Nov. 8, 1927. 1,648,116

S. S. EBEL

ELECTROTHERAPEUTIC DEVICE

Filed April 20, 1926

Fig. 1

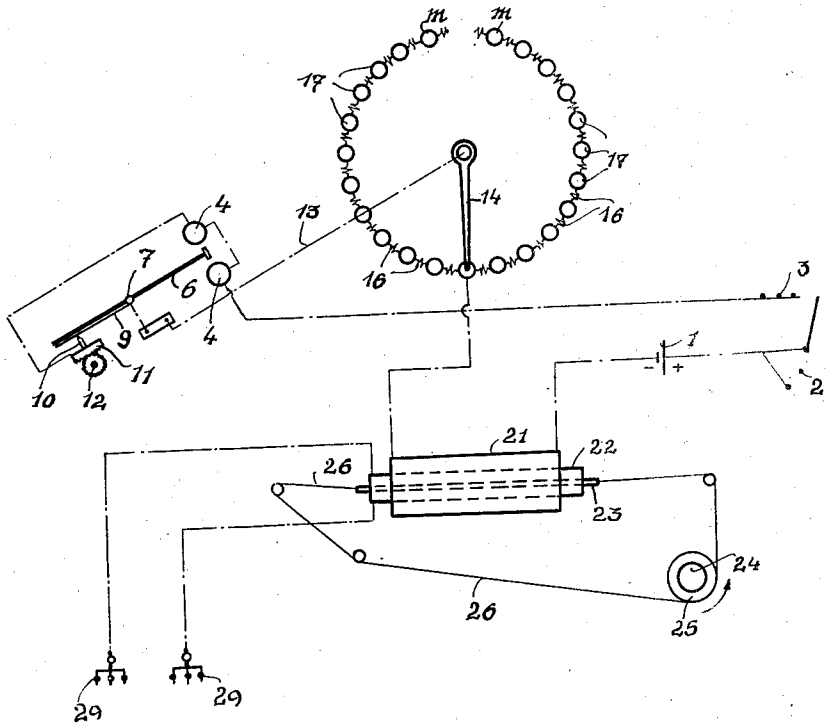

Fig. 2

S. S. Ebel
INVENTOR

By: Marks & Clerk
Attys

Patented Nov. 8, 1927. 1,648,116

UNITED STATES PATENT OFFICE.

SIEGFRIED SAMUEL EBEL, OF VIENNA, AUSTRIA.

ELECTROTHERAPEUTIC DEVICE.

Application filed April 20, 1926, Serial No. 103,370, and in Austria April 20, 1925.

This invention relates to improvements in electro-therapeutic devices of the kind in which a rheostat provided with a rotating contact-arm effects an automatically and slowly increasing and decreasing faradic current, in order to decrease the disagreeable feeling of the usual faradic current. In these known devices the rheostat, causing the slow increase and decrease of the faradic current, either is connected with the apparatus producing the current or forms a separate additional device.

In the device according to the present invention the said slow increase and decrease takes place in a proper sine curve and therefore any sudden alteration of current and shocks which would be painful to the patient cannot occur. For these reasons in the device according to the present invention the current, employed for the treatment, is increased very slowly without any disturbance of the protoplasm and shocks to the muscles owing to sudden current-shocks and therefore considerably stronger currents can be used which of course cause a more quick and through treatment without any pain.

According to the present invention the periods of vibration of the interrupter slowly increase and decrease in dependency on the rheostat.

One mode of carrying out the present invention is illustrated diagrammatically in Fig. 1 on the accompanying sheet of drawings, while Figure 2 illustrates the wave-form of the current.

The working current is supplied by dry cells 1. which are connected to a counter 3, whereby a switch 2 is interposed between the cells and the counter, in order to switch-on one or more or all cells. From the counter the current passes to the coils 4 of an interrupter, which consists of a double-armed lever 6 pivotally secured to a shaft 7. The free end of the lever 6 carries a soft-iron member 8, which is attracted by the cores of the coils 4 during the passage of the current At the bottom side of the lever 6 is provided a plate spring 9 on which rests a contact pin 10, the latter may be moved forward or backward by a rack 11 and a toothed wheel 12, so that according to the distance of the contact pin 10 from the pivotal axis 7 the lever 6 carries out larger or smaller oscillations or performs interruptions of the current for a shorter or longer time and therefore imparts a different characteristic to the same according to requirement.

This interrupter, which can be readily adjusted, is conductively connected with a contact-arm 14 of the rheostat by a wire 13 and a resilient sliding member. The rheostat consists of a circular spiral-wound resistance-wire 16, which is connected with a number of contact studs 17, on which slides the arm 14. The contact studs 17 at the right and left hand sides and disposed at the same height correspond to the switching on of like resistances. At the lowest stud a resistance is not switched on, while at the diametrically opposed studs *m m* the maximum resistance is switched on. At this place the resistance wire is interrupted, so that the studs *m m* are insulated from each other.

The contact-arm 14 is rotated by a clockwork, which can be wound up by a crank. The speed of unwinding the clockwork can be varied by a brake, which can be adjusted by a screw, so that the contact-arm 14 can rotate over the contact-studs 17 at a faster or slower pace according to requirement or can be stopped temporarily for obtaining a uniformly flowing current.

The primary winding 21 of the induction coil, necessary for producing the faradic current, is connected directly with the cells 1 and with the resistance wire 16 at the bottom stud. From the secondary winding 22, in which is disposed an adjustable iron-core 23 for varying the intensity of the faradic current, pass wires to electrodes 29, which are attached to the human body.

The adjustment of the iron-core 23 may be accomplished by a rotatable knob 24, which operates a roller 25, over the latter passing strings 26 secured to both ends of the core 23. The knob 24 is provided with a pointer operating on a dial, in order to indicate the adjustment of the iron-core 23.

A device of this kind can be greatly varied by varying the number of interruptions and independent therefrom the number of rotations of the contact-arm 14.

According to the present invention in a device of this kind the interrupter and rheostat are connected in series or behind each other in such a manner, that the switching-on of the resistances of the rheostat also acts on the interrupter, so that on switching-on a weak resistance, thus on the passage of a stronger current, the interrupter carries

out larger and correspondingly slower oscillations, while on switching-on a stronger resistance the oscillations of the interrupter are smaller and quicker.

Fig. 2 illustrates graphically the rhythmic alterations of the intensity of current and it will be seen, that sudden current-shocks cannot take place, but that the increase and decrease of the faradic current is gradual or uniform, so that the said faradic current is quite painless.

Fig. 2 also shows, that at a certain adjusted length of the interrupter-lever 6, 9, which is carried out independent of the number of rotations of the rheostat, the frequency of the interrupter depends on the position of the contact-arm 14 at the wire 16 of the rheostat.

The connecting electrodes are sub-divided, in order to correspondingly distribute the effect of the current.

The device is quite independent of heavy current, as it can be readily worked with dry cells.

Contrary to the known electro-therapeutic devices, in the device according to the present invention the oscillations of the interrupter, taking place within the sine curve, adapt themselves to the work of the rheostat and also may be regulated independent of the rheostat. The insulated adjustment of the speed of rotation of the arm rotating on the rheostat and the interruptions at the oscillating lever, as well as the stepped cooperation of the components which are of consequence for the effect of the current are a feature of the present invention, as well as of great importance for the therapeutic treatment.

I claim—

1. An electro-therapeutic device of the character described, comprising a source of current, an interrupter connected with the said source of current, an automatic and uniformly variable rheostat connected with the interrupter, and induction means connected with the rheostat and the source of current, the vibrations of the interrupter slowly increasing and decreasing in dependency on the rheostat.

2. An electro-therapeutic device of the character described, comprising a source of current, an interrupter connected with the source of current, an automatic and uniformly variable rheostat connected immediately behind the interrupter, and induction means the primary winding of which is connected with the rheostat and the source of current, the vibrations of the interrupter slowly increasing and decreasing in dependency on the rheostat.

3. An electro-therapeutic device of the character described, comprising a source of current, an interrupter connected with the source of current, a rheostat provided with a positively rotating contact-arm connected immediately behind the interrupter, the contact-arm sliding from minimum resistance to maximum resistance on bridging the space between the two latter where the current of minimum strength is interrupted, and induction means connected with the rheostat and the source of current.

4. An electro-therapeutic device of the character described, comprising a source of current, an interrupter connected with the source of current, a rheostat provided with a positively rotating contact-arm connected immediately behind the interrupter, means for regulating the frequency of the interrupter independent of the number of rotations of the said contact-arm, and induction means connected with the rheostat and the source of current.

5. An electro-therapeutic device of the character described, comprising a source of current, an interrupter connected with the source of current, the said interrupter comprising coils, a pivotally mounted double-armed lever provided with a soft-iron member at one end and a plate-spring at the other end thereof, a contact-pin operating on the said spring, a rack to which the said contact-pin is secured, and a toothed wheel for operating the rack, a rheostat provided with a positively rotating contact-arm connected immediately behind the interrupter, and induction means connected with the rheostat and the source of current.

6. An electro-therapeutic device of the character described, comprising a dry cell, a counter connected with the latter, a switch interposed in the connection between the cell and the counter, an interrupter connected with the counter, an automatic and uniformly variable rheostat connected with the interrupter, and induction means connected with the rheostat and the dry cell.

7. An electro-therapeutic device of the character described, comprising a source of current, an interrupter connected with the source of current, a rheostat connected immediately behind the interrupter, the said rheostat comprising a positively rotating contact-arm, a circular spiral-wound resistance-wire, and a number of contact-studs connected with the resistance-wire, and induction means connected with the rheostat and the source of current.

8. An electro-therapeutic device of the character described, comprising a source of current, an interrupter connected with the source of current, an automatic and uniformly variable rheostat connected immediately behind the interrupter, and induction means connected with the rheostat and the source of current, the said induction means comprising a primary winding, a secondary winding, an adjustable iron-core within the latter, and means for adjusting the said core

for varying the intensity of the faradic current.

9. An electro-therapeutic device of the character described, comprising a source of current, an interrupter connected with the source of current, means on the interrupter for regulating the frequency of the interrupter, an automatic and uniformly variable rheostat connected immediately behind the interrupter, the said rheostat comprising a rotating contact-arm, a circular spiral-wound resistance-wire, and a number of contact-studs connected with the resistance-wire, and induction means connected with the rheostat and the source of current.

10. An electro-therapeutic device of the character described, comprising a source of current, an interrupter connected with the source of current, a rheostat connected immediately behind the interrupter, and induction means connected with the rheostat and the source of current, the said induction means comprising a primary winding, a secondary winding, an adjustable iron-core within the latter, and means for adjusting the said core for varying the intensity of the faradic current, the said means comprising a rotatable knob, a roller operated by the latter, and a string passing over the roller and secured to both ends of the said core.

11 An electro-therapeutic device of the character described, comprising a source of current, an interrupter connected with the source of current, an automatic and uniformly variable rheostat connected immediately behind the interrupter, induction means connected with the rheostat and the source of current, and electrodes connected with the induction means.

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

SIEGFRIED SAMUEL EBEL.