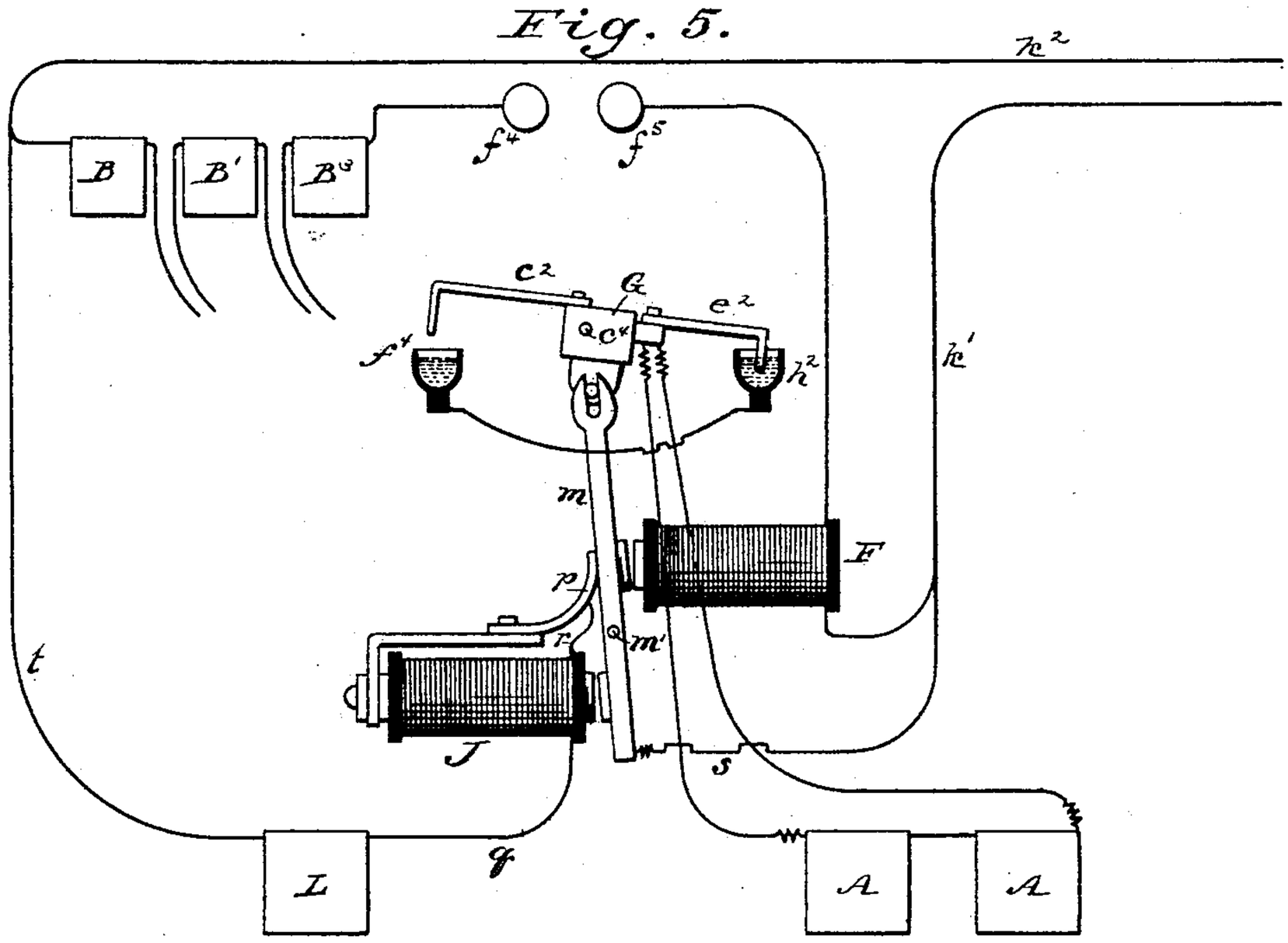

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Fig. 6.

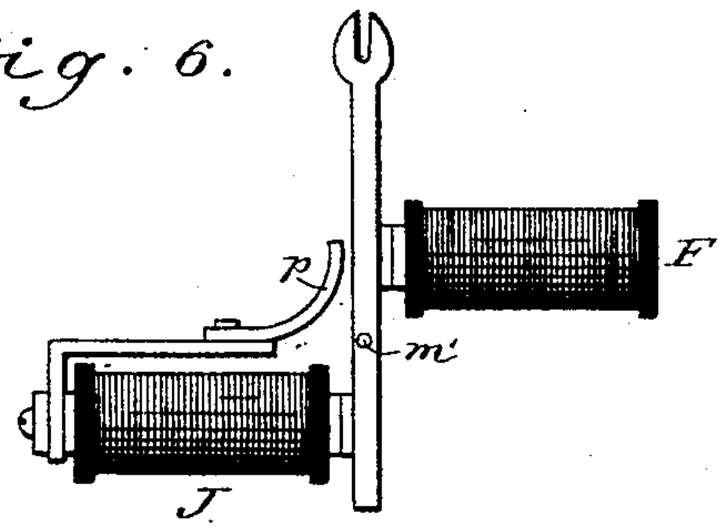


Fig. 7.

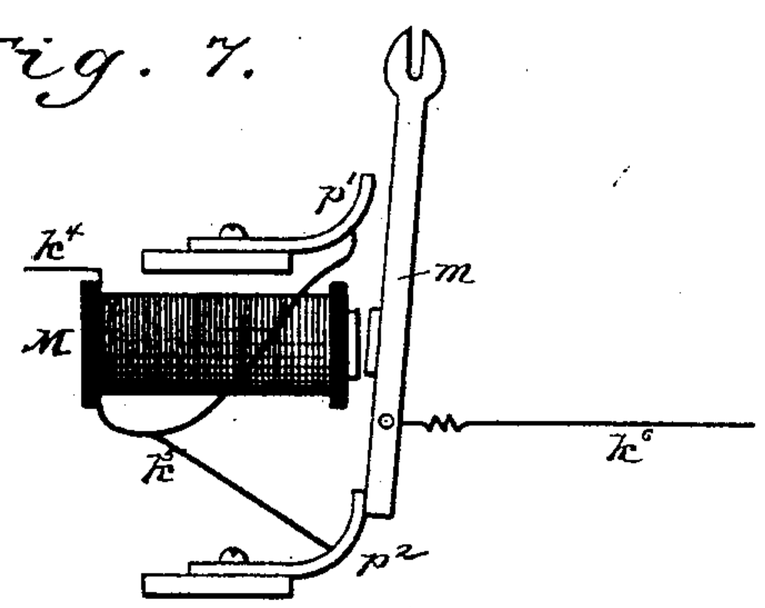
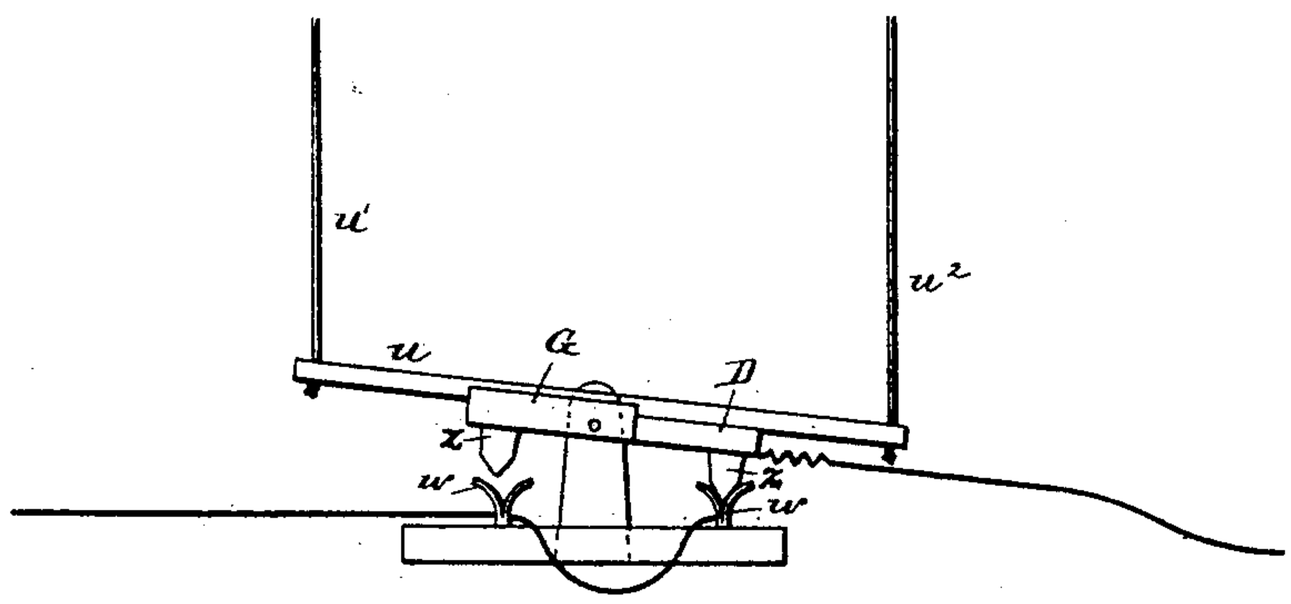


Fig. 8.



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UNITED STATES PATENT OFFICE.

WILLIAM P. KOOKOGEY, OF BROOKLYN, NEW YORK, ASSIGNOR TO THE KOOKOGEY ELECTRIC COMPANY.

APPARATUS FOR CHARGING AND DISCHARGING SECONDARY BATTERIES.

SPECIFICATION forming part of Letters Patent No. 395,836, dated January 8, 1889.

Application filed June 11, 1888. Serial No. 276,774. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM P. KOOKOGEY, of Brooklyn, New York, have invented new and useful Improvements in Apparatus and Connections for Charging and Discharging Storage-Batteries, of which the following is a specification.

My invention relates to the connection of a battery of storage-cells with the line which it is to supply, (called herein the "working-line,") and also with the primary battery from which the storage-battery is to be charged; and its main object is to provide means by which the change from one connection to the other may be automatic, so that the storage-battery is thrown into the position of discharge merely by the closing of the working-circuit, and is thrown into the position of charging by the opening of that circuit. There are various other subsidiary objects, more fully set forth in the description and claims. The main advantages attained by it are that no manual control is needed, and hence no constant attention, the circuit is always ready for use, and every moment during which it is not in use is utilized in restoring the charge to the batteries. Thus if it be an electric-light circuit the storage-battery automatically begins to charge as soon as the last light is extinguished, and the turning on of a single lamp automatically changes it back to the discharging position.

The invention, in general, consists of a commutating device capable of taking two positions, in one of which the several storage-cells are connected together and with the working-circuit in tension series and in the other of which they are connected in parallel in the primary or charging circuit; also of such a commutating mechanism, in combination with an electro-magnet in the working-circuit, which is energized by the closing of the working-circuit, and when energized draws the commutating device into the first position—viz., that of discharge—also the combination of such a commutating device and magnet in the working-circuit with another electro-magnet energized by a local battery, such second magnet also acting upon the commutating device and being energized by the closing of the working-circuit, and of various connected devices, more particularly set forth in the claims.

It may be said that I contemplate using this invention chiefly in connection with smaller electric-lighting systems, and chiefly, also, in connection with storage-batteries to be charged from primary galvanic cells rather than from a dynamo-machine, and also that I contemplate charging the storage-cells in parallel or multiple arc and discharging them in series; but it is evident that the principles of the invention extend beyond these uses; and I do not intend to limit myself either as to the character of the use to which the circuit is to be put nor the primary means of supplying electric energy, nor to the particular methods of connecting the cells when charging or discharging.

In the accompanying drawings, in which the same characters indicate analogous parts, Figure 1 is a top diagrammatic view of the commutating device and the single magnet. Figs. 2 and 3 are end views (from the left of Fig. 1) of the commutating device, showing, respectively, its two positions. Fig. 4 is a top diagrammatic view of the invention, showing the additional magnet and local battery. Fig. 5 is an end view (from the left of Fig. 4) of the same. Fig. 6 is a view of the two magnets and lever in the alternate position from that of Fig. 5. Fig. 7 shows another application of the principle involved where the local battery is used, and Fig. 8 is an end view of the commutating mechanism when controlled by hand instead of by the electro-magnet in the working-circuit.

In the various figures, A represents the primary cells, and B, B′, B^2, and B^3 the storage-cells.

G represents a piece of insulating material, and D and E two strips of conducting material firmly attached to it. The insulating-piece G is pivoted at its ends c^4 upon a suitable standard. Stout wires or other conducting-strips, c, c', and c^2, are firmly attached to the insulating-piece G, each of them branching into two branches on their outer ends, and two series of like wires or conductors, but not branching into two—viz., d d' d^2 and e e' e^2—are firmly attached, respectively, to the conductors D and E. A series of stationary cups

containing mercury—viz., $f\ f'\ f^2\ f^3$—are arranged on one side of the device, and upon the other side are two series of like stationary mercury-cups—viz., $g\ g'\ g^2$ and $h\ h'\ h^2$.

For the conductors upon the upper side, c c', are provided two mercury-cups—one for each branch. For those upon the lower side, d e, &c., there is a cup for each conductor. These mercury-cups are placed in such position that by the rocking of the insulating-piece G and the parts attached to it upon the pivots c^4 the conductors upon the two sides will alternately dip into the mercury of their respective mercury-cups, those on one side being entirely out of the mercury when those on the other are immersed. The mercury-cups are to be of conducting material, or at least the mercury within them is designed to be electrically connected with the wires leading from them. Other contact devices may be substituted for them; but there is a distinct advantage in the use of mercury in this position.

The different series of mercury-cups are connected by wires with the primary battery A and the storage-cells B B', &c., upon the following principles:

Wires a and a' lead from the negative and positive poles of the primary battery A to the negative conducting-strip D and the positive strip E, respectively. Wires b b' b^2 lead from the several negative mercury-cups g g' g^2 to the negative poles of the several storage-cells, respectively. Wires i, i', and i^2 lead from the positive cups h h' h^2, through cups f f^2 and wires j j^2, to the positive poles of the storage-batteries, respectively. Wires j j' j^2 j^3 connect the several poles of the storage-cells with the upper series of cups. Thus when the mechanism is in the position shown in Fig. 2, each of the storage-cells B B' B² has a separate conducting-connection with the negative and positive conducting-pieces D and E, and hence with the primary battery; or, in other words, they are in parallel in the primary or charging circuit, and when in the position of Fig. 3 the storage-cells are connected with each other and with the working-circuit in series. Fig. 2 shows the position taken when the storage-cells are being charged from the primary, and Fig. 3 the position when discharging into the working-circuit. In charging (the arms d e, &c., being in circuit and the arms c not in circuit) the current will pass (Fig. 1) from battery A as follows: Wire a', positive conducting-strip E, where it is distributed to the mercury-cups h h' h^2, from thence in separate currents through wires i, i', and i^2, cups f f^2, wires j j^2 to the positive poles of the storage-cells B B' B², through them, and by wires b j' b' j^3 b^2 to the negative cups g g' g^2, from which the several parallel currents are collected in the negative conducting-strip D, and pass from thence through wire a back to the battery A.

In discharging from the storage-battery upon the working-circuit (the arms c being in circuit and the arms d e, &c., out of circuit, the charging-circuit being thereby open) the current will pass as follows: From cell B through wire j, cup f, conductor c, cup f', wire j', cell B', wire j^2, cup f^2, conductor c', cup f^3, wire j^3, cell B², and thence through wires i^2 and k, magnet F, the working-circuit, and wires k^2 and b back to the storage-battery. It is evident that the wires b', b^2, i, and i' may be led directly to the respective poles of the storage-cells instead of to the cups f, f', f^2, and f^3. So, also, other cups may be added on the upper side, and thus allow the currents to be broken at both poles.

Coming now to the means of controlling the change from discharging to charging, or vice versa, this is done automatically by merely closing or opening the working-circuit, and the means is an electro-magnet forming part of the working-circuit and operating the commutating device.

F represents the magnet connected by wires k k' to the storage-batteries and the working-line, respectively. The magnet F attracts an armature upon a lever, m, which lever is pivoted to some stationary part at m'. The lever m bears against a pin, n, which is attached to the under side of the insulating-piece G. The insulating-piece G and its attached parts take the position of Fig. 2 when the magnet F is not energized. This is accomplished by so pivoting the piece G that gravity will do it. When a current is passing through the magnet F, they are retained in the position of Fig. 3. Thus when the working-circuit is opened, (as by the extinguishing of the last lamp,) the parts automatically fall into the position of Fig. 2, and the storage-batteries are thereby thrown out of series and into parallel in the charging-circuit and the operation of charge commences; but as soon as the working-circuit is closed (as by the turning on of a single lamp) the magnet F is energized. It attracts the lever m, which, by rocking the commutating device, disconnects the storage-cells from the primary and throws them into series with each other and with the working-circuit. The course of the current when the working-circuit is first closed may be either from the primaries or from the storage-cells in parallel, or from both, depending upon relative resistances and potentials. If from the primary, its course will be from battery A through strip E, cup h^2, wires i^2 and k, magnet F, the working-circuit, wire b, cup g, strip D to battery A. If from the storage-cells, its course will be (taking cell B² as an example) from B² through wires i^2 and k, magnet F, the working-circuit, wire b, cup g, strip D, cup g^2, wire b^2, back to the cell B². Thus the entire connection of the storage-battery with the charging-battery and with the circuit over which the work is to be done is automatic and no care or oversight is required, except such as is necessary to keep the primaries or other generators in working order. The principle is of course applicable to systems of batteries as well as to a single one.

In Figs. 4 and 5 all the parts already described exist, together with the addition of a local battery, L, and in circuit with it a second electro-magnet, J, preferably of higher resistance than the magnet F. In some situations—as, *e. g.*, where a very large plant is used—the current started through the magnet F when the working-circuit is first closed will not be strong enough to energize that magnet. The magnet J, energized by the current coming from the local battery L, is arranged to throw over the commutating device, and on doing so cuts itself and its battery out of the circuit. The action of this second magnet also is automatic, being operated by the closing of the working-circuit. The working-circuit forms a part of the local circuit. The advantage of the form which contains the local circuit and second magnet is that the second magnet may be made of any resistance; but with only one magnet it must be made with reference to the fact that all the working-current passes through it continuously during the period of discharge, and hence its resistance must be low.

Referring to Fig. 5, the magnet J is arranged to attract a second armature upon the lever *m*, but on the other side of the pivot *m'*. Another difference between the form of Figs. 4 and 1 is that there is another couple of mercury-cups, f^4 f^5, upon the upper side of the insulating-piece G, and that the last storage-cell, B^3, instead of being connected with the magnet F, is connected with a mercury-cup, and the magnet F is connected with the other one. This occasions, however, no difference in principle. When the working-circuit is open, the parts assume the position of Fig. 5. Immediately upon its being closed a current is established through the magnet J, the lever *m* is attracted, the conductors *c c' c²* place the storage-cells into series with the working-line, and the strong current from the storage-cells energizes the magnet F, and this retains the lever in the position shown in Fig. 6.

The course of the current from the local battery on the first closing of the working-circuit is from battery L, Fig. 5, through wire *q*, magnet J, wire *r*, contact-spring *p*, lever *m*, wire *s*, working-circuit, wire *t* back to battery L. By this operation the local battery L and the magnet J have been cut out of the circuit by the separation of the contact-spring *p* and the lever *m*, Fig. 6.

Fig. 7 represents a variation by which the same magnet is made to carry both the local and the working current, and thus take the place of the two magnets F and J. The wire k^4 (corresponding to *k* in Fig. 1) leads from the primary, the storage, and the local batteries to the magnet M, and the wire k^6 (corresponding to *k'* in Fig. 1) leads from the lever *m* to the working-circuit, and thus around to the other poles of the batteries. The wire k^5 on leaving the magnet M branches, one branch leading to the insulated stationary contact-spring *p'* and the other to the insulated stationary contact-spring p^2. When the working-circuit is open, the local circuit is also open, the storage-battery is charging, and the parts are in the position of Fig. 7. As soon as the working-circuit is closed, the local circuit is also closed thereby, and a current is established from the local circuit through wire k^4, magnet M, wire k^5, spring p^2, lever *m*, and wire k^6, the magnet M being thereby energized and caused to attract the armature upon the lever *m*. This action breaks the local circuit at the spring p^2 and establishes the circuit from the storage-battery through the spring *p'*. In this case the magnet M must be made of very low resistance, since the working current passes through it, and the necessary power to move the lever must be given it by increasing the power of the local battery. The magnet M may be doubly wound with a fine wire for the local current and a heavier one for the working current.

In Fig. 8 the commutating device is shown as adapted to control by hand, and also having contact springs and blocks to take the place of the mercury-cups and the conductors which dip into them. A rod, *u*, is attached to the insulating-piece G to be operated by hand—as *e. g.*, by cords *u' u²* running from a cellar to an upper floor. The contact-springs W take the place of the mercury-cups, and the blocks *z* take the place of the conductors *c d e*, &c.

I know that devices have heretofore been known arranged to change the connections of a number of cells from parallel to series by a single movement, and I therefore do not claim that, broadly; but I do not know of any prior device arranged to change the connections of a number of storage-cells with a working and a charging circuit by a single movement from a connection in parallel in a charging-circuit ready to charge to a connection in series with a working-circuit, nor of any prior use of an electro-magnet introduced as a part of the working-circuit to accomplish these objects, nor of any prior device by which such objects are accomplished automatically upon the mere closing and opening of the working-circuit.

I claim as my invention—

1. The combination of the following elements: an electric generator and charging-circuit, a storage cell or battery, a working-circuit, an electro-magnet forming part of such working-circuit, and commutating mechanism controlled by such electro-magnet and operating a series of circuit closers and breakers, whereby the storage cell or battery is alternately connected in circuit with the charging-circuit and with the working-circuit, substantially as described.

2. The combination of the following elements: an electric generator and charging-circuit, a storage cell or battery, a working-circuit, an electro-magnet forming part of the working-circuit, a local battery and circuit, of

which the working-circuit forms a part, and commutating mechanism controlled by such electro-magnet and operating a series of circuit closers and breakers, whereby the storage cell or battery is alternately connected in circuit with the charging-circuit and with the working-circuit, substantially as described.

3. The combination of the following elements: an electric generator and charging-circuit, a storage cell or battery, a working-circuit, an electro-magnet forming part of such working-circuit, commutating mechanism controlled by such electro-magnet during the period of discharge and operating a series of circuit closers and breakers, whereby the storage cell or battery is alternately connected in circuit with the charging-circuit and with the working-circuit, a local battery and circuit of which the working-circuit forms a part, and a second electro-magnet in the local circuit, controlling the change of the commutating mechanism from the position of charge to that of discharge, and thereby also breaking the local circuit, substantially as described.

4. The combination of the following elements: an electric generator and charging-circuit, a storage-battery consisting of a number of cells, a working-circuit, and commutating mechanism operating a series of circuit closers and breakers, whereby the storage-battery may be alternately connected in parallel in the charging-circuit and in tension series with the working-circuit, substantially as described.

5. The combination of the following elements: a primary galvanic battery and charging-circuit, a storage-battery consisting of a number of cells, a working-circuit, and commutating mechanism operating a series of circuit closers and breakers, whereby the storage-battery may be alternately connected in parallel in the charging-circuit and in tension series with the working-circuit, substantially as described.

6. The combination of the following elements: an electric generator and charging-circuit, a storage-battery consisting of a number of cells, a working-circuit, an electro-magnet forming part of such working-circuit, commutating mechanism controlled by such electro-magnet and operating a series of circuit closers and breakers, and circuit-connections between the various cells, whereby the storage-battery is alternately connected in parallel in the charging-circuit and in tension series with the working-circuit, substantially as described.

7. The combination of the following elements: an electric generator and charging-circuit, a storage-battery consisting of a number of cells, a working-circuit, an electro-magnet forming part of such working-circuit, a local battery and circuit of which the working-circuit forms a part, commutating mechanism controlled by such electro-magnet and operating a series of circuit closers and breakers, and circuit-connections between the various cells, whereby the storage-battery is alternately connected in parallel in the charging-circuit and in tension series with the working-circuit, substantially as described.

8. The combination of the following elements: an electric generator and charging-circuit, a storage-battery consisting of a number of cells, a working-circuit, an electro-magnet forming part of such working-circuit, commutating mechanism controlled by such electro-magnet during the period of discharge and operating a series of circuit closers and breakers, with circuit-connections between the various cells, whereby the storage-battery may be alternately connected in parallel in the charging-circuit and in tension series with the working-circuit, a local battery and circuit of which the working-circuit forms a part, and a second electro-magnet in the local circuit, controlling the change of the commutating mechanism from the position of charge to that of discharge, and thereby also breaking the local circuit, substantially as described.

9. The combination of insulating-piece G, having attached to it conducting-strips D and E, and conducting-arms *c d e*, &c., and pivoted at its ends at such a point that gravity will hold the arms *d e*, &c., within their respective cups, with the lever *m*, carrying an armature, and the electro-magnet F, forming part of the working-circuit, substantially as and for the purpose described.

In witness whereof I have hereunto set my name, this 9th day of June, 1888, in the presence of two witnesses.

WM. P. KOOKOGEY.

Witnesses:
WALTER S. LOGAN,
SALTER S. CLARK.