No. 765,150. PATENTED JULY 12, 1904.

J. W. SHRYOCK.

ELECTROTHERAPEUTIC INSTRUMENT.

APPLICATION FILED FEB. 27, 1904.

NO MODEL. 2 SHEETS—SHEET 1.

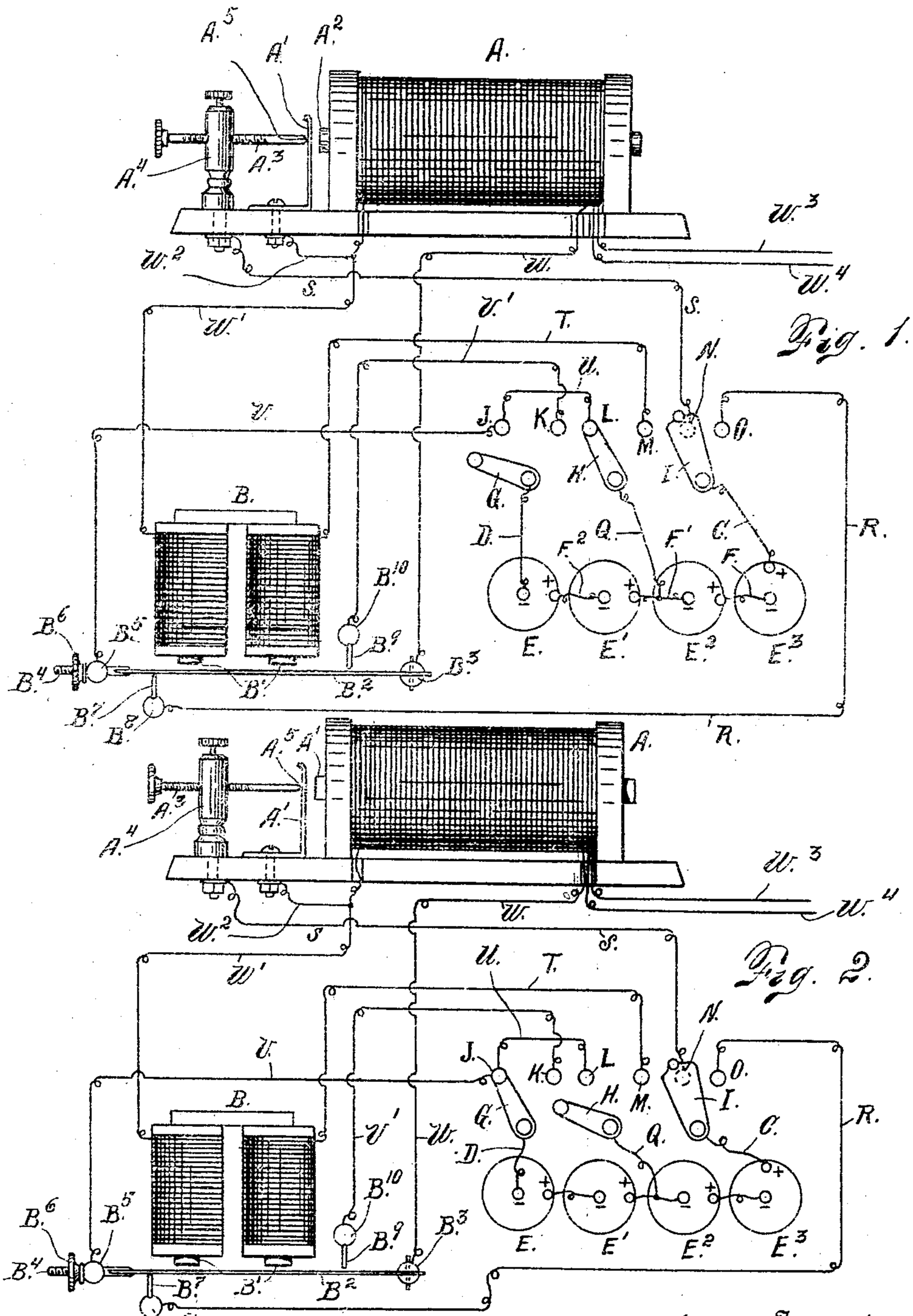

Fig. 1.

Fig. 2.

Witnesses
Otto E. Hoolick.
Dena S. Nelson.

Inventor
J. W. Shryock.
By A. P. Brice
Attorney

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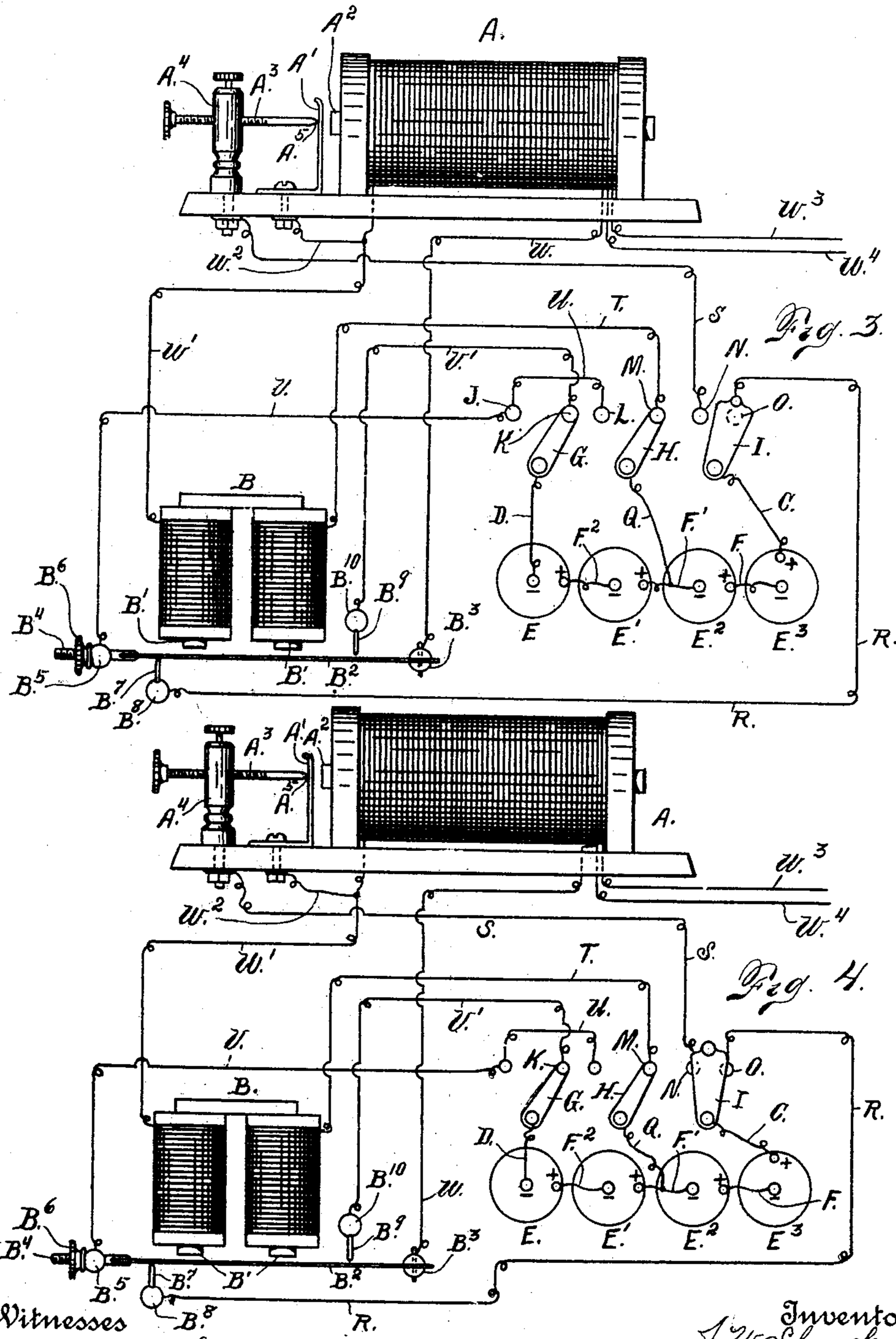

Fig. 3.

Fig. 4.

Witnesses
Otto E. Hoddick.
Denar S. Nelson.

Inventor
J. W. Shryock.
By H. R. Baker
Attorney

No. 765,150. Patented July 12, 1904.

UNITED STATES PATENT OFFICE.

JAMES W. SHRYOCK, OF PUEBLO, COLORADO, ASSIGNOR TO LORON E. WADE, OF PUEBLO, COLORADO.

ELECTROTHERAPEUTIC INSTRUMENT.

SPECIFICATION forming part of Letters Patent No. 765,150, dated July 12, 1904.

Application filed February 27, 1904. Serial No. 195,652. (No model.)

To all whom it may concern:

Be it known that I, JAMES W. SHRYOCK, a citizen of the United States of America, residing at Pueblo, in the county of Pueblo and State of Colorado, have invented certain new and useful Improvements in Electrotherapeutic Instruments; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

My invention relates to improvements in electrotherapeutic instruments.

My improved instrument is adapted to be used where the ordinary faradic current is required, while in addition to this use it is adapted to pass the current automatically alternately in opposite directions through the primary conductor of the induction-coil. It is also further adapted to produce what I call a "wave-current" by shunting a portion of the current through the interrupting device of the induction-coil simultaneously with the passage of the current in opposite directions through the primary wire of the said coil, thus producing an effect resulting from the combining of the alternating current and the interrupted current. In producing the alternating current through the primary conductor of the induction-coil I provide switches and connections whereby one half of the battery-current is first passed through the primary wire or conductor of the induction-coil in one direction, while immediately thereafter the current from the other half of the battery is passed through the same wire or conductor in the opposite direction, the change being antomatically accomplished through the instrumentality of a rheotome or an interrupting device, which, as shown in the drawings, consists of an electromagnet and a steel tape or ribbon, whose tension may be regulated as desired, the said ribbon being made to vibrate between two platina points or contacts, one of which it normally engages, while it is thrown to engagement with the other through the instrumentality of the electromagnet.

Having briefly outlined my improved construction, as well as the function it is intended to perform, I will proceed to describe the same in detail, reference being made to the accompanying drawings, in which is illustrated an embodiment thereof.

In the drawings, Figure 1 illustrates my improved instrument with the connections made for producing a faradic current by the use of two cells or half of a battery composed of four cells. Fig. 2 is a similar view with the connections made for producing the ordinary faradic current by the use of all the cells of the battery. Fig. 3 is a view of the same with connections made for passing half of the current of the battery alternately through the primary wire of an induction-coil in opposite directions, the change of the current from one direction to the other being automatically produced. Fig. 4 is a similar view illustrating the proper connections for introducing a wave element into the current produced by the construction shown in Fig. 3.

The same reference-letters indicate the same parts in all the views.

Let E, E′ E^2, and E^3 designate the four cells of an electric battery, the two cells E and E′ forming what may be termed "one pair" and the two cells E^2 and E^3 forming the other pair of cells.

A is an induction-coil of ordinary construction; A′, a flexible piece of metal forming a rheotome or interrupter, mounted in such proximity to the core A^2 of the induction-coil that when the current is passed through the primary wire of the coil and the core A^2 energized the latter will draw the part A′ away from a screw A^3, threaded in a post A^4, and thus interrupt the current which passes from the battery through the post and screw to the interrupter A′. The inner extremity A^5 of the screw A^3 is preferably composed of platina on account of its superiority in points of endurance and conductivity.

B is an electromagnet, and mounted in suitable proximity to the cores B′ of the coils is

a metal ribbon B^2, forming a rheotome or interrupter, one extremity of which is secured in a part B^3, while the other extremity is threaded, as shown at B^4, and passes through a stationary part B^5, which is engaged by a nut B^6, screwed on the threaded extremity B^4. It will be understood that by adjusting the nut B^6 the tension of the part B^2 may be regulated at will for the purpose of controlling the rapidity of the vibrations of the said part. The interrupter B^2 is normally in engagement with a platina point B^7, mounted on the relatively stationary part B^8. Another platina point B^9 is mounted on a stationary part B^{10} and located on the opposite side of the interrupter from the point B^7. The interrupter is normally out of contact with the point B^9 when the instrument is not in use. When, however, the instrument is in use and the current is passed alternately through the coils of the magnet B in opposite directions, the part B^2 is made to vibrate between the points B^7 and B^9 as often as the direction of the current through the coils of the magnet B is changed, since the polarity of the poles B′ is reversed by passing the current in opposite directions through the coils of the magnet. Hence if the cores B′ attract the interrupter B^2 when the current is passed through the coils in one direction the same core will attract the interrupter B^2 when the current is passed through the coils of the magnet in the opposite direction; but there is an instant between the opening of one circuit through the magnet and the closing of the other circuit when the magnet is deënergized; hence the vibration or oscillating movement of the part B^2 between the two oppositely-located platina-points. Between the battery and the members A and B of my improved instrument are located three switches G, H, and I, movably mounted and adapted to engage stationary contacts J, K, L, M, N, and O, as will be hereinafter explained. The switch I is connected with the positive pole of the cell E^3 by a conductor C. The switch-arm G is connected with the negative pole of the cell E by a conductor D. The positive pole of the cell E^2 is connected with the negative pole of the cell E^3 by a conductor F, the positive pole of the cell E′ is connected with the negative pole of the cell E^2 by a conductor F′, and the positive pole of the cell E is connected with the negative pole of the cell E′ by a conductor F^2. The switch H is connected with the conductor F by a branch conductor Q, the contact O is connected with the contact B^8 by a conductor R, the contact N is connected with the post A^4 by a conductor S, the contact M is connected with the electromagnet by a conductor T, the contact G is connected with the contact L by a short conductor U, while the contact J is connected with the contact or part B^5 by a conductor V, and the contact K is connected with the stationary part or contact B^{10} by a conductor V′. One terminal of the primary wire of the induction-coil is connected with the contact B^3 by a conductor W, while the other terminal of the primary wire is connected with the electromagnet by a conductor W′ at a point remote from the connection with the magnet of the conductor T, whereby the current in passing from either conductor T or W′ to the other must pass through both coils of the magnet, the latter being shown as provided with two coils. The interrupter A′ is connected with the conductor W′ by a short conductor W^2. Leading from the terminals of the secondary coil are two conductors W^3 and W^4, which lead to the electrodes, (not shown,) which are adapted to be grasped by the hands of the patient under treatment.

From the foregoing description the use and operation of my improved apparatus will be readily understood.

Referring first to the construction shown in Fig. 1—that is to say, when the switches H and I are on the contacts L and N, respectively—the current will pass from the positive pole of the cell E^3 by way of the conductor C and the switch I, the contact N, the conductor S, the post A^4, the screw A^3, the interrupter A′, conductor W^2, through the primary wire of the induction-coil, and thence by way of the conductor W to the part B^3, the interrupter B^2, the part B^5, the conductor V, the contact J, the conductor U, the contact L, the switch H, and the conductor Q to the negative pole of the cell E^2, thus giving the patient who holds the electrodes connected with the conductors leading from the secondary coil the ordinary faradic current. When the switches are set, as shown in Fig. 2, the course of the current will be the same, except that it will pass from the conductor V to the switch G, and thence by way of the branch conductor D to the negative pole of the cell E, thus utilizing the entire strength of the battery instead of only two cells thereof, according to the arrangement shown in Fig. 1.

When the parts are connected, as shown in Fig. 3—that is to say, when the switches G, H, and I are in engagement with the contacts K, M, and O, respectively—the current may be said to pass first from the positive pole of the cell E^3 by way of the conductor C to the switch I, the contact O, the conductor R, the parts B^8 and B^7, and the conductor W to one terminal of the primary wire of the induction-coil, thence through the primary coil, thence from the opposite terminal of the primary coil by way of the conductor W′ to the coils of the magnet B, and thence by way of the conductor T to the contact M, the switch H, and the branch conductor Q to the conductor F′, and thence to the negative pole of the cell E^2. It will be observed that in this case two cells only or half of the battery is utilized. It will now be understood that as soon as the magnet B is energized the interrupter B^2 will

be drawn away from the platina point B^7 to engagement with the platina point B^9, in which event the circuit just described is broken, and the current may now be said to pass from the positive pole of the cell E′ by way of a part of the conductor F′, the conductor Q, the switch H, the contact M, the conductor T, through the coils of the magnet B, in a direction opposite the previous travel of the current, thence by way of the conductor W′ to one terminal of the primary wire of the induction-coil, and thence through the primary coil in a direction opposite its previous travel, and thence from the primary wire by way of the conductor W, the part B^3, the interrupter B^2, the platina point B^9, the part B^{10}, the conductor V′, the contact K, the switch G, the branch conductor D to the negative pole of the cell E. It will be observed that in this case the current from the cells E and E′ will have passed through the primary wire of the induction-coil in the opposite direction from that of the current from the cells E^2 and E^3 in the case previously described.

After the current from the cells E^2 and E^3 has passed through the coils of the magnet B in one direction and the interrupter B^2 has been drawn to engagement with the platina-point B^9 the current then passes through the coils of the magnet B in the opposite direction; but during the instant between the opening of one circuit and the closing of the other the magnet is deënergized, whereby the interrupter B^2 will be released and will again engage the platina point B^7. Then the current will begin its travel by way of the conductor R, as already described, and there will be a repetition of the act heretofore explained, and this may be kept up indefinitely as long as the parts are adjusted as shown in Fig. 3 of the drawings.

Now if it is desired to introduce what I call a "wave element" into the current I place the switch I upon the two contacts N and O, as shown in Fig. 4, in which event the current will pass alternately through the primary wire of the induction-coil in opposite directions, as already explained when referring to Fig. 3; but a portion of the current from the cells E^2 and E^3 when the path through which the current travels from these cells in unbroken will pass from the contact N through the shunt S and the post A^4, the screw A^3, the interrupter A′ and the short wire W^2 to the conductor W′, whereby an interrupted current is introduced to the alternating current.

Having thus described my invention, what I claim is—

1. The combination with an induction-coil and a battery, of an interposed electromagnet located in the the circuit of the primary member of the induction-coil, an interrupter located adjacent the magnet and in the magnet-circuit, and connections whereby as the movable part of the interrupter is moved in one direction, the current from one half of the battery is passed through the magnet-coil and through the primary member of the induction-coil in one direction, and when the movable part of the interrupter is moved in the opposite direction, the current from the other half of the battery is passed in the opposite direction through the magnet-coils and the said member of the induction-coil.

2. The combination with an electric battery composed of a number of cells, and an induction-coil connected with the battery, of an electromagnet, a flexible interrupter mounted adjacent to the magnet, contacts located on opposite sides of the interrupter, a conductor connecting one of the said contacts with the positive pole of one of the end cells of the battery, another conductor connecting the other contact with the negative pole of the other end cell, a third conductor leading from a wire connecting the positive and negative poles of the two middle cells of the battery, to one terminal of the magnet-coils, a fourth conductor connecting the other terminal of the magnet-coils with one terminal of the primary member of the induction-coil, and a fifth conductor connecting the other terminal of said primary member with the interrupter.

3. In an electrotherapeutic apparatus, the combination with a battery composed of an even number of cells, of an induction-coil and an interrupter comprising a faradic instrument; an electromagnet, an interrupter and two contacts located on opposite sides of the magnet-interrupter; three switches, two of which are respectively connected with the positive and negative poles of the end cells of the battery, while the third is connected with the battery between the positive and negative poles of the adjacent cells; three pairs of contacts, one pair being located adjacent each switch and each switch being adapted to be moved to engagement with either contact of its pair; conductors leading from the six switch contacts to the following points respectively; the two contacts on opposite sides of the magnet-interrupter, one terminal of the magnet-coils, two connections with the magnet-interrupter, and one connection with the interrupter of the magnet-coil; another conductor leading from one terminal of the primary member of the induction-coil to the magnet-interrupter, and another conductor leading from the terminal of the magnet-coil opposite the connection with the switch-contact, to the other terminal of the primary member of the induction-coil.

4. In an electrotherapeutic apparatus, the combination of an induction-coil and an electric source, of means introduced between the said source and the coil and actuated by the current from said source for automatically passing the current in opposite direction alternately through the primary member of the

induction-coil, an interrupter connected with the primary member of the induction-coil, and means for shunting a portion of the current through the interrupter of the induction-coil to a branch of the primary circuit.

5. The combination with an induction-coil and a battery, of an interposed electromagnet located in the circuit of the primary member of the induction-coil, an interrupter located adjacent to the magnet and in the magnet-circuit, and connections whereby as the movable part of the interrupter is moved in one direction, the current from one half of the battery is passed through the magnet-coils and the primary member of the induction-coil in one direction, and when the movable part of the interrupter is moved in the opposite direction, the current from the other half of the battery is passed in the opposite direction through the magnet-coils and the said member of the induction-coil, an interrupter connected with the primary member of the induction-coil, and means for shunting a portion of the current through the interrupter of the induction-coil to a branch of the primary circuit.

In testimony whereof I affix my signature in presence of two witnesses.

JAMES W. SHRYOCK.

Witnesses:
CHARLES B. CRAWFORD,
E. B. GREENLAND.