J. KIDDER.

Magneto-Electric Machine.

No. 41,927. Patented March 15, 1864.

Fig. 1

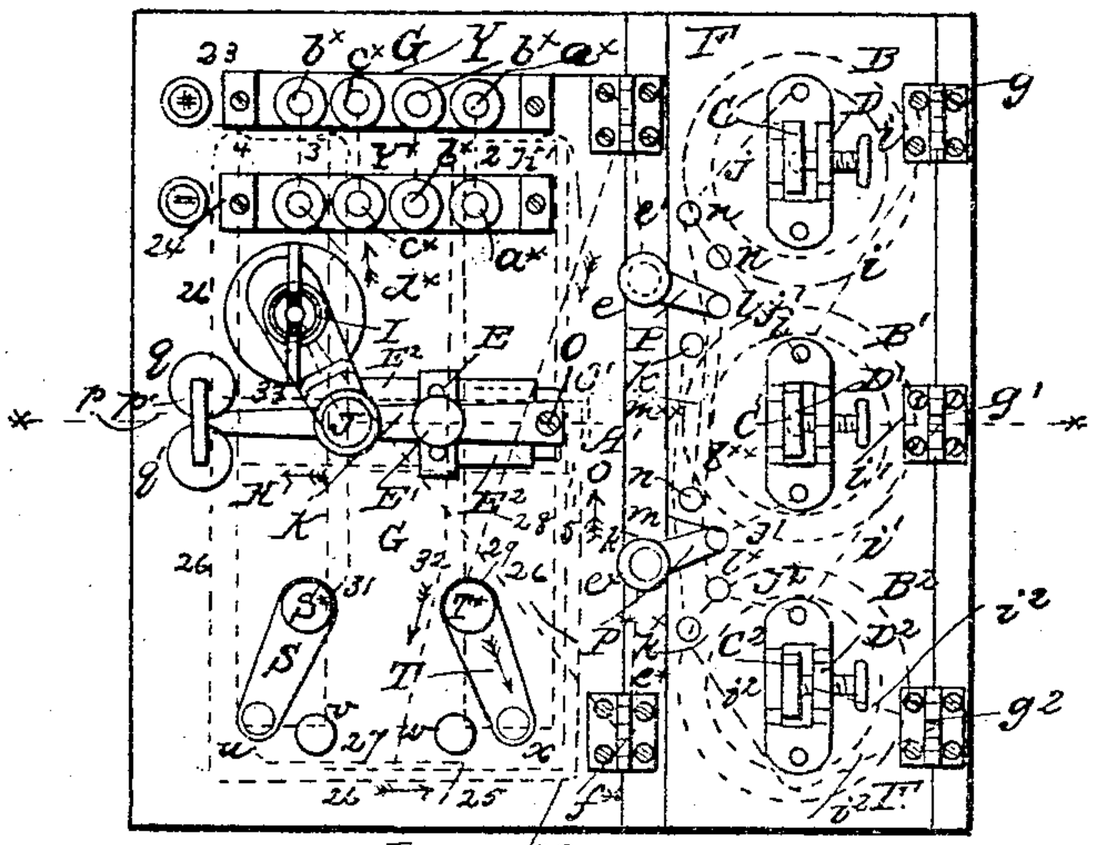


Fig. 4

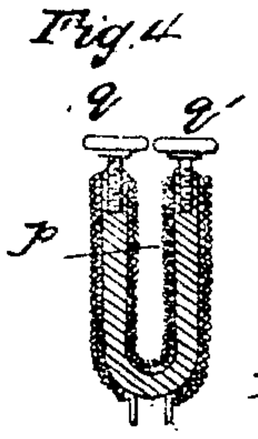


Fig. 2

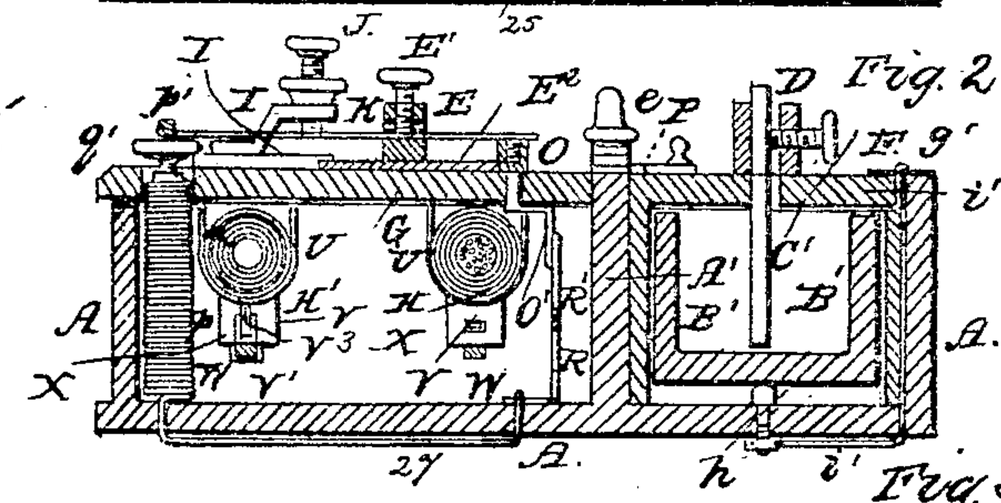
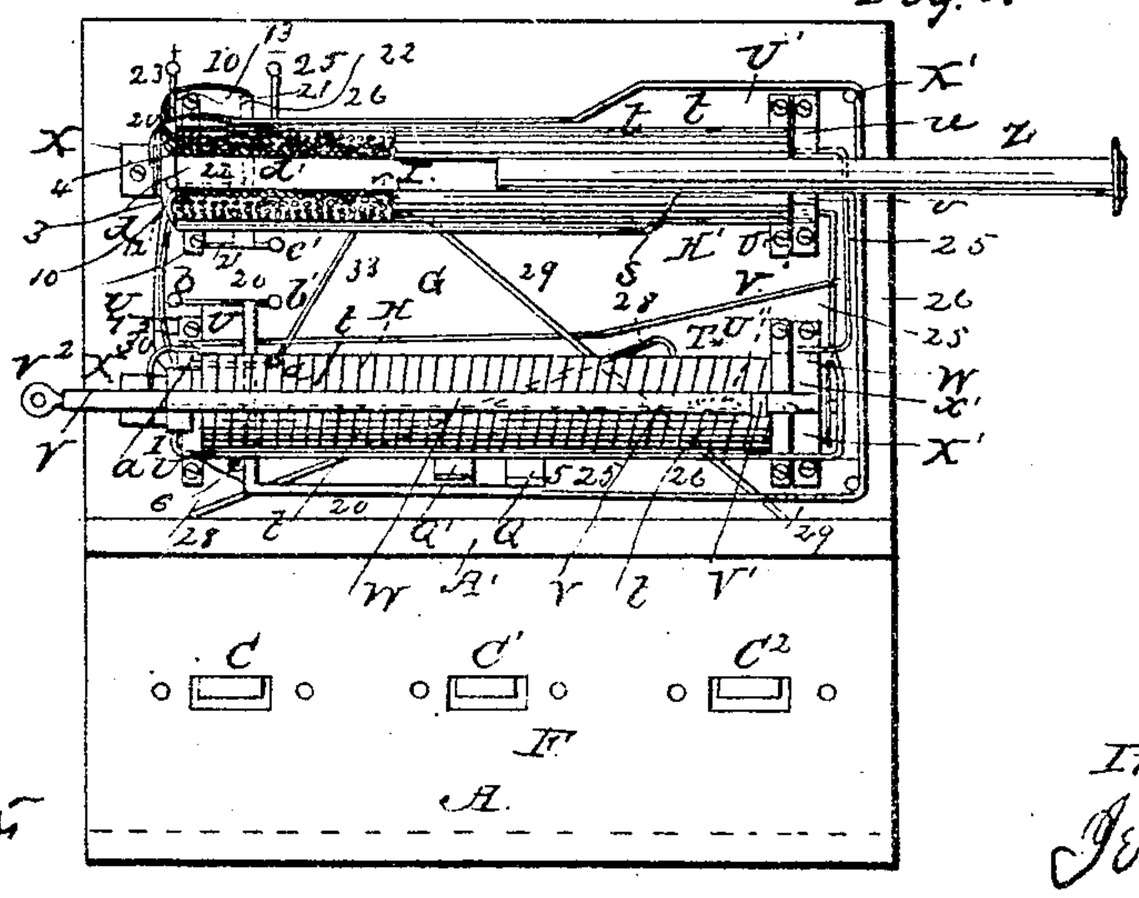


Fig. 3.



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JEROME KIDDER, OF NEW YORK, N. Y.

IMPROVEMENT IN MAGNETO-ELECTRIC MACHINES.

Specification forming part of Letters Patent No. **41,927**, dated March 15, 1864.

To all whom it may concern:

Be it known that I, JEROME KIDDER, of No. 429 Broadway, in the city, county, and State of New York, have invented certain new and useful Improvements in Magnetic-Electric Machines; and I do hereby declare that the following is a full clear, and exact description of the same, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a top view of a machine with my improvements. Fig. 2 is a vertical section of the same in the plane indicated by the line *x x* in Fig. 1. Fig. 3 is a horizontal section of the same, showing the parts above the plane of section, and representing them in inverted positions. Fig. 4 is a vertical section of the electro-magnet.

Similar letters and numbers of reference indicate corresponding parts in the several figures.

The object of my invention is to enable the character of the currents obtained by a magnetic electric machine to be varied in a very great degree, more especially with a view to apply electro-magnetism to the cure of disease, though the variations produced may be advantageous for other than medical purposes.

The invention consists, first, in the employment of two helices, or systems of helices, so combined and arranged that the current or currents of one helix or system may be added to the current or currents of another helix or system, or that the current or currents of one helix or system may be made to run in opposition to the current or currents of another for the purpose of cutting off the power by an opposing current or currents, the tension thus remaining the same while the power varies.

It consists, secondly, in the combination of a metallic strip or wire coiled around a helix, with arrangement for metallic connection upon the said strip or wire to any desirable point lengthwise of the helix for the purpose of receiving the induced current through a closed circuit, and thereby cutting off the current from the inner coils of the helix.

It consists, thirdly, in the employment of a multiplier so arranged that any one battery of a series can be used, or any number arranged in any positions in the series may be combined.

It consists, fourthly, in the construction or arrangement of the electro-magnet and vibrating armature or hammer in such a manner as to make the poles of the magnet and the armature or hammer relatively adjustable toward or from each other to command uniform vibration under different degrees of battery-power without altering the tension of the spring which draws back the armature or hammer.

It consists, fifthly, in the application to the spring which carries the vibrating armature or hammer of an adjustable clamp to regulate the vibrating length of the said spring, and thereby more perfectly control the rapidity of the vibrations, making them faster or slower, as may be desired.

It consists, sixthly, in a novel system of adjustable screws so arranged in a stationary bar or bars and in relation to a series of disks or their equivalents, forming the termini of the several wires of the helix or helices, as to serve the purpose of bringing the currents of the said wires, or any number of them, to two fixed electrodes to which the conductors are to be attached.

To enable others skilled in the art to make and use my invention, I will proceed to describe its construction and operation with reference to the drawings.

A is the base or stand, of wood or other non-conducting material, which supports the machine made in the form of a box, which is divided by a partition, A′, into two compartments, of which one contains the helices and magnet and some of their appurtenances, and the other contains the battery.

B B′ B^2 are carbon-cups forming the negative element of the battery, and C C′ C^2 the zincs forming the positive element of the same. The cups are set in suitable seats in the base A, and the zincs are held in screw-clamps D D′ D^2 secured to a hinged lid, F, which covers the battery-compartment of the base, and which serves as a convenient means of raising all the zincs simultaneously out of the cups. The bottoms of the cups rest on metallic screws H, one under each cup, to which are attached the wires *i i′* i^2, (see Fig. 1,) which conduct the positive currents from the cups, the said wires passing to the hinges *g g′* g^2 of the wooden lid F, which correspond in number with the battery-cups, and from these hinges the said wires lead to metal studs secured in the lid F. Of these studs, which are shown in Fig. 1, there

are two sets, one marked *k l m n*, and the other *k* l* m* n**, each set arranged in an arc concentric with the center of motion *e* or *e** of one of two switches, P P*. The studs *k k** are connected by a wire, *k***, the studs *l l** by a wire, *l***, the studs *m m** by the wires J J′ and clamp D′, and the studs *n n** by a wire *n***, and the said studs, switches, and connections constitute the multiplier. The wire *i* from the cup B′ leads to the stud *m*, that I′ from the cup B′ to the stud *l**, and that i^2 from the cup B^2 to the stud *k**, while the negative currents are conducted from the zincs C C′ C^2 by wires *j j′* j^2, from the screw-clamp D to the stud *n*, from the clamp D^2 to the stud *l**. By this arrangement of connections and switches of the multiplier, and a proper adjustment of the switches on the studs, the current from either one of the cups may be used separately, or the currents of any two, or of the whole three, may be combined, and the currents may be brought in either direction to the switches, to be passed thence through the two helices H H′, which are attached to the under side of the wooden lid G, which covers the larger compartment of the base A, the said lid being hinged to the partition A′ by two metal hinges, *f f**, with which the center pins, *e e**, of the switches P P* are connected by wires *e′ e′**.

Each of the helices H H* is composed of a coil of coarse wire, extending in one or more (say two) layers the entire length of the helix, and two coils of finer wire, each of many layers, and each may therefore be considered as a series of helices; but it will be sufficient, in describing my apparatus, to speak of them as helices. The first end of the inner coil of the coarse wire of the first helix, H, is soldered to a metal stud, *x*, Figs. 1 and 3, which is secured in the lid G, and which is also connected by a wire, 25, with a stud, *v*, which is also secured in the said lid. The said wire enters the helix at 1, Figs. 1 and 3, and, having been coiled in the helix, the said wire leaves the helix at 2 and is soldered to a stud, *u*, and connected by a wire, 27, with a stud, *w*. The inner coil of the corresponding coarse wire of the other helix, H′, is soldered to a center pin of a switch, S, which is arranged above the lid G to move between the studs *u* and *v*, above mentioned; and the said wire enters the helix at 3, and, having been coiled in the helix, leaves it at 4 and passes round, as indicated by the numeral 26 in Figs. 1 and 3, and connects with an angle-plate, Q, which is secured to the inside of the lid G, and which, when the lid is closed, comes in contact with a metal spring, R, which is secured to the bottom of the box A, and this spring is connected by a wire, 27, (see Fig. 2,) with one end of the coil of the U-shaped electro-magnet *p*, which is erected upon the bottom of the said box, the other end of the said coil being connected with a spring, R′, precisely similar to R, which, when the lid G is closed, is in contact with an angle-plate, Q′, precisely like Q, secured to the lid G. This plate Q′ is soldered to the bolt O, which holds one end of the vibrating spring K, to the other end of which the armature *p′* of the magnet *p* is attached, the said armature and spring resembling a hammer, and the tension of the said spring tends to draw the armature from the poles of the magnet. A wire, 20, also leads, as shown in Figs. 1 and 3, from the angle-plate Q, with which the last-mentioned end of the aforesaid coil of the helix H′ is connected, to the two studs *b b′*, Fig. 3, secured in the lid G. These studs constitute parts of two series, *a′ b′*, *c′ d′*, which will be hereinafter fully described.

The connections of the fine coils of the helices H H′ are shown in Fig. 3 in red color. The first end of the inner coil of fine wire of the helix H is soldered at 6 (see Fig. 3) to the wire 20, which connects it with *b b′*, and with the last end of the coarse wire of the helix H, and, having been wound in several layers around the coarse wire of the helix H, comes out at 7 and passes to the other helix, H′, which it enters at 8, and, having been wound in several layers around the coarse wire of that helix, comes out at 9, and is there soldered to a wire or metal, 21, connected with the two studs *c c′* secured in the lid G. The first end of the outer coils of fine wire is, like that of the inner one, connected, as shown at 10 in Fig. 3, with the last end, 9, of the second coils, and, having passed around the first helix, H, comes out at 11, entering the helix H at 12 and coming out at 13, where it is soldered to a wire or strip of metal, 22, connected with the studs *d d′* secured in the lid G.

The helices receive the current from the battery through the switch S, before mentioned, and a similar switch, T, which is movable from one to the other of the studs *w* and *x*. The center pin, T*, of the switch T is connected by a wire, 28, with the hinge *f* of the lid G. The other hinge, *f**, of the lid is connected by a wire, 29, with the metal stand I, which is secured to the top of the lid G to carry the platinum-pointed stop-screw J, against which the armature or hammer-spring K stops when it rises, after the attraction of the magnet *p* ceases, the hinges *f* and *f**, it will be remembered, are connected with the battery-switches P P*, as shown in Fig. 1.

The switches S and T are to change the ends of the coarse wire, of which the inner coil of the helix H is composed, making the primary current pass through it in one or the other direction, so that the latter currents are made either to add to or cut off the power of the currents of the other helix, H, at option, and thus a current of fixed and definite tension may be secured while its power is varied.

The studs *a b c d* and *a′ b′ c′ d′*, hereinbefore described, are arranged in two rows and terminate outside of the lid G in disks or button-like heads, and over the two rows there are arranged two metal bridges, Y Y′, (shown in

Fig. 1,) which are secured to the said lid. The bridge Y, situated over the studs *a b c d*, has screwed through it, in positions corresponding with the said studs, a row of screws, *a* b* c* d**, and the bridge Y′, situated over the studs *a′ b′ c′ d′*, has screwed through it, in positions corresponding with the said studs or rows of screws *a′* b′* c′* d′**, each one of the said screws being directly over one of the studs, and the said screws are furnished with heads of such form as to permit them to be taken hold of by the thumb and fingers and turned to bring them into or out of contact with their respective studs. The bridge Y is connected, by a wire, 23, with an electrode marked + in Figs. 1 and 3, and the bridge Y, by a wire, 24, with an electrode marked — in the same figures. The studs and screws serve as the means for combining the several coils of the two helices in various ways, so that their currents may be developed in them together or separately, thus giving different characters to the currents, as may be desired, and as will be hereinafter described. Each pair of studs—that is to say, each two opposite ones of the two rows—have a metallic connection. Those *a a′* are connected by a wire, 33, (see Fig. 3,) with the stand I, before described. When the machine is in operation one of the screws in the bridge Y is always screwed down upon its respective stud, and some one of the other screws in the opposite bridge, Y′, is screwed down to its respective stud to bring the two bridges, and consequently the two electrodes, + and —, into the circuit of the coil or coils, as will be hereinafter explained.

The two soft-iron cores of the magnet *p* have holes drilled in their extremities, and these holes are tapped for the reception of two iron screws, *g g′*, which, by being made susceptible of being screwed up or down, constitute adjustable poles that may be brought relatively nearer to or farther from the position occupied by the armature *p′* when the circuit through the magnet is broken and the vibrating spring K is in contact with the screw J, so that the armature may be made to vibrate equally well under a strong or weak battery-power.

The relative mobility which shortens or lengthens the distance between the magnet and armature may be obtained by making the lid G adjustable higher or lower. In either of the above modes of adjustment the distance between the armature and magnet is varied without altering the tension of the spring which draws the armature away from the magnet.

E is the adjustable clamp for regulating the vibrating length of the spring R. This clamp is fitted to slide lengthwise of the spring on a plate, E^2, which is firmly secured on the top of the lid G, and is furnished with a screw, E′, the screwing down of which at the same time secures it to the plate E^2, and tightens it upon the spring in such manner as to prevent any vibration of the latter between the said clamp and the bolt O. By bringing the clamp nearer to the armature *p′*, and so shortening the vibrating length of the spring, the vibration is made quicker, and by setting back the clamp an opposite result is obtained.

t t are thin strips of metal wound around each of the helices H H′ from one end to another, and having their several turns insulated from each other. The two ends of each of these strips are secured to the metal supports U and U′, in which their respective helix is supported under each helix, and parallel with the axis thereof, there is a straight fixed bar, W, which is secured to the lid G by means of two metal brackets, X and X′, the former of which is also connected by a wire, 30, with the support U to make a metallic connection between the said bar and one end of the strip *l*.

In the bracket X there is provided a slot through which passes a straight metal rod, V, one end of which is made with a clasp, V′, to fit and slide along the fixed bar W, and the other is formed with a handle, V^2, which protrudes through an opening in one end of the box A. The end of the said rod V, on which the clasp V′ is provided, is also furnished with a roller, V^3, which bears against the strip *t*, and which, by the longitudinal movement of the rod V, is moved longitudinally upon the helix, by which means a metallic connection is made with the strip *t* at any desirable distance from the support U, where there is another metallic connection. When the connection is so made the strip *t* receives the induced current of the helix in its closed circuit, and so cuts it off from the coils beneath the portion of the said strip between the support U and the roller. This contrivance is useful to cut off a current which is produced with strong battery-power (without the use of the piston or core of wires being introduced) to apply it to the most sensitive parts of the body. It is also useful to prevent accident by the strong shock which is liable to be received in starting the machine before the piston or core of wires is withdrawn.

I will now describe the operation of the machine.

Suppose, for example, the battery-switch P on the stud *l*, the switch P on the stud *m**, the switch T on the stud *x*, and the switch S on the stud *u*, as shown in Fig. 1. The current is received at *l*, and passes, as may be traced in Fig. 1, through the switch P, wire *e′*, hinge *f*, and wire 28, as indicated by arrows in Fig. 1, to the switch T; thence through the stud *x* and wire 25 to the end of the helix H, which it enters at 1, and, passing through the inner coil of large wire, passes out at 2, and proceeds thence along the wire 32 to the stud *u*, through the switch S and wire 31, to the second helix H′, which it enters at 3, and making the circuit of the coarse wire of the said helix comes out at 4, and passes along the wire 26 to the angle-plate Q; thence through R, and through the wire 27, to the coil of the magnet

p, whence it passes by the wire 33 to the angle-piece Q′, through the spring R′ up to the bolt O. From thence it passes along the spring K to the screw J, through the support I, and onward along the wire 29 to the hinge *f*, and thence along the wire *e′** and switch P* to the disk *m*, which is the negative of the battery. The current passing through the coil of the magnet *p* causes the armature *p′* to be attracted and the circuit to be broken between the spring K and screw J, and the magnet then ceasing to attract the armature allows the spring K to rise again into contact with the screw J and reclose the circuit, which again causes the armature to be attracted and the circuit to be rebroken between the spring and the screw, and in this way a vibrating movement of the spring K, and armature and intermission of the current is kept up, the rapidity of such vibration and intermission depending upon the position of the clamp E and vibrating length of the spring. When the circuit through the magnet *p* is closed at J K the electrodes + and — are out of circuit; but when the circuit is open at J K and any conductor connects the said electrodes a circuit will be made through the wire 33, one of the studs *a a′* and *b b′ c c′* or *d d′*, the bridges *y y′* and wires 23 25, to one of the before-described connections of the studs *b b′ c c′ d d′*, with the helices H H′. When the switch S is on the stud *u* and the switch T on the stud *x*, as hereinbefore described and represented in the accompanying drawings, the primary current passes through both helices H H′ in the same direction, as may be seen by tracing the course of the arrows in Fig. 1, and develops the induced currents in the same direction, so that the said currents are added together to give greater power and tension; but by placing the switch S on the stud *v* and the switch T on the stud *w* the primary current is caused to run in the opposite direction through the helix H, and to develop the induced current of that helix in the opposite direction, so that the said current cuts off the power from H′.

It may be understood that by the connection of the first end, 6, of the fine wire of the helices with the last end, 4, of the coarse wire thereof by the wires 26 20, as shown in Figs. 1 and 3, or in an equivalent manner, the galvanic current will be caused to pass through the inner coils of fine wire of both helices H H′ when the screw *a** or *a′** in one of the bridges Y Y′, and the screw *c′** or *c** in the other bridge, are screwed down upon their respective studs *a a′* or *c c′*, or it will traverse through both the inner and outer coils of fine wire when the screw *d** or *d′** of one bridge is screwed down with the screw *a′** or *a** of the other, or it will traverse the coarse coils alone, if the screw *b** or *b′** of one bridge be screwed down with the screw *a′** or *a** of the other.

By turning down one or other of the two screws in the two bridges, denoted by any letter, it will be seen that the studs indicated by that letter may be brought into connection with the electrode marked +, or with that marked —, so that it will be seen that not only can any current be brought to the two electrodes + and —, but the direction of the current can be changed by its positive being brought to either electrode; hence not only is the inconvenience of changing the conducting-wires to different posts or electrodes avoided, but great convenience is afforded for reversing the direction of, as well as receiving, any one of any number of currents at two definite electrodes.

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

1. The two helices or systems of helices H H′, so combined and arranged that the induced current or currents of one may be added to the current or currents of the other, also that the current or currents of one may be made to run in opposition to the current or currents of another for the purpose of cutting off the power, substantially as herein specified.

2. The combination of a metallic strip or wire, *t*, surrounding a helix, and the arrangement for metallic connection V V′ V³, to connect any desirable points upon the said strip, substantially as and for the purpose herein specified.

3. The battery-multiplier, composed of a system of studs, *k l m n k* l* m* n**, or their equivalents, and switches P P* with suitable battery-connections, substantially as and for the purpose herein specified.

4. Making the poles of the electro-magnet *p* and the armature or hammer *p′* relatively adjustable toward or from each other without altering the tension of the spring which draws back the armature or hammer, substantially as herein specified.

5. The movable clamp E, applied to the spring K which carries the vibrating armature or hammer, substantially as and for the purpose herein specified.

6. The combination of the two bridges Y Y′, screws *a* b* c* d* a′* b′* c′* d′**, and studs *a b c d a′ b′ c′ d′*, the whole applied in relation to the several coils of the helices, and to the electrodes + and —, to operate substantially as and for the purpose herein specified.

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