2 Sheets--Sheet 1.

JAMES W. POWELL.

Improvement in Electro-Magnetic Apparatus.

No. 125,078. Patented March 26, 1872.

Fig: 1

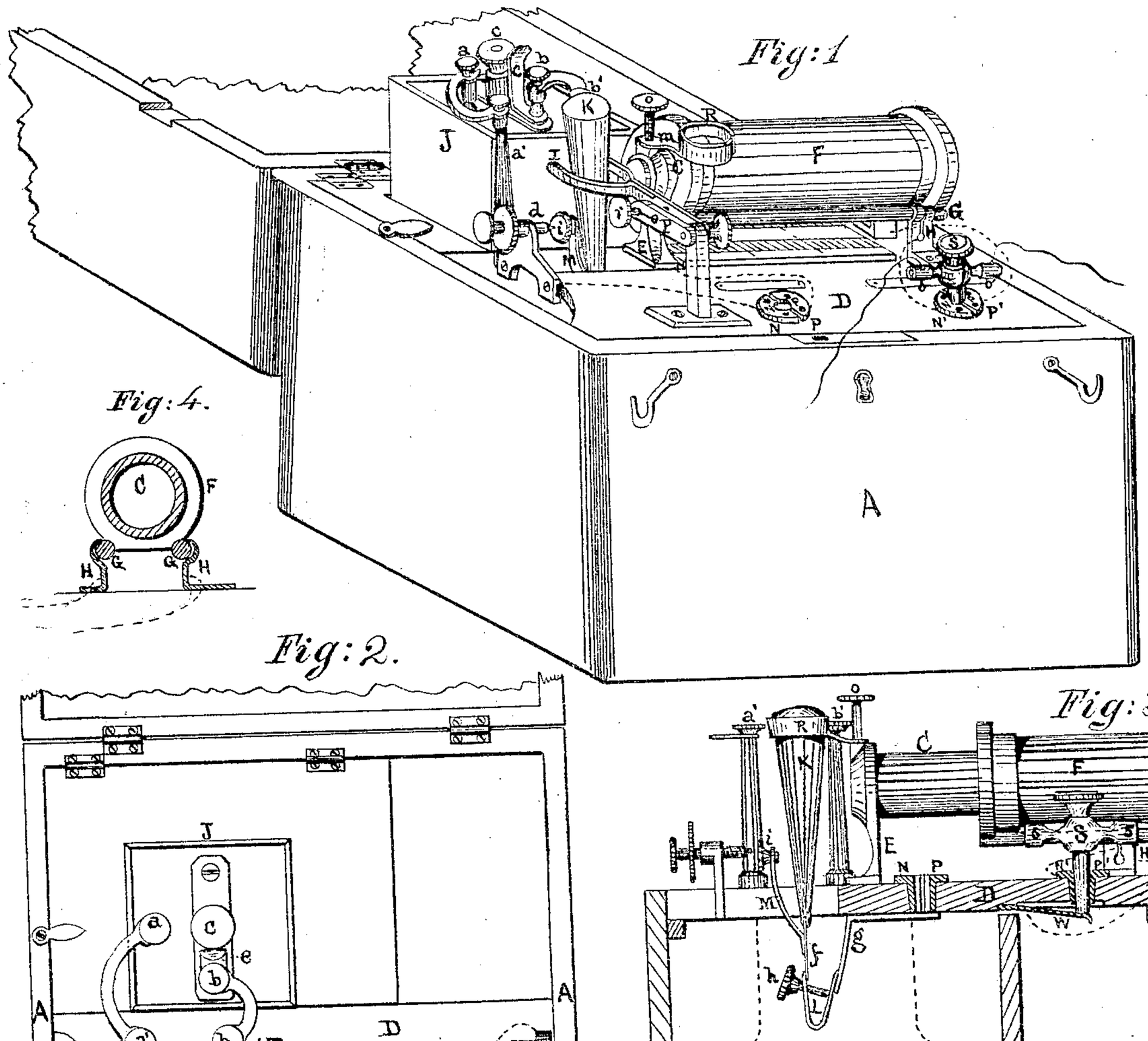


Fig: 4.

Fig: 2.

Fig: 3.

Fig: 5.

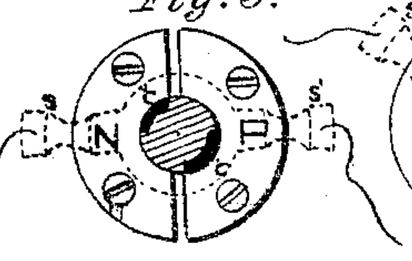


Fig: 6.

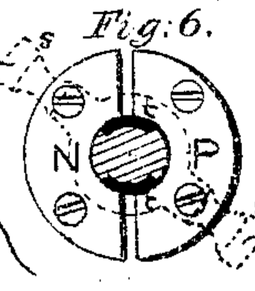
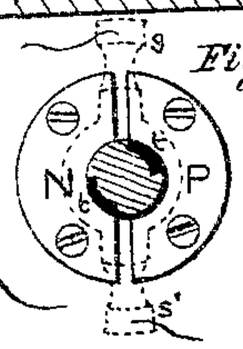


Fig: 7.



WITNESSES

H. H. Young

F. H. Burr

James W. Powell M.D
Inventor

By David A Burr atty.

2 Sheets--Sheet 2.

JAMES W. POWELL.

Improvement in Electro-Magnetic Apparatus.

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Fig: 8.

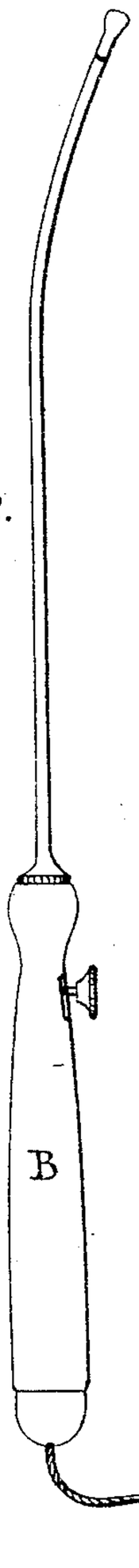


Fig: 9.

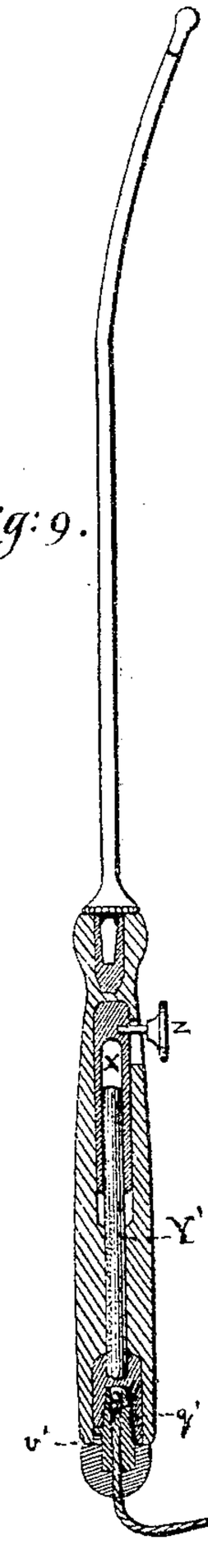


Fig: 10.

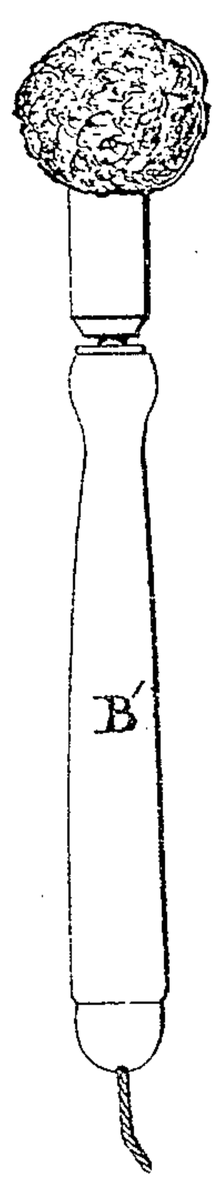
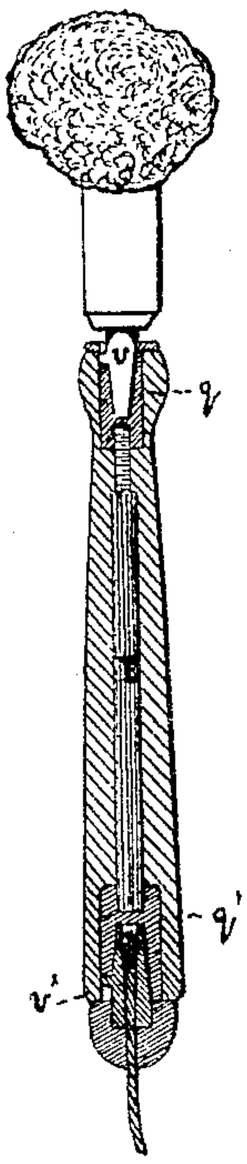


Fig: 11.



WITNESSES

H. H. Young

F. H. Burr

James W. Powell M. D.
Inventor

By David A. Burr Atty:

UNITED STATES PATENT OFFICE.

JAMES W. POWELL, OF NEW YORK, N. Y.

IMPROVEMENT IN ELECTRO-MAGNETIC APPARATUS.

Specification forming part of Letters Patent No. 125,078, dated March 26, 1872.

SPECIFICATION.

I, JAMES W. POWELL, M. D., of the city, county, and State of New York, have invented Improvements in Electro-Magnetic Machines, of which the following is a specification:

My invention relates, in the first place, to improved devices for changing the currents of the instrument from primary to secondary, and vice versa, and for instantaneously reversing the polarity of either the primary or secondary current; which said devices consist, first, of two rheotropes, consisting each of a pair of plates slightly separated, or of two centrally-divided metallic disks, the divisions of each being separated from each other and connected, respectively, with the positive and negative poles, in the one case of the primary and in the other of the secondary currents of the instrument; and, secondly, of a key to be inserted at pleasure in either rheotrope between the two plates, or the divisions of the disks constituting the same, in an aperture formed for the purpose, said key consisting of a central pin or column of hard rubber or other insulating material, upon opposite sides of which are secured arms to receive the electrode-wires, and so arranged as to be wholly separated by the intervening central column, each being provided with a narrow strip extending part way down the column, to come into contact with the one and the other plate or division of the rheotrope on either side, or to form, by a turn of the key, a connection between the two divisions by contact with both. By simply moving the key, with its attached electrode-wires, from one rheotrope to the other, a primary or secondary current is obtained at will, while, at the same time, the possibility of an accidental change of the current is prevented; and with either current a quarter turn of the key quickly made will instantly change its polarity without shock or perceptible interruption. Contact between the two divisions of the secondary rheotrope is automatically maintained, when the key is removed therefrom for use with the primary current, by means of a connecting-spring, the contact of the spring being broken and the secondary current through it opened by the insulated point of the key when inserted in the secondary rheotrope. The object of this spring-connection is to prevent the possibility of an induction-current in the primary current when in use, which would give the patient most painful shocks, and to permit the adjustment of the primary current by a movement of the sliding coil of the magnet. The second part of my invention relates to electrode-handles constructed with metallic terminal sockets, to receive, respectively, the wire at one end and the sponge or other electrode at the other, which said sockets are connected by a metallic rod, either divided to admit of connection and disconnection by means of a slide, or else unbroken, the whole being fixed and entirely inclosed in an outer casing of wood or other insulating material; and also to the combination of the wires of the instrument with said electrode-handles, each by means of a pin fitting within and secured at pleasure to said sockets in the handles, by means of a detachable socket or screw-joint. The third part of my invention relates to the combination of the elastic lever or spring carrying the armature or hammer of the magnet with one arm of a bent or U-shaped strip, secured by its outer arm to the under side of the base-plate of the instrument, the two arms of the bent strip being connected by a set-screw, which serves to draw them together or to allow their separation, for the purpose of regulating the perpendicularity of the hammer and approximating the same more or less to the magnet. The fourth part of my invention relates to the combination of the platina disk, working against the battery-connecting screw, with the elastic armature-lever, by means of an inelastic plate or strip secured to the lever so as to project therefrom, and which tends to prevent an excessive vibration of the hammer, the hammer-fork being likewise made inelastic for the same purpose. The fifth part of my invention relates to the use of a detachable ring secured at pleasure, by means of a thumb-screw, to the fixed standard carrying the magnet, so as to project therefrom and embrace the end of the vibrating hammer, to confine the same rigidly when the instrument is to be transported to a distance or carried from place to place, and thus prevent any strain thereon or derangement thereof. The sixth part of my invention relates to the combination of the sliding induction-coil of the magnet with the base-plate of the instrument by means of lateral metallic

bars working longitudinally through or between metallic standards fixed to the base-plate at the rear end of the magnet, on either side thereof, and formed at their upper ends to embrace or partially embrace said bars, so that the bars and coil may slide back and forth smoothly and easily and the connections thereof remain positively unbroken in any and all positions of the coil, thus avoiding a constant source of annoyance and embarrassment because of the want of such permanent reliable connections. The seventh part of my invention relates to the use of an elastic strip of metal as a spring, in combination with the binding-post of the zinc battery-plate, to bear constantly against the head of the rod carrying the latter, when the rod is fully down and the battery is in action, so as to surely establish connection therewith and supply a constant conductor, even should all other points of contact with the binding-post and its base-plate be impaired by oxidation or otherwise.

In the accompanying drawing, Figure 1 is a view in perspective of my improved electro-magnetic machine; Fig. 2, a plan view thereof; Fig. 3, a vertical section taken in the irregular line *x x* of Fig. 1, giving the greater part of the instrument in elevation; Fig. 4, a detached view of the standard and hooks which hold the sliding induction-coil of the magnet, the rods being in section. Figs. 5, 6, and 7 are transverse sections through the rheotrope-key, illustrating the effect and operation thereof in its different positions. Fig. 8 is an elevation and Fig. 9 a longitudinal central section of my improved electrode-handle, fitted with a slide. Fig. 10 is an elevation and Fig. 11 a longitudinal section of the electrode-handle without slide.

A is the case or box inclosing my improved electro-magnetic instrument; C, the electro-magnet, of approved construction, secured in the usual manner to the base-plate D of the machine by a metallic standard, E; F, the induction-coil inclosing and sliding back and forth upon the magnet C. This coil is guided in its movements and supported by means of metallic rods G G, secured on either side thereof, and which are embraced and upheld by short standards H H projecting from the base-plate D at or near the rear end of the magnet, as shown in Fig. 1, and which terminate either in rings or eyes, through which the rods G G may pass, or, as illustrated in the drawing, (see Fig. 4,) in elastic hooks, to grasp and partially inclose said rods and insure a constant contact of the two. The wires of the coil are connected to the rods, and a constant connection is thus secured between the induction-coil and the metallic standards H H, which said connection will remain unbroken in any position of the coil. J is the cap, covering the top of a galvanic-battery cell of the usual form and construction. *a a'* are the binding-posts (the one on the cell, the other on the base-plate of the instrument) through which connection is established with the carbon-plates of the battery, and *b b'* are the binding-posts through which a connection with the zinc battery-plat is formed. *c* is the head of the rod carryin the zinc plate, and by which the latter is ele vated and depressed at pleasure. *e* is a me tallic spring or "current-assistant," so secure to the metallic plate which connects the colla through which the rod *c* plays with the bind ing-post *b* as to bear against the head *c* of th rod, and thus form a conductor for the galvani current, and insure a connection between th rod and the post *b*, even though the contact o connection between the rod and its collar b broken or impaired by reason of a corrosion o coating of the surfaces. The post *a'* is con nected with the adjusting-screw *d* and the pos *b'* with the magnet and its armature by suita ble wires, in the usual manner. K is the arma ture or hammer of the instrument, made cone shaped, as shown in Figs. 1 and 3, and secure to a metallic spring, *f*, which is itself secure to a bent strip or plate, L, attached to a me tallic arm, *g*, projecting from the under side o the base-plate D, so that the hammer is uphel in a vertical position in front of the magnet all as fully illustrated in Fig. 3 of the drawing A set-screw, *k*, works through an aperture i one arm of the bent strip L into the opposit arm thereof, so as to cause, at pleasure, an ap proximation of the two arms, for the purpos of adjusting the verticality of the hammer. M is a non-elastic metallic strip, secured to an projecting forward, as shown at Fig. 3, at a acute angle from the spring *f*, carrying th hammer K; and upon the end of this strip M is pivoted the platform-disk *i*, which come into contact with the point of the adjustin connection-screw *d*. I is an adjustable fork pivoted at one end to a pillar or support, a shown in Figs. 1 and 2, so as turn up and dow in a vertical plane. The prongs of this for are made rigid and non-elastic, and embrac the hammer K, so as to limit the extent o its vibrations. P is a stiff bar, pivoted wit the fork I, to turn upon the same axis, and pro jecting parallel therewith. A set-screw, *r*, a the extremity thereof, works through a slotte aperature against the fork, whose inner end i made sufficiently elastic to yield slightly to th pressure of the screw, and thus receive latera adjustment. R is a ring, upon an arm, *m*, se cured, at pleasure, by means of a set-screw, *o* to the top of the standard E of the magnet, s that the ring may be made to encircle the up per end of the hammer, and rigidly confine and secure the same in transporting the instrument to long distances. P N P' N' are rheotrope o commutator plates, by preference cut into semi-circular form, so as that when approximated in pairs they will form circular, centrally-divided disks, as shown in Figs. 1 to 6 of the drawing. These plates P N are secured in pairs upon the base-plate D of the instrument, the plates in each pair being separated by a narrow interval, as shown in the drawing. A central conical aperture is formed in and between the two plates through the base-plate

D, to receive a rheotrope-key, the aperture being lined on opposite sides with metallic strips connected each with its appropriate plate, as shown in Fig. 3 of the drawing. Two pairs of these rheotrope-plates are employed in the instrument—one for the primary current, the other for the secondary current. The plates P N of the rheotrope for the primary current are connected, respectively, by suitable wires, the one, P, with the magnet or positive pole, and the other, N, with the connecting-screw or negative pole of the primary current in the instrument. The plates P′ N′ of rheotrope for the secondary current are connected, respectively, the one, P′, with the induction-coil, (or positive-pole,) and the other, N′, with the magnet (or negative pole) of the secondary current of the instrument. S is a rheotrope-key or current-changer, consisting of a pin or column of hard rubber or other non-conducting material, made to fit accurately into the apertures between the plates N P and N′ P′ of the rheotropes, so as to project very slightly through said apertures, as shown in Fig. 3. Upon opposite points of the upper end of this pin are secured metallic arms *s s′*, to receive and hold the electrode-wires of the instrument; and to these arms are connected narrow metallic strips *t t*, (see Figs. 5, 6, and 7,) let into the surface of the key, to extend from the arms downward, toward the point of the latter, so as to insure connection between the arms and the plates N P on either side. These strips *t t* are of such a width as to fully span the interval between the two plates N P and establish connection between them, and are so placed relatively to the arms as that, when the arms are placed either in a right line with the front edge of the base-plate or at right angles thereto, said side plates shall each be in contact with one only of the rheotrope-plates P N, as illustrated in Figs. 4 and 6, whereas, when upon an intermediate line or at an intermediate angle, as shown in Fig. 5, the side plates shall each be in contact with both plates P and N, and establish direct connection between them. W is a metallic spring, secured to the under side of the base-plate, beneath the secondary rheotrope P′ N′, so as to project over the opening therein, and when free to come into contact with the end of the lining-plate connected with and projecting downward from plate P′. This spring is connected by a wire with the opposite plate N′ of the rheotrope, so that when left free it establishes a connection for and opens the secondary current, which is broken and opened by the insertion of the key into the rheotrope; the pressure of the non-conducting point of the key operating to push down the spring and break its contact with the lining-plate projecting from the plate P′. Hence, when the key is removed from the secondary rheotrope and the primary current is in use, the secondary current is surely and automatically closed, and the danger of producing an induction-current when the primary current is in use, by an opening of the secondary current, is avoided. By the use of the key S with either rheotrope the current is instantly closed or opened, at pleasure, by turning the key one-eighth of a circle in the one direction or the other, as the case may require, while the polarity of the current is instantly changed by turning the key one-quarter of a circle, as illustrated in Figs. 4, 5, and 6.

At the same time all possibility of a change of the current from primary to secondary communicating a severe and injurious shock, as has happened in the use of the pivoted rheotropes heretofore employed, is wholly avoided; for a change in the currents can be made only by changing the key from one rheotrope to the other, which may be quickly done when required, but cannot occur by accident. The key may be turned slowly in the secondary rheotrope to reverse the polarity of the current without danger of interrupting it, but must be turned quickly in the primary rheotrope. B B′, Figs. 8, 9, 10, and 11, are my improved "universal" electrode-handles. These consist each of a suitable outer casing, made wholly of wood, rubber, or other non-conducting material, in the ends of which are inserted and secured metallic cone-shaped sockets *q q′*, (see Fig. 11,) to receive conical metallic pins *v v′*, which, when inserted into the sockets, are secured by means of a stud, *w*, projecting therefrom, and which passes into a right-angled slot in the socket, to form a "bayonet-joint;" or a threaded socket may be used to receive a screw instead of a pin, *v*. The outer ends of these pins *v v′* are inclosed with wood or other non-conducting material, to form the outer end of the handle; and an insulated wire connected to the pin passes outward through the insulating material, as illustrated in the drawing. To the pins *v′*, fitting into the sockets at the opposite end, are secured the several forms of electrodes employed. Instead of securing the electrodes to a detachable pin, *v′*, fitting into a socket, *q′*, the tang or end of the metallic shank of the electrode may be fitted and permanently secured into the end of the handle, as illustrated in Figs. 7 and 8. The sockets *q q′* at each end, where the electrodes and electrode-wires are both made detachable, as shown in Figs. 9 and 10, or the socket *q* at one end and the end of the electrode at the other, where the latter is permanently secured in the handle, as shown in Figs. 7 and 8, are either connected with each other permanently by means of a metallic rod, strip, or wire, Y, Fig. 11, extending from one to the other, or otherwise, by means of a rod or strip, Y′, Fig. 9, upon which is fitted a sliding collar or plate, X, moving upon the rod or strip to and from the end socket, so as to establish or break, by a movement thereof, the connection of the one with the other; this movement being produced, at pleasure, by the operator with his finger by pressure upon a button or knob, Z, projecting from the sliding plate or collar outwardly through a slot in the handle, as shown in Figs. 7 and 8. In these improved handles there is

no metal or other conducting medium exposed, either upon the surface or at the ends, so that all possibility of the patient or operator's receiving a shock of electricity from the external surface of the handles unintentionally, as often happens with the ordinary handles, is wholly avoided. Again, the liability of wetting and oxidizing the electrode cords, or of entangling and breaking them, incident to their connection with the old styles of handles, is avoided in the use of these improved handles, and, in addition to the protection afforded in the connections of the wires in their electrodes by their inclosure within the insulating-handles, the currents may not only be instantly closed or interrupted, at pleasure, by a simple movement of the slide through the pressure of the operator's finger upon the knob Z, but it will remain opened or closed without further attention until a further movement is made. This device for opening or closing the current, at pleasure, is of especial importance in the use of uterine electrodes, or electrodes to be introduced into any of the cavities of the body, and for application within the nose, throat, or rectum, as the current of electricity is thereby restrained from passing until the desired point of application is reached.

In some cases, instead of using cone-shaped sockets and counterpart conical pins, I use a screw in the stead thereof, in attaching electrodes to their handles.

I claim as my invention—

1. A rheotrope and polarity changer for electro-magnetic machines, consisting of a pin or key, formed of or covered with a non-conducting material, to be inserted between two adjacent metallic plates, connected, respectively, with the opposite poles of the instrument; said key or pin being fitted on opposite sides with metallic strips, either of them being wide enough to span the interval between the plates, and each connected with an arm or other suitable device for holding an electrode cord or wire, all substantially as and for the purpose herein set forth.

2. A metallic spring connected with one pole of the secondary current in a magneto-electric instrument, placed in contact with that plate or division of the rheotrope which is connected with the opposite pole of said current, and arranged to be retracted by an insulated pin or key to be inserted in the rheotrope, all substantially in the manner and for the purpose herein set forth.

3. An electrode-handle constructed, substantially as herein described, of metallic terminal sockets, connected by a metallic rod or strip, and fixed and wholly inclosed within an outer casing of wood or other non-conducting material.

4. A metallic slide, arranged within the electrode-handle of an electro-magnetic machine, and operating to establish or break, at pleasure, a connection between the terminal sockets of the handle, substantially as and for the purpose herein set forth.

5. A tapering metallic pin attached to the electrode or electrode-wire of an electro-magnetic machine or galvanic battery, and secured within a counterpart terminal socket in an electrode-handle by a detachable joint, substantially as and for the purpose herein set forth.

6. A bent or U-shaped strip or fork, contracted, at pleasure, by a set-screw, and interposed between the elastic armature-lever of an electro-magnetic instrument and the device by which it is secured to the base-plate, for the purpose of adjusting the perpendicularity of the hammer, substantially as herein set forth.

7. A non-elastic metallic strip, interposed between the battery-connecting screw and the elastic armature-lever of an electro-magnetic instrument, and attached to said lever, substantially as and for the purpose herein set forth.

8. A detachable ring or clasp, secured to a fixed support in an electro-magnetic instrument, and combined with the armature-lever or hammer of its magnet, to confine and secure the same for transportation, substantially as herein set forth.

9. The combination of lateral metallic rods with the sliding induction-coil of an electro-magnetic instrument, and with metallic standards to grasp or encircle said rods and permit a free, longitudinal, sliding movement of the coil without breaking the contact of the rods and standards, so as to afford constant, unbroken connection between the coil and the standards, and through them with the electrodes of the instrument, substantially as herein set forth.

10. An elastic metallic strip or spring, in combination with the binding-post of the zinc plate of the battery of an electro-magnetic instrument, and with the rod carrying said battery-plate, all substantially as and for the purpose herein set forth.

JAMES W. POWELL.

Witnesses:
JOHN IVES,
FREDERIC C. BANLETT.