J. B. WANTZ.

ELECTROTHERAPEUTIC DEVICE.

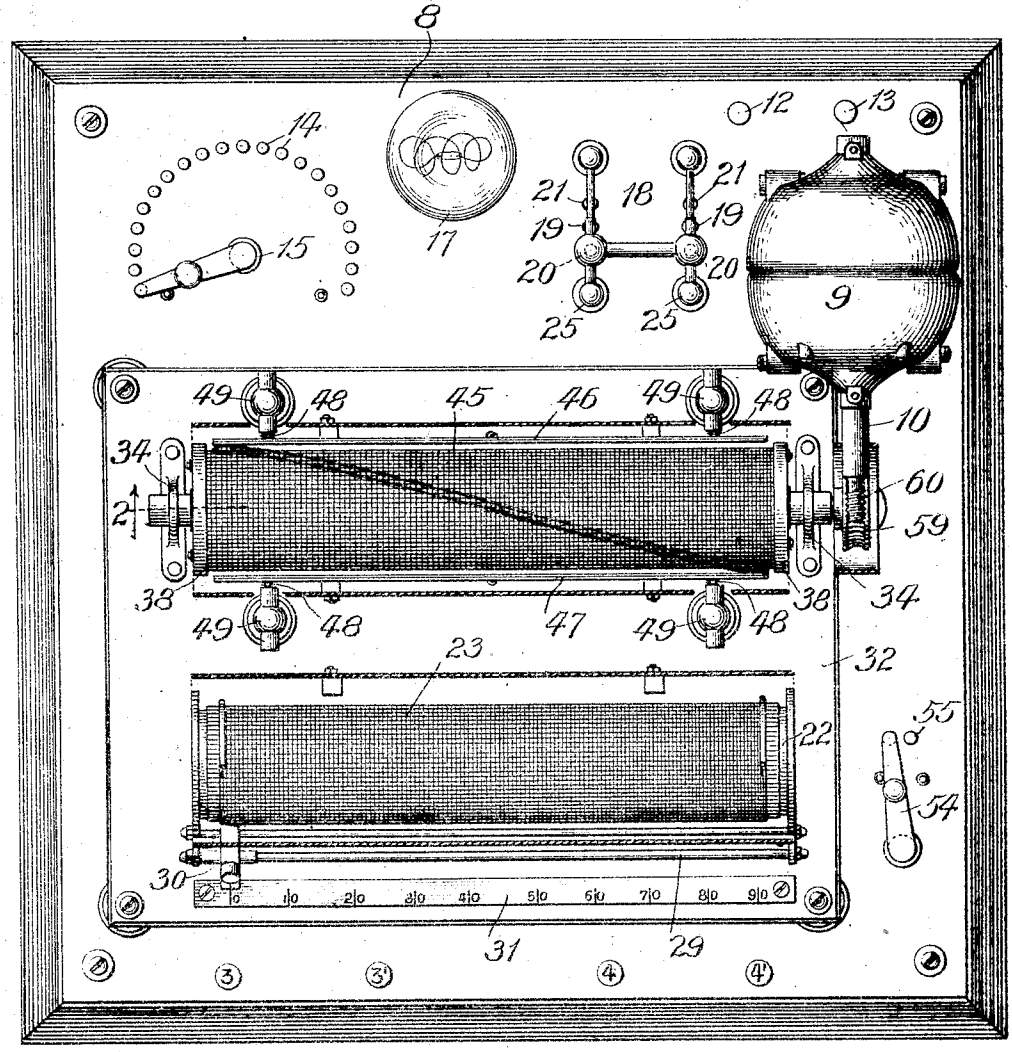
APPLICATION FILED OCT. 21, 1909.

1,003,676.

Patented Sept. 19, 1911.

4 SHEETS—SHEET 1.

Fig. 1.



Witnesses:

John Enders

Chas. H. Bull

Inventor:

Julius B. Wantz,

By Lyon, Lyon, Smith, Lee, Christton & Miller

Attys.

J. B. WANTZ.

ELECTROTHERAPEUTIC DEVICE.

APPLICATION FILED OCT. 21, 1909.

1,003,676.

Patented Sept. 19, 1911.

4 SHEETS—SHEET 2.

Fig. 2.

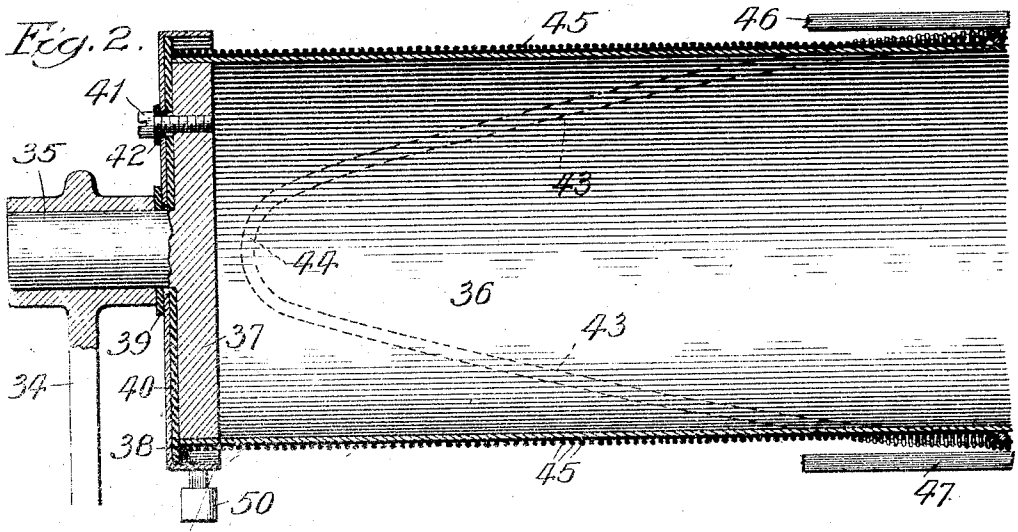
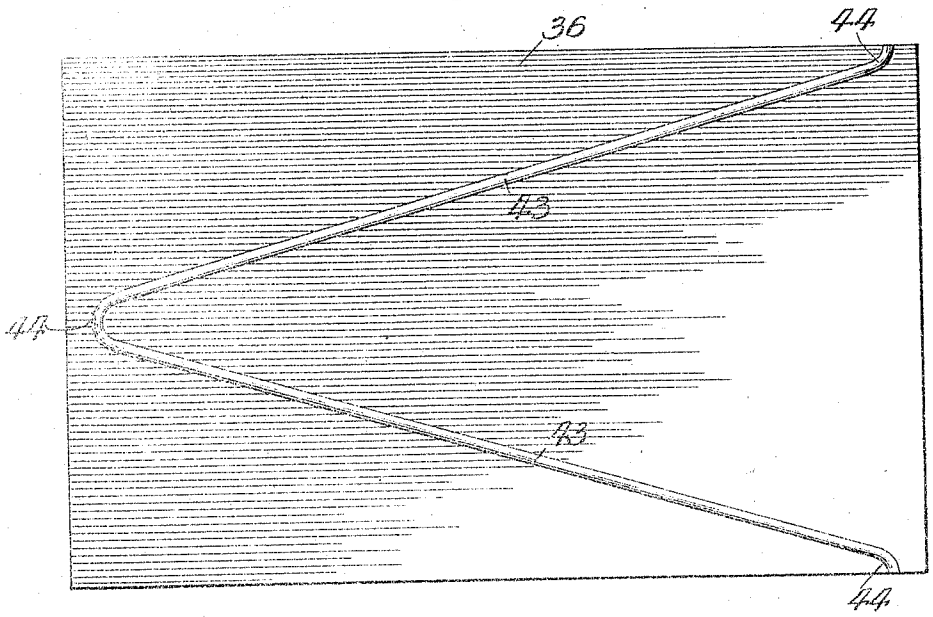


Fig. 3.



Witnesses:

John Enders

Chas. H. Buell

Inventor:

Julius B. Wantz.

By Dyrenforth, Lee, Chritton & Wiles

Attys

J. B. WANTZ.

ELECTROTHERAPEUTIC DEVICE.

APPLICATION FILED OCT. 21, 1909.

1,003,676.

Patented Sept. 19, 1911.

4 SHEETS—SHEET 3.

Fig. 4.

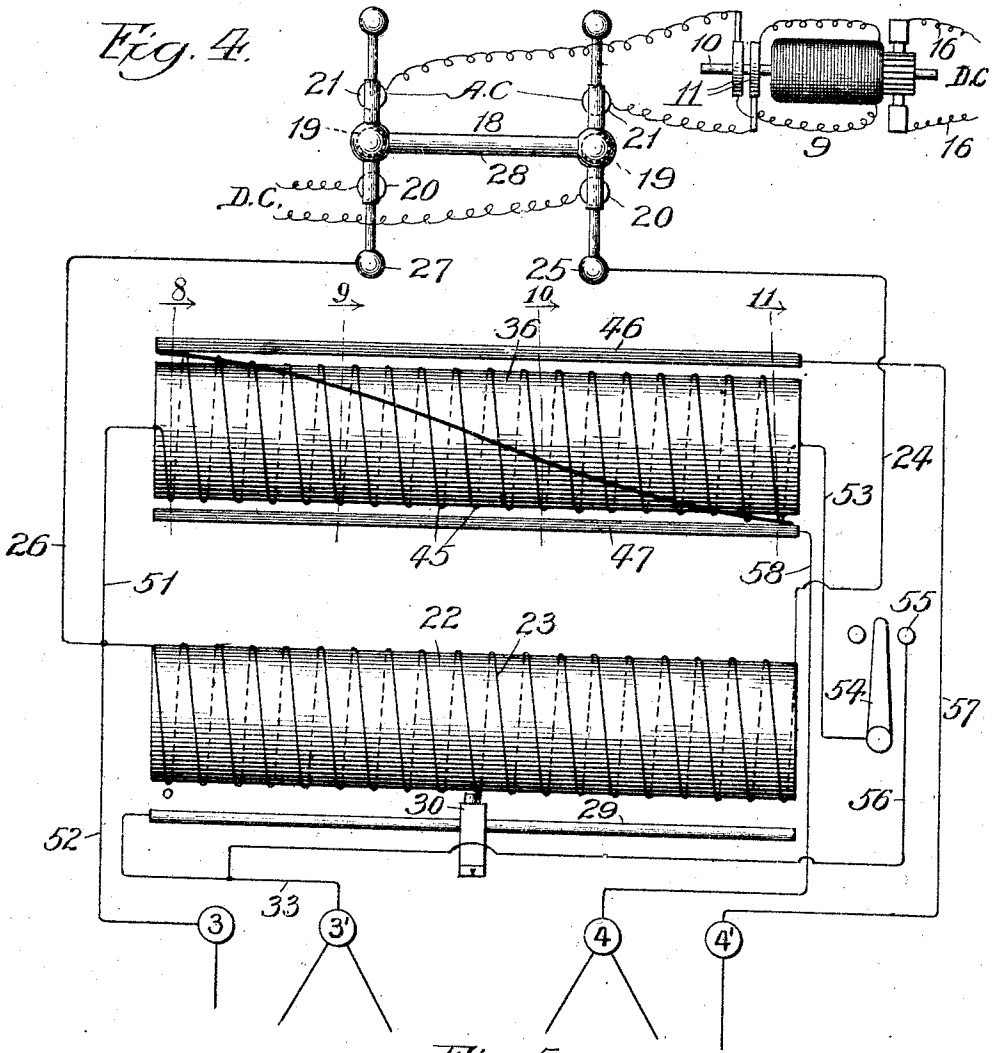


Fig. 5

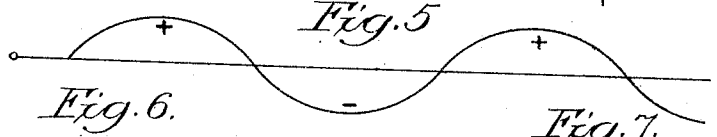


Fig. 6.

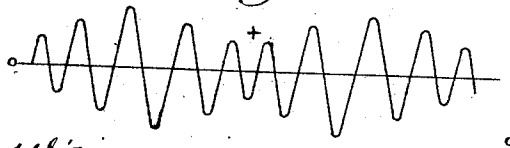
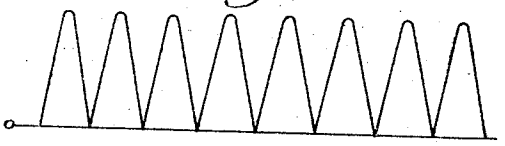


Fig. 7.



Witnesses:

John Enders

Chas. H. Buell

Inventor:

Julius B. Wantz,

By Dyrenforth, Lee, Chrittor & Wiles

Attys

J. B. WANTZ.

ELECTROTHERAPEUTIC DEVICE.

APPLICATION FILED OCT. 21, 1909.

Patented Sept. 19, 1911.

1,003,676.

4 SHEETS—SHEET 4.

Fig. 8.

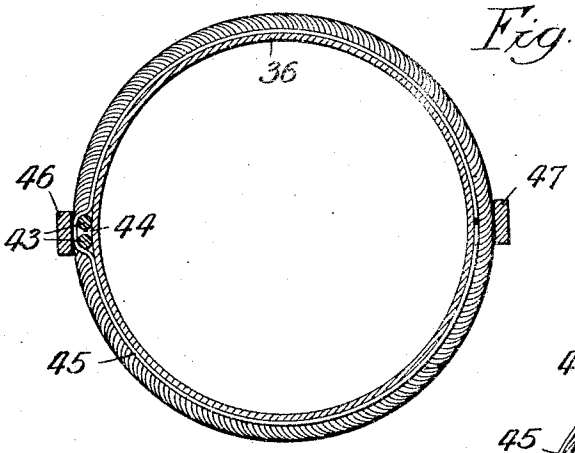


Fig. 9.

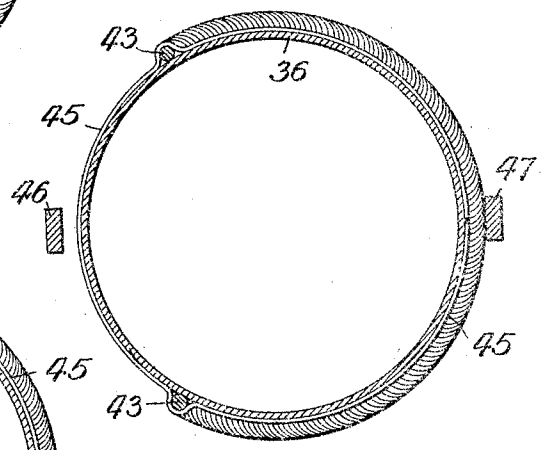
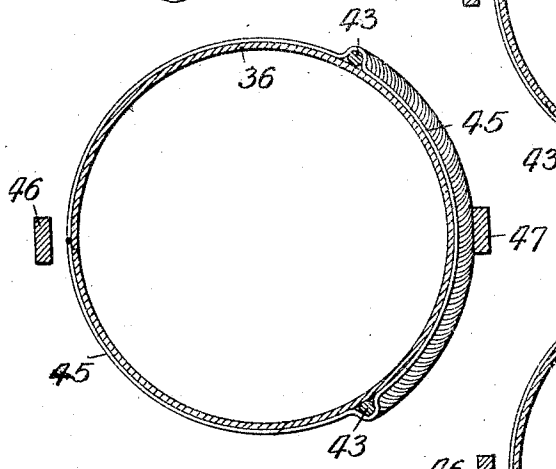
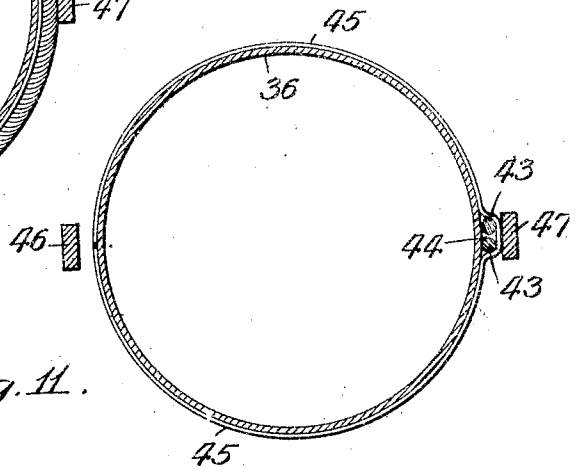


Fig. 10.





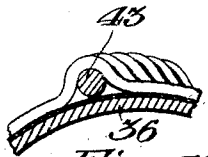


Fig. 12.

Fig. 11.

Witnesses:
John Enders
Chas. H. Bull

Inventor:
Julius B. Wantz,
By Dyrenforth, Lee, Chritton & Wiles
Attys.

UNITED STATES PATENT OFFICE.

JULIUS B. WANTZ, OF CHICAGO, ILLINOIS, ASSIGNOR TO VICTOR ELECTRIC COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

ELECTROTHERAPEUTIC DEVICE.

1,003,676. Specification of Letters Patent. **Patented Sept. 19, 1911.**

Application filed October 21, 1909. Serial No. 523,774.

To all whom it may concern:

Be it known that I, JULIUS B. WANTZ, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Electrotherapeutic Devices, of which the following is a specification.

My primary object is to provide means of improved construction for use in the production of a, so-called, sinusoidal current; also to provide improved mechanisms whereby the strength or intensity of such a current and the speed of the sine-waves or pulsations, may be varied at will.

It is further my object to provide means for the production of what I term a "multiplex" current brought about by the combination of sinusoidal and alternating current waves; and it is also my object to provide improved means for producing a so-called surging current. The above currents are believed to effect beneficial therapeutic results when properly applied, and it is one of my objects, therefore, to provide a self-contained electrotherapeutic device which, when coupled in circuit with an electric generator, may be easily manipulated for the production of any of the above-mentioned currents, as well as a straight galvanic current, and to vary such currents throughout a wide range, and which, by the incorporation in the device of well known coöperative features, may be employed for the production of other currents or current manifestations like, for example, induced currents having different characteristics, from a straight galvanic current.

Referring to the accompanying drawings—Figure 1 is a plan view of an insulating slab or table with my improved mechanisms mounted thereon, the various circuit-wires being hidden; Fig. 2, an enlarged and broken section on line 2 in Fig. 1 illustrating part of the construction of a rotary cylinder and resistance winding I employ; Fig. 3, a developed view of the circumferential face of the rotary cylinder beneath the resistance-winding; Fig. 4, a diagrammatic view of the circuits; Figs. 5, 6 and 7, views, respectively, in illustration of sinusoidal, multiplex and surging currents; Figs. 8, 9, 10 and 11 are enlarged sections taken on dotted lines 8 to 11 inclusive of Fig. 4, and Fig. 12 is an enlarged detail view showing the wiring of the cylinder 36.

Mounted upon the insulating slab, or the like, 8 is a rotary converter 9 which is also used as a direct current motor, the armature shaft 10 of which carries the collector-rings 11 whereby the direct current may be transformed into an alternating current. The main-current wires, in the present instance from the direct-current generator, or supplier (not shown), are connected in practice to the binding-posts 12, 13, the wires from said posts leading to a resistance or rheostat, represented by the series of buttons or contacts 14 shown, and a switch lever 15, all in a common manner. The parts 14, 15 form a motor regulating switch in circuit with the direct-current wires 16 leading to the motor 9 from the binding-posts 12, 13.

18 is a sliding selector switch having the dead contacts 19, 19, the contacts 20 in circuit with a direct-current, and alternating-current contacts 21 in circuit with the rotary transformer, or collector-rings, 11 on the armature-shaft 10. In the said direct-circuit is a lamp 17 useful to indicate that the current through contacts 20 is on.

22 is a stationary insulating drum wound with a resistance coil 23, which is connected at one end by means of the wire 24 with the binding-post 25 of the selector-switch 18. The other end of the coil 23 is connected by a wire 26 with the binding-post 27 of the selector-switch 18. It will be understood that when the sliding selector switch is moved by means of its insulated handle 28 to the contacts 20, direct current passes through the wire 24 to the winding 23 and thence through the wire 26 to the other contact 20; while if the sliding selector switch is moved to the contacts 21, an alternating current passes through the wires 24, 26, and through the winding 23. Extending parallel with the drum 22 is a stationary rod 29, upon which slides a contact 30 held against the resistance winding 23 and operating as a shunt-current voltage-regulator, which is

adjusted on the rod 29 in accordance with the scale 31. For convenience, the drum 22 and coöperating features, described, are mounted upon a raised insulating platform 32, which in turn is mounted upon the slab or table 8. Extending from the rod 29 to a binding-post "3¹" is a wire 33.

Journaled in bearings 34 on the platform 32 are the trunnions 35 of a rotary cylinder 36. The construction of the cylinder-ends is shown in Fig. 2, each being formed with an end-plate 37 integral with the trunnion, metal end-cap 38, an insulating collar 39 between the bearing 34 and cap 38, and an annular insulating plate 40 between the cap 38 on one side and the adjacent end of the cylinder 36 and the disk 37 on the other side. The cap and insulation 40 are fastened in place by screws 41 passing through insulating collars 42. Integral with or fastened as with solder upon the surface of the cylinder 36 is a continuous convolute ridge presenting spirally projecting legs 43 with rounded connecting portions 44 at opposite ends. The said ridge, it will be understood, describes an endless zigzag course around the cylinder with rounded return bends adjacent to opposite ends of the cylinder. It is in effect an integral part of the cylinder, and although provided, preferably, by means of a continuous strip of wire, shaped as indicated and soldered to the cylinder-surface, it may be formed by any other suitable means. Closely wound about the cylinder 36 is a resistance-wire 45 forming a resistance winding which hugs closely the ridges and intermediate surfaces of the cylinder, and presents a continuous, narrow, zigzag contact-projection coincident with the zigzag ridge.

The turns of the resistance-wire 45 may be insulated from each other and from the cylinder 36 in any desired way. Applicant at the present time effects this insulation by first covering the cylinder with a thin sheet of mica. This sheet may be secured to the cylinder by a thin interposed layer of shellac during the winding of the wire 45. The wire is then wound upon the cylinder, leaving a space of about .002 of an inch between the turns. The cylinder thus wound is then given a coating of shellac and baked, and then another coating of shellac and baked, and so on until sufficient shellac has been applied to fill the spaces between the turns of the resistance-wire 45. The wire 45, where it covers the ridge 43 and 44, is then cleaned off with emery-paper and surfaced so that all turns are exposed on the ridge and are of exactly the same height. It is to be understood, however, that any other method of construction desired may be employed.

On opposite sides of the cylinder 36 and extending longitudinally thereof are terminal-brushes, preferably in the form of contact-bars 46, 47 mounted upon spring plungers 48, disposed as shown, which pass through bearings 49, rising from the platform 32. The bars 46, 47 bear yieldingly against the winding 45 at the projecting-ridge portion thereof, but they contact with no other portion of said winding. The winding 45 at each end is connected with the adjacent metal end-cap 38 and bearing against the rim portion of each cap 38 is a brush 50.

A shunt wire 51 extends from the wire 26 to one end of the winding 45, through the respective brush 50 and end-cap 38; and a continuation, 52, of the wire 51 extends to a binding-post "3." A wire 53 extends from the end-cap and brush at the opposite end of the winding 45 to a switch-lever 54. The switch-lever 54 is adapted to close against a contact 55 from which a wire 56 extends to the wire 33. A wire 57 extends from the contact-bar 46 to a binding-post "4¹", and a wire 58 extends from the contact-bar 47 to a binding-post "4."

One of the trunnions of the cylinder 36 carries a worm-gear 59 engaged by a worm 60 on the armature-shaft 10, whereby in the turning of said shaft the cylinder 36 and its ribbed winding 45 are rotated.

To obtain a sinusoidal current, the selector-switch 18 is moved to the direct-current contacts 20 and the switch 54 is closed against the contact 55. The motor is started by moving the regulating switch-lever 15 to one of the first contacts of the series 14. The patient's electrode-cords are coupled to the binding-posts "4", "4¹". The direct current passes, say, from the binding-post 25 through the wire 24 to the resistance winding 23, thence through wire 26 to the binding-post 27. When the sliding voltage regulator 30 is at zero on the scale 31 as indicated in Fig. 1, all the current will pass from the resistance wire 23 through 26 to the binding-post 27. By moving the voltage regulator 30 to the right in Fig. 1, along the scale 31, a primary shunt current is taken from the direct circuit passing through the winding 23, the voltage of the shunt current being approximately in accordance with the position of the regulator 30 with reference to the scale 31. The primary shunt current passes from the wire 26 to the tap wire 51 into the winding 45 of the rotating drum 36, thence through the wire 53, switch 54 and contact 55, wire 56 and wire 33 to the rod 29 and thence through 30 back to the winding 23, (or through the same course in the reverse direction).

The bars 46, 47 are pressed yieldingly against opposite sides of the drum 36, each bearing at one point between its ends against the raised, continuous rib of resistance winding 45, for the purpose of taking from the primary shunt current, described, a secondary shunt current. This latter current

passes, say, from the bar 47 through wire 58 to the binding-post "4" and from binding-post "4¹" through the wire 57 to the bar 46. When the gap between "4", "4¹" is closed through the body of the patient.

In the turning of the drum 36, the point of contact of each of the bars 46, 47, moves from the center of the drum to one end, then back to the center, and then to the other end, said contacts moving equally and simultaneously at all times in opposite directions with reference to each other. Thus, as will be readily understood, when, as illustrated in Fig. 2, the points of contact of the bars 46, 47 are diametrically opposite each other against the winding 45, there will be no secondary shunt circuit. As the contact point of the bar 46 moves, say to the left and the contact point of the bar 47 moves to the right, more and more resistance will be cut in between them, causing (depending upon the direction of the primary shunt current) say a positive secondary shunt circuit of gradually increasing strength to pass through the patient. When the contact points of the bars 46, 47 reach the rounded return bends of the rib, the strength of the secondary shunt circuit is greatest, becoming gradually reduced until the contact points of the bars 46, 47 (which form the secondary shunt-current circuit-terminals) are again diametrically opposite each other. In the further movement of the said contacts in the opposite directions beyond the said center, a secondary negative shunt-current of gradually increasing strength passes through the patient, reaching its maximum when the said contact points are at the opposite rounded return bends of the rib. The secondary shunt-circuit, or sinusoidal current, thus produced is illustrated in Fig. 5. The maximum voltage of the sinusoidal current is regulated by shifting the sliding volt regulator 30 on the scale 31; and the length of the sine-waves, or rapidity of undulations, of the sinusoidal current is regulated by changing the speed of the motor by means of the regulating switch 14, 15, thereby increasing or diminishing the speed of rotation of the cylinder 36.

If the sliding selector-switch 18 is moved to the contacts 21, the secondary shunt circuit described is changed from a sinusoidal current to what, as aforesaid, I call a "multiplex" current, illustrated in Fig. 6. The same rise and fall, or wave, of voltage, or strength of current passing through the patient will be sinusoidal as before, but alternating in accordance with the cycles of the motor 9. The alternations will not vary, but the maximum voltage may be increased or diminished by movement of the sliding volt regulator 30, and the rapidity of sinusoidal waves increased or diminished by changing the speed of rotation of the drum 36, as before described.

To produce a surging current, the sliding selector-switch 18 is moved to the direct current contacts 20, the switch 54 is closed against the contact 55 as before, and the patient's electrode-cords are coupled to the binding-posts "3¹", "4". The direct current between the binding-posts 25, 27 passes through the resistance winding 23 as before. The primary shunt current also pursues the same course as before described, but a secondary shunt current is taken by the bar 47 from the winding 45 passing thence through the wire 58, binding-post "4", patient, binding-post "3¹", wire 33, rod 29, sliding voltage regulator 30, winding 23, wire 26 and tap-wire 51, back to the winding 45. The rise and fall between zero and maximum voltage is produced by the movement of the contact of the bar 47 back and forth along the zigzag contact rib of the winding 45, as will be readily understood. The rapidity of the surges is regulated by regulating the speed of rotation of the drum 36, and the maximum voltage by means of the sliding voltage regulator 30, as before described.

To apply a straight galvanic current to a patient, the patient's electrode-cords are coupled to the binding-posts "3", "3¹", and the sliding selector switch 18 is moved to the contacts 20. The direct current passes through 24, 23, 26 between the binding-posts 25, 27 as before. A shunt current is taken off the winding 23 through the sliding voltage regulator 30, passing through the bar 29, wire 33, and binding-post "3¹", through the patient to binding-post "3" and wires 52, 26 back to 23. The strength of the current is regulated by the sliding voltage regulator 30. The straight galvanic current can be changed to an alternating current by merely shifting the selector switch to the contacts 21.

By employing the mechanisms described, and mounting upon the slab or platform in proper relation thereto other well-known mechanisms, induced circuits may be obtained from the galvanic current, and thus other well-known therapeutic currents provided from the same general device. The rounded return-bends 44 in the resistance 45 are desirable as they tend to effect gradually or smoothly the reversal at the peaks of the sine-waves. The construction which effects a surging, sinusoidal or "multiplex" current in the present case, and which involves, broadly stated, a resistance on the one part, (as the winding 45) and one or more terminals, (as the brush 46 or 47, or both) on the other part, revolving one with relation to the other, and so arranged that resistance in a circuit is gradually increased or diminished, while the parts rotate rela-

tively, may be useful in other connections than that particularly herein shown and described.

I have shown and described my improvements in the form I now prefer, but I wish it understood that the construction may be variously modified in the matter of details without departing from the spirit of my invention as defined by the claims.

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

1. In combination, a rotary cylindrical electric resistance formed to present a circumferential endless zigzag contact, and a pair of circuit terminals bearing respectively against different sides of said contact, the points of engagement between said terminals and contact being shifted in opposite directions back and forth along said resistance by the turning of the latter in one direction.

2. In combination, an electric circuit, a rotary cylinder, a continuous closely wound resistance wire on the cylinder interposed in said circuit and forming an endless zigzag contact surface along the cylinder, and a shunt circuit having terminals at opposite sides of the cylinder bearing against said contact, whereby in the rotation of the cylinder in one direction the points of engagement between said terminals and contact are shifted respectively in opposite directions back and forth on the said resistance winding.

3. In combination, an electric circuit, a rotary cylinder, a continuous closely wound resistance wire on the cylinder interposed in said circuit and forming an endless zigzag contact surface along the cylinder, and a shunt circuit having terminals at opposite sides of the cylinder bearing against said contact, whereby in the rotation of the cylinder in one direction the points of engagement between said terminals and contact are shifted respectively in opposite directions back and forth on the said resistance winding, and means for changing at will the speed of rotation of the cylinder.

4. In combination, an electric circuit, a rotary cylinder, a continuous closely wound resistance wire on the cylinder interposed in said circuit and forming a raised endless zigzag contact surface along the cylinder, a shunt circuit, and brushes extending parallel with said cylinder at opposite sides and forming the terminals of said shunt circuit in engagement with said contact, whereby in the rotation of the cylinder in one direction the points of engagement between said brushes and contact are shifted respectively in opposite direction back and forth on the said resistance winding.

5. In combination, a cylindrical rotary electric resistance having endless zigzag contact surface formed with rounded return-bends, and an electric-circuit having terminals bearing slidably against said contact, whereby in the rotation of the resistance in one direction the points of engagement between the terminals and contact are shifted respectively back and forth in opposite directions along the resistance.

6. In combination, a rotary cylinder, a continuous closely wound resistance wire on the cylinder forming a zigzag contact surface around the cylinder, a shunt circuit having terminals at opposite sides of the cylinder bearing against said contact, whereby in the rotation of the cylinder the points of engagement between said terminals and contact are shifted respectively in opposite directions back and forth on the said resistance winding, and means for directing at will either an alternating or a direct electric current through said winding.

7. In combination, an electric circuit, a rotary cylinder, a continuous closely wound resistance wire on the cylinder interposed in said circuit and forming a zigzag contact surface around the cylinder, means for regulating, at will, the speed of rotation of said cylinder, and a shunt circuit having a terminal at one side of the cylinder bearing against said contact, whereby in the rotation of the cylinder the point of engagement between said terminal and contact is shifted back and forth on the said resistance winding at a speed governed by the speed of rotation of the cylinder.

8. In combination, an electric circuit, a resistance and a terminal in the circuit rotating one with relation to the other, the successive turns of the resistance presenting contacts so disposed with relation to the terminal as to contact successively therewith first in one direction and then the other along the resistance while the parts are rotating relatively, and a voltage regulator interposed in the circuit.

9. In combination, an electric circuit, a rotary cylinder, a continuous closely wound resistance wire on the cylinder interposed in said circuit and forming a zigzag contact surface along the cylinder, a shunt circuit having a terminal at one side of the cylinder bearing against said contact, whereby in the rotation of the cylinder the point of engagement between said terminal and contact is shifted back and forth on the said resistance winding, and a voltage regulator interposed in one of said circuits, for the purpose set forth.

10. In combination, an electric circuit, a rotary converter in the circuit, a rotary cylindrical resistance in circuit with the collecting rings of the converter and operatively connected with the converter to be rotated thereby, said resistance presenting

a circumferential zigzag contact, and a shunt circuit terminal bearing against said contact, the point of engagement between said terminal and contact being shifted back and forth along said resistance by the turning of the latter.

11. In combination, an electric circuit, a rotary converter in the circuit, a rotary cylindrical resistance in circuit with the collecting rings of the converter and operatively connected with the converter to be rotated thereby, said resistance presenting a circumferential zigzag contact, a pair of circuit terminals bearing against said contact at opposite sides of the cylindrical resistance, the points of engagement between said terminals and contact being shifted in opposite directions back and forth along said resistance by the turning of the latter, and means for regulating the speed of rotation of the converter, for the purpose set forth.

JULIUS B. WANTZ.

In presence of—
M. A. NYMAN,
R. A. RAYMOND.