R. W. CHAPMAN.

ELECTRICAL THERAPEUTIC APPARATUS.

APPLICATION FILED MAY 21, 1915.

**1,153,839.** Patented Sept. 14, 1915.

Fig. 1.

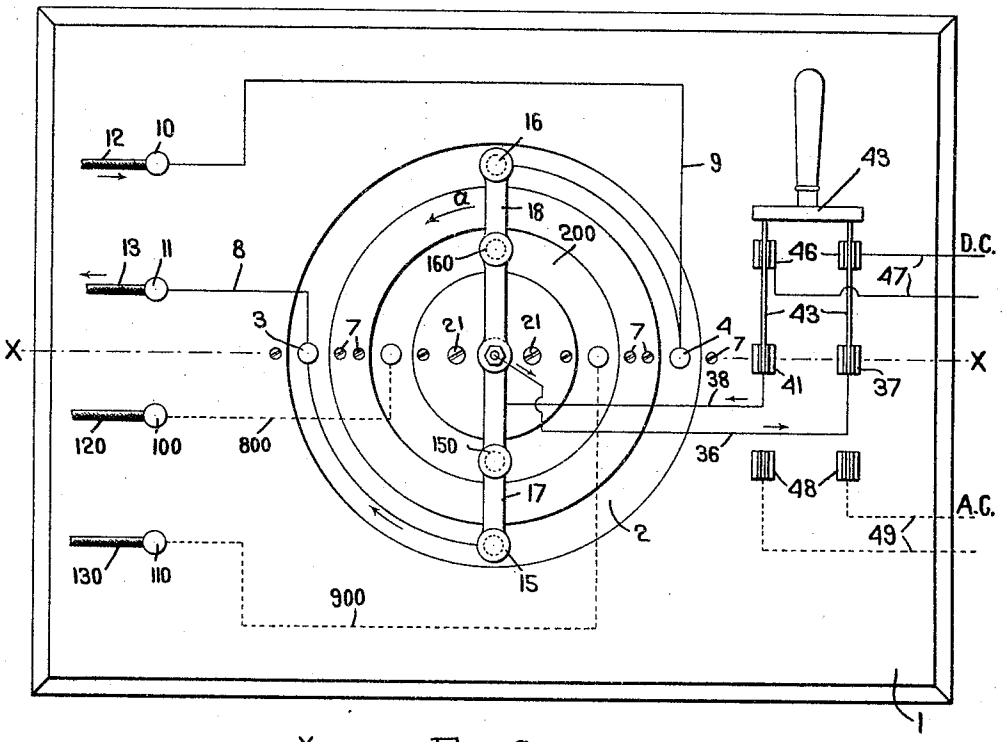


Fig. 2.

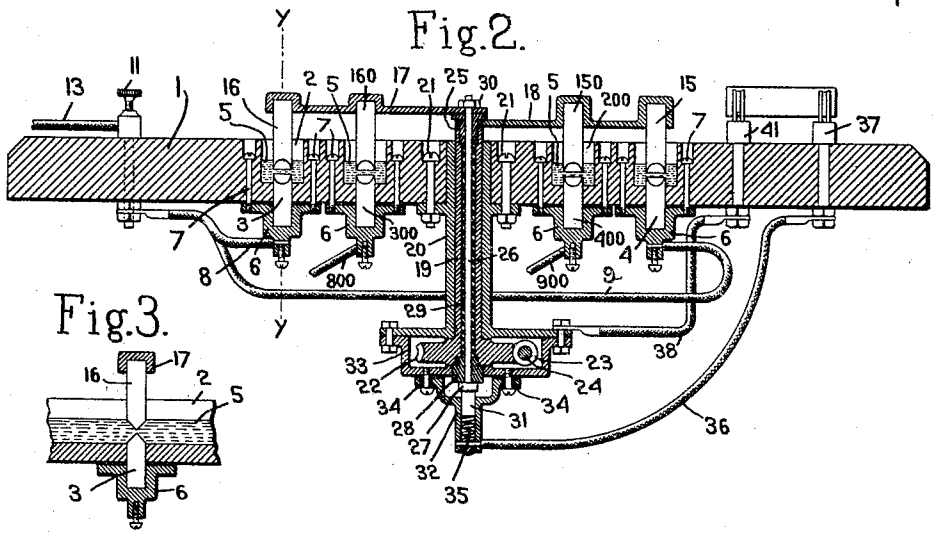


Fig. 3.




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# UNITED STATES PATENT OFFICE.

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## ELECTRICAL THERAPEUTIC APPARATUS.

1,153,839. Specification of Letters Patent. Patented Sept. 14, 1915.

Application filed May 21, 1915. Serial No. 29,641.

*To all whom it may concern:*

Be it known that I, RALPH W. CHAPMAN, a citizen of the United States, residing at Oldtown, county of Penobscot, State of Maine, have invented an Improvement in Electrical Therapeutic Apparatus, of which the following description, in connection with the accompanying drawing, is a specification, like characters on the drawing representing like parts.

This invention relates to an electrical therapeutic apparatus by which a current having an alternately increasing and decreasing voltage can be delivered to a patient first in one direction and then in the other.

The object of the invention is to provide a novel device of this nature by which the variation in the voltage and the reversal of direction of the current can be accomplished smoothly and without the unevenness which is inherent in those devices of this nature that employ a wire resistance for this purpose. I secure the desired object by using a liquid resistance which can be increased or decreased alternately and by employing a mechanism by which as the resistance is increased or decreased the direction of the current will be reversed.

In order to give an understanding of my invention I have illustrated in the drawings a selected embodiment thereof which comprises a chamber containing the liquid resistance, a pair of terminals submerged in the liquid in said chamber, and a carrier movable relative to the chamber and carrying another pair of contacts insulated from each other which extend into the liquid so that in passing from the terminals of one pair to those of the other the current is compelled to pass through the liquid resistance. By moving the carrier and varying the distance between the terminals carried thereby and the other terminals, the amount of resistance can be varied. The apparatus is so designed that the movement of the carrier will alternately increase and decrease the resistance in the circuit and also alternately reverse the direction of the current.

Referring to the drawings wherein a selected embodiment of the invention is illustrated, Figure 1 is a plan view thereof; Fig. 2 is a section on the line *x*—*x*, Fig. 1 with the carrier turned so as to present the terminals sustained thereby directly over the submerged terminals; Fig. 3 is a section on the line *y*—*y*, Fig. 2.

The chamber containing the liquid resistance is shown herein as formed in a base or slab 1 preferably made of insulating material. Such chamber can conveniently be formed by making a groove in the top of the base 1, and in the preferred embodiment of my invention this chamber is annular or circular in shape. Such liquid-resistance-containing chamber is shown at 2 in the drawings and is in the form of an annular, circular open-topped groove formed in the base plate 1. This groove or chamber 2 contains liquid 5 of some suitable character which constitutes the liquid resistance of the device. Situated within the chamber 2 are a pair of terminals 3 and 4 which are submerged in the liquid 5. These terminals may be made of carbon, metal or any other conducting material, and they are herein shown as inserted upwardly through the base plate 1 into the chamber 2, each terminal being sustained by a holder 6 that is secured to the underside of the base plate 1 by suitable screws 7. The holders 6 are connected to two wires or leads 8 and 9 that extend to two binding posts 10 and 11 carried by the base and to which are connected wires 12 and 13 that lead to the patient. Situated above the plate 1 is a carrier supporting two additional terminals 15 and 16 which are insulated from each other but are extended into the open top of the chamber 2 and into the liquid resistance 5 therein. These two terminals 15 and 16 are electrically connected to a source of current supply and the carrier is rotatably mounted in such a way that as it rotates the terminals 15 and 16 will be carried around in the chamber 2.

In the use of the device the current from the source of supply will flow to the terminal 15, thence through the liquid resistance 5 to one of the submerged terminals, and thence to the patient, and back to the other submerged terminal, through the resistance 5, to the terminal 16 and thence to the source of supply.

The carrier which sustains the movable terminals 15 and 16 may have any suitable construction adapted to carry said terminals around in the chamber 2. As herein shown this carrier is rotatably mounted on the base 1 to turn about the center of the annular chamber 2 as its axis. Said carrier is herein illustrated as comprising the two arms 17 and 18 which are rigidly secured together but insulated from each other, and these

arms are sustained by a shaft 19 which extends through the base 1 and is rotatably mounted in a suitable bearing or housing 20 secured to the base by means of screws or bolts 21. This shaft 19 may be rotated in any suitable way. As herein shown it is provided with the worm gear 22 which is driven by a worm 23 mounted on a driving shaft 24, but any other way of rotating the shaft 19 might be employed without departing from the invention. The arm 18 is shown as resting against the end of the shaft 19 thereby being electrically connected therewith, while the arm 17 although carried by the shaft is insulated therefrom. This is herein accomplished by providing an insulating bushing 25 between the arms 17 and 18 and by clamping the arm 17 to the insulating bushing by means of a bolt 26 that extends down through the shaft 19, the latter being hollow for this purpose. The lower end of the bolt 26 is provided with a head 27 and an insulating sleeve 28 is interposed between this head 27 and the end of the shaft 19. The bolt 26 is also insulated from the shaft by suitable insulation 29. When the nut 30 on the bolt 26 is set up tight, the arms 17 and 18 will both be firmly clamped to the shaft 19 but said arms will be insulated from each other. The head 27 of the bolt 26 engages a contact 31 which is mounted in a housing 32 that is secured to the casing 33 for the worm gearing, but is insulated therefrom, as at 34. This contact 31 is yieldingly held against the head 27 of the bolt by a spring 35 and it is connected by a wire 36 to a source of electrical supply. The casing 33 is also connected to the source of electrical supply by a suitable wire 38 so that with this construction the path of the current from the source of supply will be through the wire 38, to the casing 33, shaft 19, arm 18, terminal 15, resistance 5, to one of the submerged terminals, thence to the patient, to the other submerged terminal and through the resistance 5 to the terminal 16, and thence through the clamping bolt 26 and contact 31 and wire 36 to the source of supply. As the carrier comprising the arms 17 and 18 revolves the contacts 15 and 16 are moved toward and from the submerged contacts. The contacts 3 and 4 are preferably placed diametrically opposite each other and the terminals 15 and 16 are so sustained on the carrier that they are also diametrically opposed. Therefore, at certain times in the revolution of the carrier the contacts 15 and 16 will be directly over the contacts 4 and 3, as shown in Fig. 2, and at other times they will be midway between the terminals, as shown in Fig. 1. When the moving terminals 15 and 16 are directly over the terminals 4 and 3, as shown in Fig. 2, then the current will pass from one terminal to the other with the least resistance. When, however, the terminals 15 and 16 and 3 and 4 are in the relative position shown in Fig. 1, there is a maximum resistance between terminals and the circuit has the maximum resistance therein. Assuming that the terminals are in the relative position shown in Fig. 2 and that the arms 18 and 19 are rotating in the direction of the arrow *a*, Fig. 1, the distance between the terminals 15, 16 and 4, 3 will gradually increase, thus placing a gradually-increased resistance in the circuit, such resistance increasing to its maximum when the terminals 15, 16 are in the position shown in Fig. 1. During this movement of the carrier the terminal 16 has been moving away from the terminal 4 and the terminal 15 has been moving away from the terminal 3. When the carrier is advancing beyond the position shown in Fig. 1, then the distance between the terminal 16 and the terminal 3 is less than that between said terminal 16 and the terminal 4, and the distance between the terminal 15 and the terminal 4 is less than that between the terminal 15 and the terminal 3. As a result, the current from the terminal 15 will naturally take the shorter course to one of the submerged terminals which will be through the resistance to the terminal 4 rather than to the terminal 3. There will, therefore, be a reversal of the direction of the current through the patient simultaneously with the variation in the resistance. The device, therefore, gives a wave-surging current through the body of the patient first in one direction and then in the other, and it causes the current to come on and go off gradually and smoothly, due to the fact that liquid resistance is used, and to the manner in which the device operates.

I have provided the device herein shown so that it may be used with either direct current or alternating current, and for this purpose have provided the base 1 with a second chamber 200 containing liquid resistance 5, and have provided the arms 17 and 18 with terminals 160 and 150 which extend into the chamber 200 and into the liquid resistance therein. Said chamber 200 is also provided with two submerged terminals 300 and 400 which are similar in construction to the terminals 3 and 4, they both being sustained in holders 6 secured to the underside of the base 1. These holders 6 are connected by wires 800 and 900 to two posts 100 and 110 to which are connected wires 120 and 130 leading to the patient. The inleading wires 36 and 38 extend to the two points 37 and 41 of a two-pole switch device 43 that is adapted to connect the points 37 and 41 either to the terminals 46 of a direct current circuit 47 or of the terminals 48 of an alternating current circuit 49.

If it is desired to submit the patient to the action of a direct current, the switch 43 will be thrown into the position shown in

Fig. 1 and the patient will be connected or associated with the wires 12 and 13. In such case the terminals 15, 16 and 3 and 4 will be used for carrying current. If, however, an alternating current is desired the switch 43 is thrown over onto the contacts 48 and the patient will be connected with the wires 130. In the latter case the terminals 150, 160 and 300 and 400 are the active terminals and the liquid 5 in the chamber 200 gives the varying resistance in the circuit.

I have thus provided a device which gives the desired wave-surging current, but by reason of the construction set forth and the use of the liquid resistance the increase and decrease of the resistance is effected smoothly and in such a way as to subject the patient to minimum discomfort.

I claim:

1. In a device of the class described, the combination with an annular chamber containing a liquid resistance, of a pair of terminals submerged in said liquid, a carrier rotatably mounted above the chamber and carrying two terminals insulated from each other which extend into said liquid resistance but are adapted to pass over the submerged terminals as the carrier rotates, and means to rotate the carrier in one direction.

2. In a device of the class described, the combination with an annular open-topped chamber containing a liquid resistance, of two terminals submerged in said liquid, a carrier rotatably mounted to turn about the center of said chamber, two terminals insulated from each other sustained by said carrier and extending through the open top of the chamber into the liquid resistance, and means to rotate the carrier.

3. In a device of the class described, the combination with a base of insulating material having a circular, annular open-topped chamber therein containng liquid resistance, of two terminals sustained by said base and submerged in said liquid, a carrier rotatably mounted on the base and situated above the chamber, a pair of terminals depending from said carrier through the open top of said chamber into the liquid, and means to rotate the carrier.

4. In a device of the class described, the combination with a ring-like chamber containing liquid resistance, of a terminal submerged in said liquid, a coöperating terminal extending into said liquid, a circuit to which said terminals are connected, and means to cause one of said terminals to traverse the chamber longitudinally thereof, thereby to vary the resistance in the circuit.

5. In a device of the class described, the combination with two concentric annular chambers, each containing liquid resistance, a pair of terminals submerged in the liquid in each chamber, a rotatably-mounted carrier, two pairs of terminals sustained by said carrier, the terminals of one pair extending into the liquid in one chamber and those of the other pair extending into the liquid in the other chamber, and the terminals of each pair being insulated from each other, and means to rotate the carrier.

6. In a device of the class described, the combination with a base of insulating material, of an annular groove formed in the upper face thereof and containing liquid resistance, two diametrically-disposed terminals submerged in said liquid, a shaft extending through the base centrally of the groove, two diametrically-opposed arms carried by said shaft but insulated from each other, a terminal depending from each arm and extending into the liquid in the groove, said arms being connected to the two sides of a circuit, and means to rotate the shaft.

In testimony whereof, I have signed my name to this specification.

RALPH W. CHAPMAN.