Electrostatic Therapy Apparatus

The present invention relates to an improvement of an electrostatic therapy apparatus which uses high voltage to treat the human body and which is also called electric potential or ion therapy apparatus.

An electrostatic therapy apparatus which serves to treat the human body or the like in an electric field is called electrical potential, electrostatic, or ion therapy apparatus and has been widely used as one means to attain physio-therapy and excellent therapeutical effects. The feature of this electrostatic therapy apparatus exists in that therapeutical treatment can be easily effected all over the human body without current being applied directly to the human body.

Fig. 1 is a circuit diagram showing an example of the conventional electrostatic therapy apparatus. In Fig. 1, numeral 1 represents a boosting transformer, which is provided with a primary winding 2 and a secondary winding 3 which generates boosted voltage. Numerals 4, 4 denote power source terminals of a commercial power source E, 5,6 connecting points of the secondary winding 3, 7, 8 high impedance elements connected to the connecting points 5 and 6, respectively, and comprising resistors or

capacitors, 9, 10 connecting points, and 11, 12 therapeutical electrodes, one 12 of which is connected to the earth 13 through the high impedance elements 8.

14 denote an earth conected to one line of the commercial power souce E. V_1 represents a voltage applied between the power source terminals 4 and 4 of the primary winding 2, and V_2 a voltage output between the connecting points 9 and 10.

In the case of the conventional **electrostatic** therapy apparatus arranged as described above, the side of the connecting point 6 of the secondary winding 3 is earthed, thereby enabling the electrode 12 to be of low withstand voltage to ground (dielectric strength against the voltage to ground, hereinafter referred to as "withstand voltage to ground") structure, but the side of the connecting point 5 of the secondary winding 3 is by about the voltage V_2 higher than the side of the connecting point 6 and this voltage V_2 is usually high, amounting to several kilo-volts, thereby causing the electrode 11 to be of high withstand voltage to ground structure.

When safety is considered, only the high impedance element 7 is sufficient, and the conventional apparatus is usually provided with only this high impedance element 7. When therapeutical effects attained

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by the electrostatic therapy apparatus are considered, the high impedance elements 7 and 8 are not necessarily needed.

It is an object of the present invention to provide an electrostatic therapy apparatus whereby the withstand voltage to ground of the electrodes is small. It is a further object of the present invention to provide an elctrostatic therapy apparatus whereby the electric potential difference between the electrodes can be large. It is a still further object of the present invention to provide an electrostatic therapy apparatus having a simplified construction of each of the electrodes so as to make the whole of the apparatus compact.

According to the present invention there is provided electrostatic therapy apparatus for electrostatic treatment of the human body or the like, the apparatus comprising a pair of electrodes to treat a human body; and transformer means having a primary winding for connection to an AC voltage source, and a secondary winding connected to supply a boosted voltage to said electrodes at essentially the same frequency as said voltage source; and wherein the secondary winding is connected to earth at an intermediate point thereof.

Examples of the present invention will now be descibed in more detail with reference to the accompanying drawings. It should be understood that various charges and modifications of these examples are included within the scope of appended claims.

Fig. 1 is a circuit diagram showing an example of the conventional electrostatic therapy apparatus.

Figs. 2a - 2d are circuit diagrams showing an embodiment of the present invention.

Fig. 3 is a view showing a case where the circuit shown in Fig. 2a is used.

Figs. 4a - 4e are circuit diagrams showing other embodiments of the present invention.

The present invention relates to an electrostatic therapy apparatus wherein an intermediate voltage point of terminal voltage on the secondary winding side of a boosting

transformer is connected to the earth to make withstand voltage to ground of each of electrodes small and electric potential difference between the electrodes large.

Fig. 2a is a circuit diagram showing an embodiment of the present invention, in which same parts as those in Fig. 1 will be denoted by same reference numerals. Numeral 15 represents an intermediate tap positioned at a predetermined point of the secondary winding 3. This intermediate tap 15 is connected to the earth 13'.

The position of the intermediate tap 15 may not necessarily be the center of the secondary winding 3. Since the high impedance elements 7 and 8 are not necessarily needed from the viewpoint of therapeutical effects attained, they will be incorporated into the circuit, when needed.

Fig. 2b shows an example wherein the intermediate tap 15 is connected to the primary winding 2 instead of its being directly earthed as shown in Fig. 2a, and wherein the intermediate tap 15 is earthed by connecting one line ℓ of the commercial power source E to the earth 14.

Fig. 2c shows another example wherein a safety resistor 16 is connected to the circuit shown in Fig. 2b.

In Fig. 2d, two boosting transformers 1 and 1' are used and primary windings 2 and 2' are connected with each other in parallel while secondary windings 3 and 3' are connected with each other in series. The intermediate point between the secondary windings 3 and 3' connected is connected to the earth 13".

Fig. 3 is a view showing a case where the circuit shown in Fig. 2a is used and M denotes a human body. The human body M to be treated is positioned between the electrodes 11 and 12. As apparent from the above, the electrostatic therapy apparatus of the present invention enables the withstand voltage to ground to be made smaller than when the voltage used is the same as in the conventional case and the electric potential difference between the electrodes 11 and 12 to be made large when the withstand volatage to ground of the electrodes is same as in the conventional case.

Figs. 4a - 4e are circuit diagrams showing other embodiments of AC/DC superposed type embodying the present invention where a part of the secondary winding side is shown, respectively. Same parts as those in Fig. 2a will be represented by same reference numerals.

In Fig. 4a, the intermediate tap 15 is connected to a connecting point 6' through a

capacitor 19A and a diode 18A is interposed between the connecting point 6' and the connecting point 6 of the secondary winding 3. The example shown in Fig. 4a is same as that in Fig. 2a except the above. In this case, alternating current is applied between the earth and the electrode 11, while direct current between the earth and the electrode 12.

In Fig. 4b, the connecting point 5 of secondary winding 3 is connected to the high impedance element 7 through a diode 18B, and the intermediate tap 15 is connected to a connecting point 5' between the output side of the diode 18B and the high impedance element 7 through a capacitor 19B. The example in Fig. 4b is same as the one shown in Fig. 2a except the above. In this case, direct current is applied between the earth and the electrode 11, while alternating current between the earth and the electrode 12.

In Fig. 4c, two intermediate taps are arranged at the secondary winding 3 and represented by numerals 20 and 21 as first and second intermediate taps. The first intermediate tap 20 is connected to the connecting point 6' through the capacitor 19A, similarly to the case shown in Fig. 4a, and the diode 18A is interposed between the connecting point 6'and the connecting point 6

of the secondary winding 3. The second intermediate tap 21 is connected to the earth 13'. In this case, alternating and direct current is applied between the earth and the electrode 12, while alternating current between the earth and the electrode 11.

In Fig. 4d, the second intermediate tap 21 is connected to a connecting point 5' through a capacitor 19C and a diode 18C is interposed between the connecting point 5' and the connecting point 5 of the secondary winding 3. The first intermediate tap 20 is connected to the earth 13', similarly to the case shown in Fig. 2a. Alternating and direct current is applied between the earth and the electrode 11, while alternating current between the earth and the electrode 12.

Fig. 4e shows a case where a third intermediate tap 22 is arranged at the secondary winding in addition to the first and second intermediate taps 20 and 21. The third intermediate tap 22 is connected to the earth 13'. This example in Fig. 4e corresponds to the combination of those shown in Figs. 4c and 4d. Alternating and direct current is applied to the electrodes 11 and 12.

Even in the cases of these embodiments shown in Figs. 4a - 4e, the high impedance elements 7 and 8 are not necessarily needed, as described

above.

In the cases of these embodiments shown in Figs. 4a - 4e, each of the intermediate taps 15, 20, 21 and 22 may be connected to the side of the primary winding 2, as shown in Fig. 2b, or a safety resistor may be interposed between each of the intermediate taps and the primary winding 2, as shown in Fig. 2c. The circuit shown in Fig. 2d may be employed.

As described above in detail, the intermediate tap is positioned at a certain point on the secondary winding of the boosting transformer in the case of the electrostatic therapy apparatus.

Therefore, the withstand voltage to ground of each of the electrodes may be adapted to be higher than voltage on the basis of the intermediate tap, thereby enabling the whole of the apparatus to be small-sized. Further, not earth electric potential (which is same in electric potential as the earth) but voltage corresponding to that at the intermediate tap is applied to the two electrodes, respectively. When a detector such as the neon tube is brought near one of the electrodes, therefore, it is turned on, thereby making it visible to the user that electric field is formed, so that relief and reliability can be guaranteed to the user, which is an extremely practical effect attained by the therapy apparatus.

CLAIMS

1. Electrostatic therapy apparatus for electrostatic treatment of the human body and the like, the apparatus comprising a pair of electrodes to treat a body; and transformer means having a primary winding for connection to an AC voltage source, and a secondary winding connected to supply a boosted voltage to said electrodes at essentially the same frequency as said voltage source; and wherein the secondary winding is connected to earth at an intermediate point thereof.

2. Apparatus as claimed in Claim 1 wherein said transformer means comprises two boosting transformers having their primary windings connected to each other in parallel and their secondary windings connected with each other in series with a connecting point therebetween providing said intermediate point.

3. Apparatus as claimed in Claim 1 or 2 wherein one or more impedance means are provided in series between the electrodes and the, or each secondary winding.

4. Apparatus as claimed in any preceeding Claim and substantially as herein described with reference to the accompanying drawings.