(No Model.)

R. H. WAPPLER.

ELECTROMEDICAL APPARATUS.

No. 581,091. Patented Apr. 20, 1897.

Fig. 1.

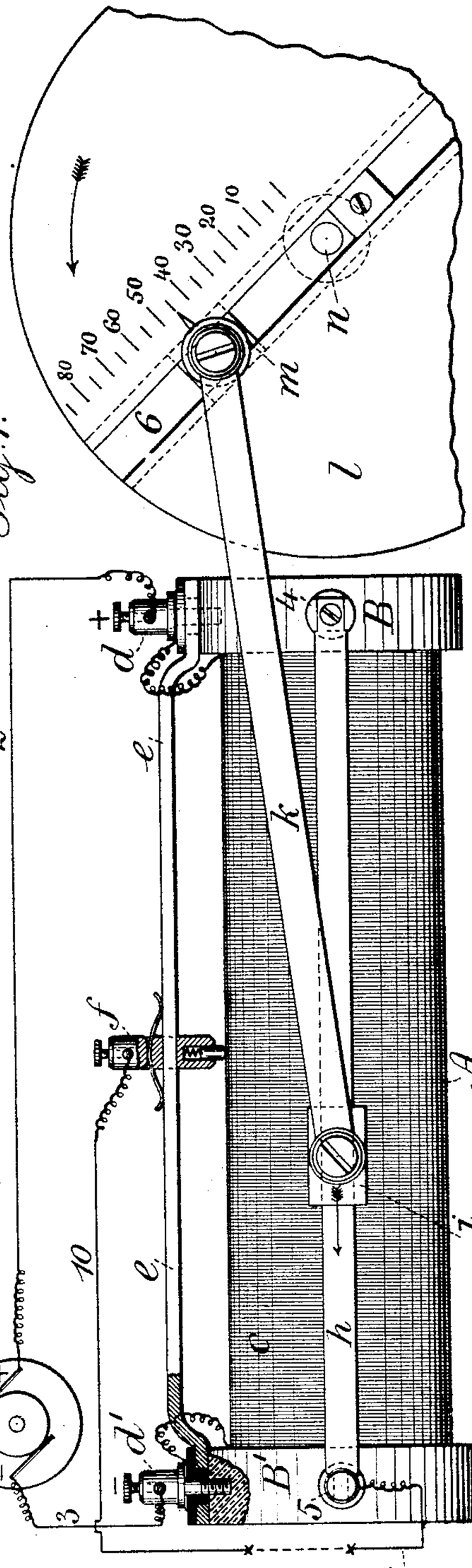
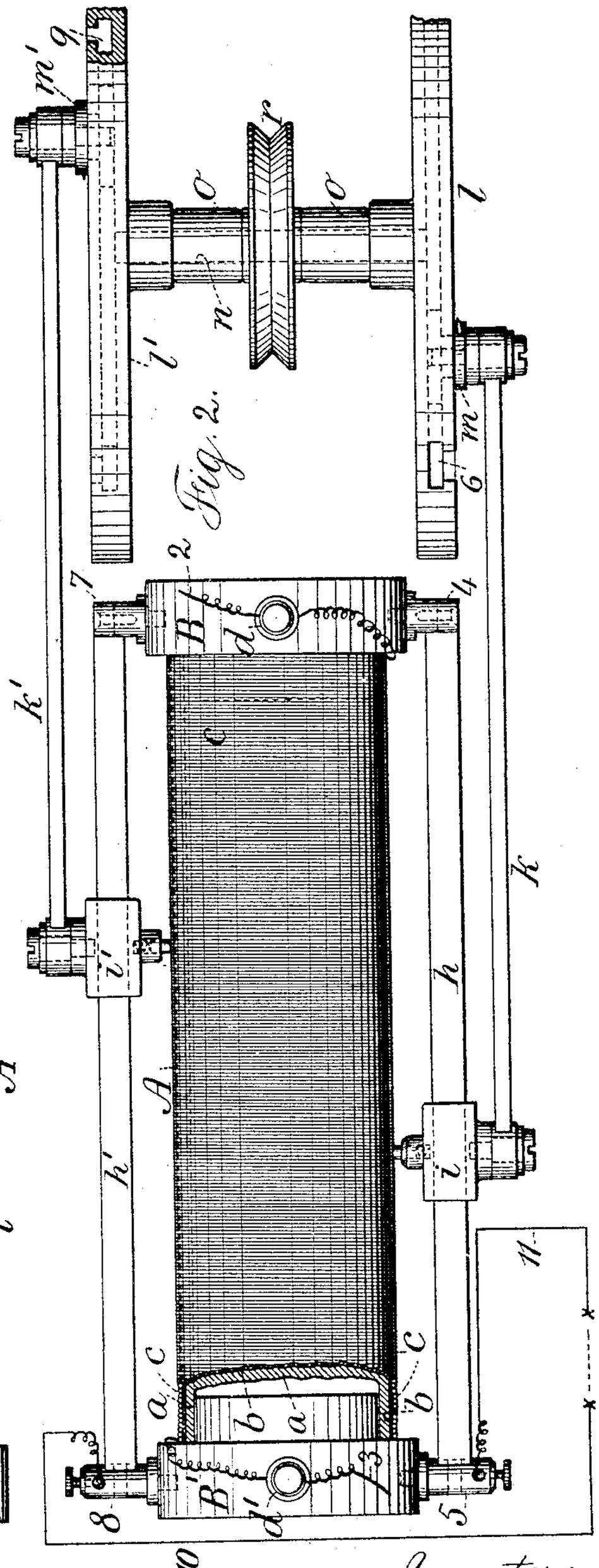


Fig. 2.



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UNITED STATES PATENT OFFICE.

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ELECTROMEDICAL APPARATUS.

SPECIFICATION forming part of Letters Patent No. 581,091, dated April 20, 1897.

Application filed February 5, 1897. Serial No. 622,116. (No model.)

To all whom it may concern:

Be it known that I, REINHOLD H. WAPPLER, a citizen of the United States, residing at New York, in the county and State of New York, have invented a new and useful Improvement in Electromedical Apparatus, of which the following is a specification.

My invention relates to electrical apparatus adapted for medical use in the treatment of the human body; and the objects of my invention are threefold, as follows: first, to gradually modify and affect the relative intensities of the current at pleasure; second, to change the polarity of the current by the device in use; third, to establish an alternating or sinusoidal shunt-current from a direct and continuous current.

In the present improvement I make use of a resistance-cylinder in the main circuit of a dynamo or other source of electric energy and also a shunt-circuit passing through the person to be electrically treated and having movable terminals. The current in the shunt-circuit is in proportion to the resistance in the main and in the shunt circuits, and two terminals or contacts are employed to vary the relative resistances according to their positions on the resistance-cylinder. Where one reciprocating contact and one stationary contact are employed to form the terminals of the shunt-circuit, the extent of current passing through the shunt and the individual will depend upon the position of such shunt-terminals on the helix of the resistance-cylinder. If these terminals are near the ends of the resistance-cylinder, the maximum amount of current will flow through the shunt, and if they are near together the minimum amount of current will flow through the shunt. If the terminals are at the same place or in line on the resistance-cylinder, no current will pass on the shunt, and as the one contact or terminal is reciprocated there will be a rise and fall of tension according to the position of the terminal upon the resistance-cylinder, and as the moving terminal passes by the stationary terminal the shunt-current will descend to zero and then be reversed. The same operation is performed where the two contacts or terminals of the shunt are reciprocated. When they are in contact with the same portion of the coil of the resistance-cylinder, no current will flow in the shunt, and as they separate they divert more or less of the current in the line and the shunt-current rises and falls in proportion, and as they reciprocate past each other the direction of current in the shunt is reversed.

By this improvement any desired current can be diverted into the shunt and through the person and the current can be increased or decreased at will from nothing up to the maximum portion of the main-circuit current, and it can also be reversed in direction, and the speed of reversals will depend on the rapidity of the mechanical movement given to the shunt terminal or terminals. The relative periods of time during which the current is flowing in one direction and in the other can also be varied according to the position of the terminals upon the resistance-cylinder.

In the drawings, Figure 1 represents by an elevation one form of my invention, and Fig. 2 represents by a plan a slightly-modified form of my invention.

A represents the resistance-cylinder, which is composed of a foundation-tube *a*, around which is a wrapping *b* of paper or other similar material, and outside of this is the fine-wire surface wrapping *c;* and B B′ represent the heads to the cylinder, which are of fiber or other insulating material, the smaller parts of which pass into the ends of the tube *a*, the exposed parts being of greater diameter than the cylinder. On the head B is a binding-post *d* and on the head B′ is a binding-post *d′*.

C illustrates a dynamo or other source of electrical energy, and the + wire 2 from the dynamo passes to the binding-post *d* and the — wire 3 passes to the binding-post *d′*, and the respective ends of the fine wire coiled around the cylinder are connected to the binding-posts *d* and *d′*, so that the current from the dynamo passes through the + wire, through the binding-post *d*, through the entire surface winding of the cylinder, to the binding-post *d′*, and back by the — wire 3, the current flowing continuously in this manner.

e represents an insulated bar extending from the head B to the head B′ longitudinally of the cylinder, and at the ends of this bar are eyes receiving insulating-disks, through which the screw-stems of the binding-posts *d* *d′* pass in securing this bar in place upon the

respective fiber heads. Upon this bar *e* is a sliding adjustable shunt-post *f* with a spring-actuated contact bearing upon the surface of the wire of the cylinder. This shunt-post is provided with a friction-spring for holding the same upon the bar wherever placed. The bar *h*, which is preferably square, is secured at one end by a connector 4 to the head B and at the other end by a post-connector 5 to the head B′, and the circuit-wire 10 extends from the post *f* and the circuit-wire 11 from the post 5, and the terminals of said wires are shown by the letters X, between which the body to be treated is presumed to be located.

Upon the bar *h* is a slide *i* with a spring-actuated contact bearing upon the wire surface of the resistance-cylinder, and pivoted to said slide is a connecting-rod *k*, and the other end of said rod is pivoted to the adjustable crank-pin *m*, located in a radial groove 6 in the outer surface of the disk or wheel *l*. Upon this adjustable crank-pin *m* is a pointer, and the surface of the disk or wheel adjacent to the radial groove is marked with a numbered scale, the numbers of which may represent units of electrical energy.

The disk or wheel *l* has an axle *n*, supported and rotated in any desired manner.

The parts just described have special reference to Fig. 1, and in the operation of this device we will presume that the shunt-post *f* is located, as shown, at the center of the resistance-cylinder. The slide *i* is moved back and forth upon the bar *h* by the connecting-rod *k*, and the rotation of the disk or wheel and the extent of movement imparted to this slide at either side of the center of the resistance-cylinder is to be regulated by the position of the adjustable crank-pin *m* in the groove of the disk or wheel *l*, the movement being less, of course, when the block is nearer to the axle of the disk or wheel and greatest when the block is nearest the periphery of said disk or wheel, said slide moving an equal amount in this manner at each side of the center indicated by the shunt-post *f*. In the position of the parts shown in Fig. 1 the main current is flowing through the wire surface of the resistance-cylinder from the binding-post *d* toward the shunt-post *f*, and so on along the surface of the cylinder, the shunt-current being taken off at the shunt-post *f*, which becomes the + end of the shunt-current, said shunt-current passing from the post *f* through the wire 10, through the person under treatment, and by the wire 11 to the post 5, the bar *h*, and slide *i*, which becomes the — end, and back to the surface winding of the cylinder.

It will be noticed that as the disk or wheel *l* turns in the direction of the arrow and the slide *i* moves in the direction of the arrow the shunt-current will increase in intensity as the slide moves farther away from the shunt-post along the cylinder until its extreme movement is reached, which represents the maximum current, and that as the slide returns toward the shunt-post the current will decrease in intensity until the spring-contact of the slide comes into line with the spring-contact of the shunt-post, at which point no current passes. Thereafter as the slide continues its movement along the bar *h* to the right and away from the shunt-post the current is reversed and increases in intensity until the limit of movement is reached and the maximum current obtained, and that as the slide again moves back toward the shunt-post the shunt-current will decrease in intensity. Thus with the slide at the left-hand side of the shunt-post the shunt-post is + and the post 5 is —, whereas when the slide is at the right-hand side of the shunt-post the post 5 is + and the shunt-post becomes —, because in this position the shunt-current passes from the slide and the bar by the post 5, the wire 11, through the person under treatment, by the wire 10 and the shunt-post to the surface of the cylinder. In this manner the alternating or sinusoidal shunt-current is established from the direct and continuous current flowing from the dynamo, and the direction of current is changed as the brush or contact passes the neutral point, and the current increases to the maximum as the brush or contact reaches the end of its movement.

It will be observed that the shunt-post *f* can be moved at will along the insulated bar *e*. If this is done and said shunt-post is moved to a position nearer the fiber head B and the adjustable crank-pin *m* moved outward in the slide nearer to the periphery of the disk or wheel, so that the slide *i* is given its full movement, the shunt-current in one direction, say to the left of the shunt-post, will be a long gradually increasing and decreasing current, and the current to the right of the shunt-post will be short and of less intensity. Thus by the shifting of the shunt-post along the bar *e* the shunt-current can be modified and its relative intensities altered at the pleasure of the operator.

In the form of my invention shown in Fig. 2 the bar *e* and shunt-post *f* have been replaced by duplicating the bar, slide, connecting-rod, and disk or wheel at the opposite side of the resistance-cylinder A. In this figure *h′* is the bar; 7, the connector at one end thereof to the head B, and 8 the connector-post at the other end to the head B′; *i′*, the slide upon the bar *h′* and having a spring-actuated contact like that of the slide *i*. *k′* is the connecting-rod, and *l′* a disk or wheel corresponding but oppositely located to the disk or wheel *l*, and *m′* is the adjustable crank-pin to which the connecting-rod *k′* is pivoted at one end, said crank-pin being movable in the groove 9 of said disk or wheel and having a pointer to indicate the position of the block upon a scale similar to that employed upon the disk or wheel *l*. In this figure *o* represents the supports for the disks or wheels and their axle, and *r* a pulley upon said axle between said supports for rotating the axle and disks

or wheels, a belt being employed therefor from any source of power. In this figure the circuit-wire 10 is from the post 8 and the circuit-wire 11 from the post 5, as in the former instance. The letters X represent the terminals of said wires adjacent to the person being operated upon, and it will be apparent from an examination of the circuit connections shown in Fig. 2 that precisely the same effect is attained electrically as has heretofore been described in reference to Fig. 1, except that the slides *i* and *i'* both moving the speed of reversals of the shunt-current are quicker than in the form shown in Fig. 1, and in this device it is also possible by the adjustment of the crank-pins *m m'* to impart to the slides *i i'* greater or less movement, so as to modify or affect the relative intensities of the shunt-current at the pleasure of the operator. In this device there will also be a neutral point when the contacts of said blocks are in line, and if said blocks are both given the maximum amount of movement the currents of opposite polarity will be of equal duration and maximum intensity and the rise and fall of tension will be accelerated, whereas if one is given a maximum movement and the other a minimum movement or both are given a minimum movement the currents will be of less intensity or of minimum intensity, and the degrees between these two points are regulatable entirely at the pleasure of the operator.

It is preferable to insulate the connecting-rod *k* either at its pivotal connection with the slide *i* or with the adjustable crank-pin *m*, so as to prevent any current escaping by means of the connecting-rod to the disk or wheel. This may be done in any desired manner at the pivotal connection at either end of said rod, as this forms no essential part of my invention, and the same remarks apply to the connecting-rod *k'* in its pivotal connection with the slide *i* and crank-pin *m'*.

The fine-wire surface wrapping *c* must of necessity be wire not covered. Hence it will be essential that sufficient insulation be provided to prevent the wires coming into electrical contact. This is provided for by treating the naked fine wire with some adhesive material that places an infinitesimal coating or oxidation upon the surface before winding upon the cylinder, which, when the winding is complete, will prevent the actual contact of the convolutions and so cause the current to traverse the entire length of the wire instead of becoming short-circuited. The insulating material upon the surface is afterward removed.

I claim as my invention—

1. In an electromedical apparatus, the combination with a resistance-cylinder having a fine-wire surface winding, a dynamo or other source of electric energy and wires therefrom to the winding of the cylinder to complete the main circuit, of an adjustable contact or terminal bearing upon the surface winding of the cylinder, a support therefor and one wire of a shunt-circuit therewith connected, a bar supported parallel with the surface of the resistance-cylinder and the other wire of the shunt-circuit therewith connected, a slide upon the bar and a contact bearing upon the surface of the cylinder and mechanism for reciprocating said slide and contact for varying the resistance in the shunt-circuit, substantially as and for the purposes set forth.

2. In an electromedical apparatus, the combination with a resistance-cylinder having a fine-wire surface winding, insulated heads and posts thereon to which the ends of said surface winding are connected, of a dynamo or other source of electrical energy and wires therefrom to the respective posts on the insulating-heads to complete the main circuit, posts supported upon said insulating-heads and wires therefrom forming a shunt-circuit, movable contacts bearing upon the surface winding, and supports therefor and means for moving said contacts upon said supports to change the relation of the one to the other so as to take off from said surface winding an alternative or sinusoidal shunt-current, substantially as and for the purposes set forth.

3. In an electromedical apparatus, the combination with a resistance-cylinder having a fine-wire surface winding, of insulating-heads and posts thereon to which the respective ends of said winding are connected, a dynamo or other source of electrical energy and wires therefrom to said posts so as to cause the main current from the source of energy to flow continuously through the surface winding, an adjustable contact or terminal in electrical contact with the surface winding and a support therefor, a shunt-circuit wire in electrical contact with said terminal, a return shunt-circuit wire and a post to which the same is connected, the post being supported upon one of the heads, a bar connected with said post and parallel with the surface of the cylinder and supported upon another post at its other end, a movable contact upon said bar in electrical contact with the surface winding, a disk or wheel grooved radially and an adjustable crank-pin movable in said groove, a connecting-rod pivoted at its respective ends to the movable contact upon the bar and to the adjustable crank-pin of the disk or wheel whereby the slide is caused to move longitudinally or reciprocate upon the bar and in contact with the surface of the cylinder to take off therefrom the shunt-current in alternate directions and by the adjustment of the sliding device in relative intensities as desired, substantially as set forth.

4. In an electromedical apparatus, the combination with a resistance-cylinder having a fine-wire surface winding, a dynamo or other source of electric energy and wires therefrom to the winding of the cylinder to complete the main circuit, of an adjustable contact bearing upon the surface winding of the cylinder and a support therefor, a reciprocating contact also bearing upon the surface winding, a sup-

port and means for moving the same, a shunt-circuit whose terminals are connected respectively to the adjustable and reciprocating contacts whereby the current diverted into the shunt-circuit can be increased and decreased, reversed and varied at the will of the operator, substantially as set forth.

5. In an electromedical apparatus, the combination with a resistance-cylinder having a fine-wire surface winding, a dynamo or other source of electric energy and wires therefrom to the winding of the cylinder to complete the main circuit, of movable terminals or contacts bearing upon the surface winding of the cylinder, supports therefor, and means for moving the same, a shunt-circuit whose terminals are connected respectively to the movable contacts whereby the current diverted into the shunt-circuit can be increased and decreased, reversed and varied at the will of the operator, substantially as set forth.

Signed by me this 29th day of January, 1897.

REINHOLD H. WAPPLER.

Witnesses:

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