(No Model.)

W. J. HERDMAN.

ELECTRO THERAPEUTIC APPARATUS.

No. 458,625. Patented Sept. 1, 1891.

Fig. 1.

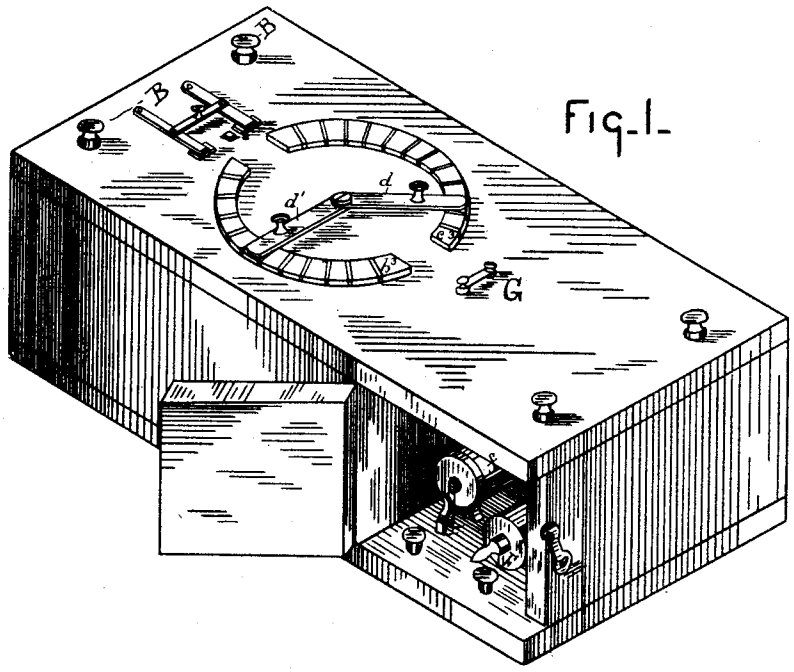
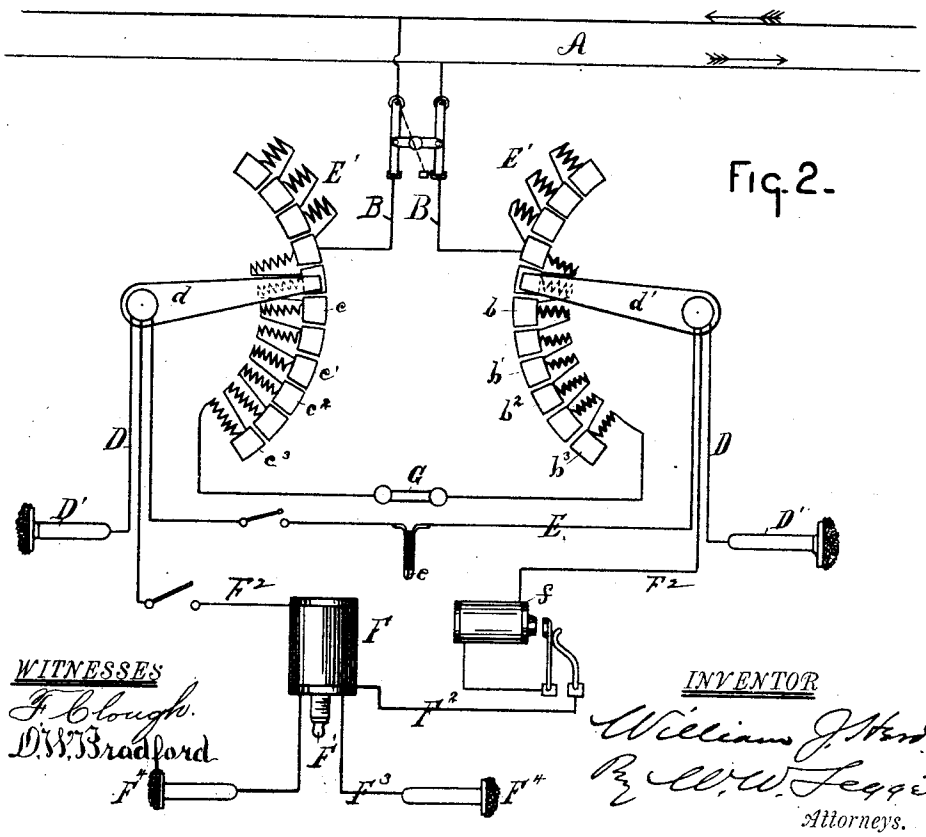


Fig. 2.



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ELECTRO-THERAPEUTIC APPARATUS.

SPECIFICATION forming part of Letters Patent No. 458,625, dated September 1, 1891.

Application filed December 27, 1890. Serial No. 375,966. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM J. HERDMAN, a citizen of the United States, residing at Ann Arbor, county of Washtenaw, State of Michigan, have invented a certain new and useful Improvement in Therapeutical Electrical Apparatus; and I 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 pertains to make and use the same, reference being had to the accompanying drawings, which form a part of this specification.

In the drawings, Figure 1 is a plan view of an apparatus embodying my invention. Fig. 2 is a diagrammatic view illustrating the construction and operation of said apparatus, and more clearly demonstrating my invention.

Heretofore in therapeutical electrical apparatus there has been a great variety of machines for producing and applying electricity in the various ways desirable. These have usually been accompanied with batteries or electrical generators, likewise in great variety both as to their amprage and voltage, and also very different with respect to their variability when in action. Again, the use of the same apparatus at different times has been liable to vary greatly in its action. All this has caused a great disparity in the data as to the effect of the electric treatment upon patients, even where the physical conditions of the patient were similar. It has also given rise to great uncertainty among physicians as to what effects might be expected under certain electrical conditions, because the conditions vary so widely, even where they are presumed to be known, as to clothe the results with great uncertainty. The difficulties may therefore be summed up and attributed almost solely to the fact that there has been no certainty as to the electrical conditions existing in the large variety of applications of electricity for therapeutical purposes. It is the purpose of my invention to overcome these varying conditions and to place within the reach of physicians an apparatus simple in its character and adapted for use with any of the various commercial currents to be found in almost all cities and towns of any considerable size. I would, however, have it understood that it is equally applicable for use with batteries or other generators.

My invention consists, essentially, in providing the machine with a series of resistances located upon a shunt-circuit closed at its ends into the main lines of the commercial circuit or circuit from a battery or other generator in such a manner that the current thus shunted from the main line of the generator passes constantly through the said unbroken circuit of the resistances. This circuit I will term the "machine-circuit." Then I provide suitable pole-pieces or electrodes, and from these pole-pieces or electrodes lines are led to shifting-terminals, which two terminals may be engaged with any of the said resistances. The circuit thus completed through the patient I will term the "patient's circuit." Thus by engaging the said terminals with, say, the two adjacent resistances on the machine b^3 and c^3 circuit, it is apparent that very little current would be shunted through the body of the patient; but by shifting one or both of said terminals so as to embrace more or less of said resistances between them more current will be shunted through the body of the patient proportioned to the relative impediment afforded to the passage of the current through the said resistances and the body of the patient, because if the resistance between the terminals on the main line is greater than that afforded by the body a larger proportion of current would pass through the patient than through the said resistances, and vice versa.

In carrying out my invention, A may represent the main-line wires of any commercial circuit, preferably a constant-potential circuit.

B represents the circuit of my machine, which I term the "machine-circuit," closed at its ends into the said circuit of the generator.

b b' b^2, &c., represent a series of resistances, and c c' c^2, &c., another series of resistances. These are located on the machine-circuit, and are connected in series in said circuit. Thus b b' b^2, &c., might each represent one-tenth of an ohm resistance, while c c' c^2, &c., might each represent one one-hundredth of an ohm resistance.

D represents the patient's circuit, and is

provided with any usual pole-pieces D′, by which the patient is brought into the circuit.

d and *d′* represent switch-levers which are insulated from each other, and which constitute the terminals of the patient's circuit. They are each arranged to sweep over the segments corresponding with the different resistances, so that by shifting the said switch-levers more or less of said resistances may be incorporated between them. The physician may shift one of the terminals along the segments of the resistances *b b′ b²*, &c., bringing into the patient's circuit the additional current each time due to a resistance in the main line of one-tenth of an ohm until the patient is receiving nearly the desired quantum, or until the introduction of the current at such rapid steps becomes obnoxious to him. Then by shifting the lever *d′* along the terminals *c c′ c²*, &c., he may increase the current very gradually, due to the introduction at each step of but one one-hundredth of an ohm of resistance into the machine-circuit, and so gradually bring the current up to the desired standard.

In order to adapt the machine for the various purposes required by the physician in his ordinary practice, I provide the apparatus with means for producing a cauterizing-current, and also with an induction-coil for the production of interrupted current. Thus E may represent a cauterizing-circuit, being simply a closed shunt-circuit in lieu of the patient's circuit. It is apparent that when the switch-levers *d d′* are brought into position so as to bring all the resistances between the two terminals the circuit from the main line is shunted directly through the cauterizing-circuit, which affords but little resistance, and the cauterizing-section *e*, which forms a higher resistance than the remainder of the cauterizing-circuit, is heated up to the requisite degree. The degree to which it may be heated may be regulated in the same way as the strength of the current over the patient's circuit was regulated by reducing or increasing the resistances on the machine-circuit between the terminals *d d′*. These resistances, however, which were employed for the patient's circuit, might be burned out with the greater amprage of current passed over the cauterizing-circuit, and for this reason I prefer to provide the special resistances E′ for use with the cauterizing-circuit. They may, if desired, be arranged so as to be swept by the same switch-levers or terminals *d d′*, as shown.

F may represent an induction-coil for the production of interrupted current and having the usual vibrator *f* for this purpose. F′ is its adjustable core, graduated with a definite scale, so that exact notes may be maintained in the treatment of a patient therewith.

F² is the primary circuit of the coil. F³ represents the secondary circuit, and F⁴ its pole-pieces. This is likewise so arranged that current shunted through the induction-circuit F² may be graduated by shifting the terminals *d d′*.

If desired, a fusible plug or strip G may be introduced into the machine-circuit for the protection of the resistances should the current from the generator for any reason become excessive.

It is apparent that with this machine the current from the generator becomes practically uniform under all circumstances—that is to say, if it is any of the usual commercial currents these currents for the different systems possess uniform characteristics as respects voltage and amprage wherever they are found, and if the current is from a battery an ammeter and a voltmeter brought into the machine-circuit before using will afford correct and reliable data as to the current from the generator entering over the machine-circuit. A physician can therefore use the apparatus with comparative confidence that with a similar adjustment of his terminals his electrical conditions will always be the same, and not only the same in his own practice, but that the conditions will be the same as they were in any reported case where the data purported to be the same. In this way the machine, it is expected, will accomplish the production of reliable and definite data and enable physicians employing similar machines to reproduce the electrical conditions for the treatment of like cases.

I am not aware that therapeutical electrical apparatus has before been made in which the machine-circuit has been provided with a series of resistances and closed at its extremities into the battery or the circuit of any other generator, and in which reliance is had for the patient's or operator's current upon the shunt from the machine-circuit of the requisite current required upon the patient's or operator's circuit without disturbing or interrupting in any way the machine-circuit. It will be observed that the relative capacity of the series *b b′ b²* of resistances to that of the series *c c′ c²* is a decimal ratio—that is to say, the resistance *c* is one-tenth of the resistance *b*. Of course this need not necessarily be the relation between them; but it is convenient, since it enables the use of decimals, units, tenths, and hundredths in stating the resistances that are employed in any case.

I have used the terms "patient's circuit," "operator's circuit," "induction or interrupted circuit," and "the cauterizing-circuit" simply to distinguish the same. Of course other circuits for other purposes might likewise be employed, and all of them might be comprehended by the term "operator's circuit," being in any instance the circuit whereby the physician is producing the desired effect upon a patient, and I would have the term "operator's circuit" as employed in the claims to be thus broadly construed. I would also have it understood that instead of the pivoted switch-levers any other convenient means for connecting the terminals of the operator's cir-

cuit into shunt connection with the machine-circuit, whereby more or less of the resistances may be embraced between them, might be employed.

I have found that this machine operates admirably when deriving its current from the converter of an alternating circuit; but when the induction-coil is to be employed difficulty may arise in the use of an alternating current, and where the machine is connected up with the converter of an alternating circuit I would provide a separate battery for use, from which to derive the machine-current when it is desired to use the induction-coil.

What I claim is—

1. In an electrical therapeutical apparatus, the combination of a main circuit and a patient's circuit in shunt therewith, two series of resistances, and sweep-arms for varying the resistance on the shunt circuit, the consecutive resistances on one of said series varying in a decimal ratio to the consecutive resistances on the other of said series, substantially as and for the purpose described.

2. In an electrical therapeutical apparatus, the combination of a machine-circuit and a patient's circuit in shunt therewith, two series of resistances, in one of which consecutive resistances vary in amount equal to the sum of a number of the resistances in the other set, sweep-arms arranged to bring into the shunt-circuit any desired number of said resistances, and pole-pieces whereby the circuit can be closed through the patient, all combined and operating substantially as described.

3. In an electrical apparatus, the combination of two series of resistances, of which the consecutive resistances in one series vary in an amount equal to the sum of the resistances of several of the other series, means for closing the circuit beyond the resistances, and means, substantially as described, for using the two series of resistance in combination, so as to vary gradually through the whole system of resistance from the lowest to the highest by the difference in resistance between two consecutive resistances in the series of low resistances, substantially as and for the purpose described.

4. In a therapeutical apparatus, the combination, with a machine-circuit permanently closed from the point of entrance to the point of departure of the current, the said machine-circuit provided with a series of resistances, of a patient's circuit, an induction or interrupted circuit, and a cauterizing-circuit, each provided with terminals, whereby it may be engaged into shunt connection with the machine-circuit and its current be graduated by bringing more or less of said resistances between said terminals, substantially as described.

5. In a therapeutical apparatus, the combination, with a machine-circuit permanently closed from the point of entry to the point of departure of the current, said circuit provided with a series of resistances, of a cauterizing-circuit adapted to be connected in shunt with the machine-circuit, and special resistances E′, arranged to be brought into said cauterizing-circuit and adapted to carry the increased amprage of current without injury, substantially as described.

In testimony whereof I sign this specification in the presence of two witnesses.

WILLIAM J. HERDMAN.

Witnesses:

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F. L. PARSONS.