

[54] **THERAPEUTICAL APPARATUS APPLYING SUPERPOSED OUTPUT OF DC AND AC VOLTAGES**

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[52] U.S. Cl. **128/420**

[51] Int. Cl. **A61n 1/36**

[58] Field of Search 128/1 C, 2.1 R, 419 R, 128/420, 421, 423

[56] **References Cited**

UNITED STATES PATENTS

2,327,874 8/1943 De Jong 128/420
3,483,672 12/1969 Jahnke 128/419 R

FOREIGN PATENTS OR APPLICATIONS

919,338 2/1963 United Kingdom 128/419 R

1,317,060 12/1962 France 128/421
1,065,950 9/1959 Germany 128/1 C
1,063,293 8/1959 Germany 128/419 R

OTHER PUBLICATIONS

Buchsbaum "Electronic World," Sept., 1963, pp. 27-29.

Primary Examiner—William E. Kamm

Attorney, Agent, or Firm—Larson, Taylor & Hinds

[57] **ABSTRACT**

A therapeutical apparatus applying a superposed output of DC and AC voltages to a human body comprising a voltage generating part producing a superposed output of DC and AC voltages and an electric field forming part including two sheets of parallel electrodes to which said output is applied, wherein said superposed output of DC and AC voltages is applied to the human body disposed in the electric field forming part to receive electrical and therapeutical treatment.

5 Claims, 29 Drawing Figures

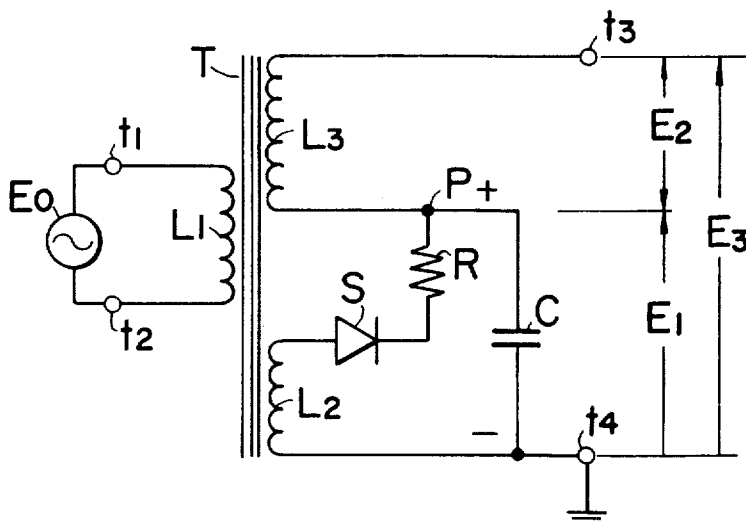


FIG. 1

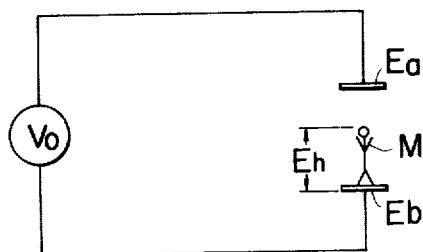


FIG. 2a

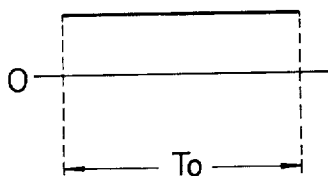


FIG. 2b

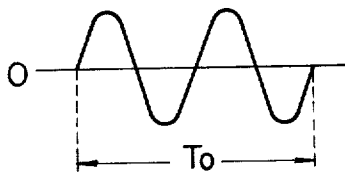


FIG. 2c

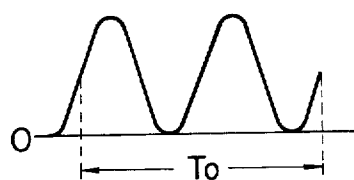


FIG. 3a



FIG. 3b

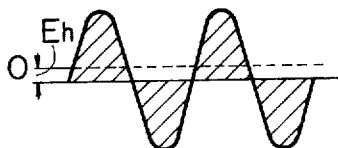


FIG. 3c

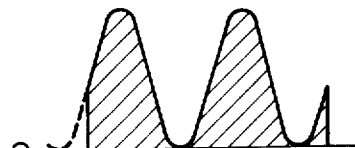


FIG. 4a



FIG. 4b

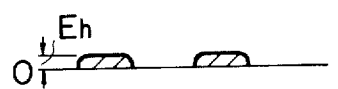


FIG. 4c

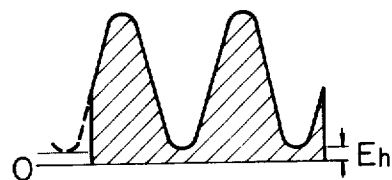


FIG. 5a

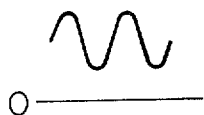


FIG. 5b

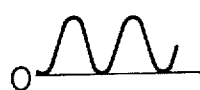


FIG. 5c

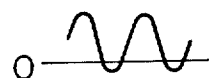


FIG. 5d

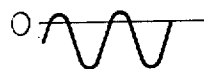


FIG. 5e

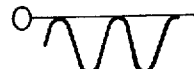


FIG. 5f

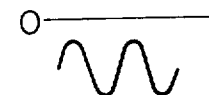


FIG. 6a

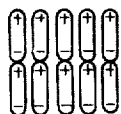


FIG. 6b

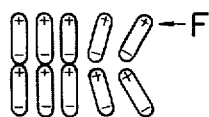


FIG. 6c

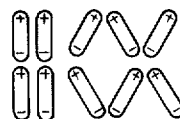


FIG. 7

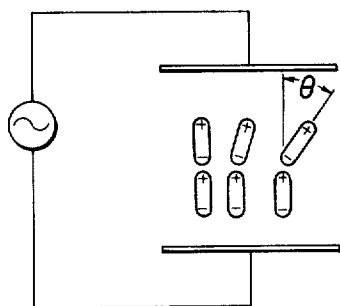


FIG. 8

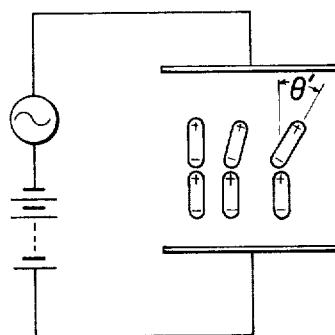


FIG. 9

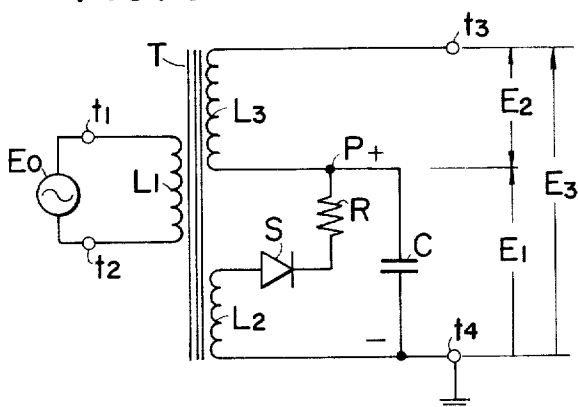


FIG. 10

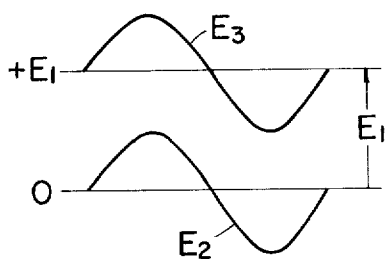


FIG. 11

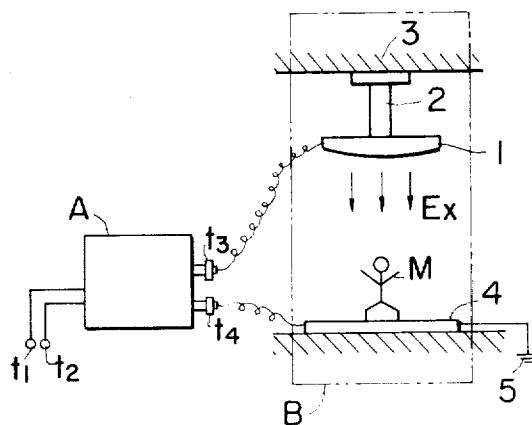


FIG. 12

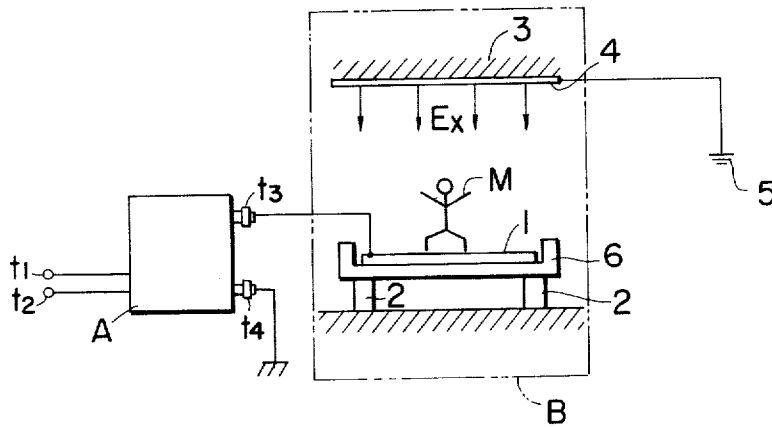


FIG. 13

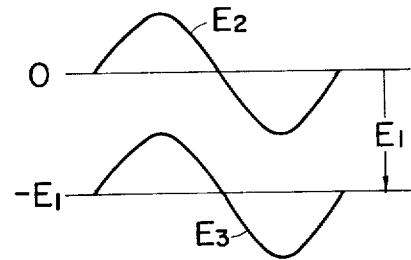


FIG. 14

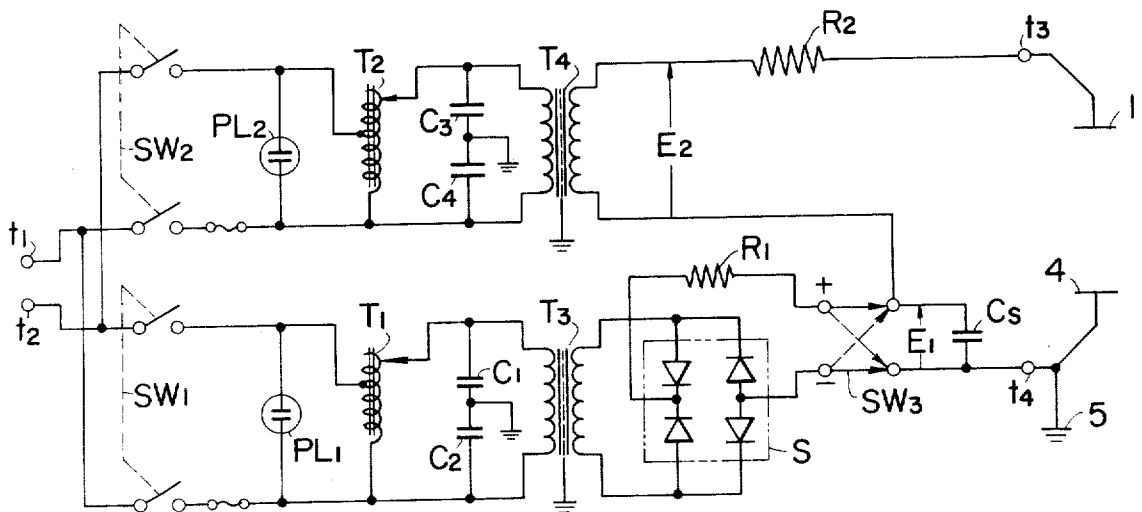


FIG. 15

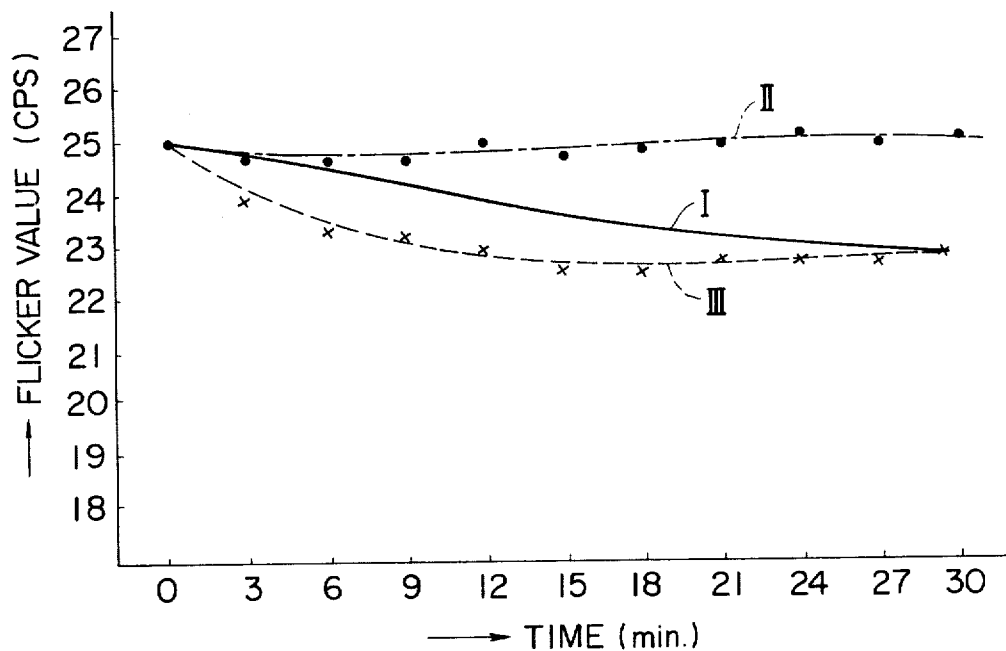
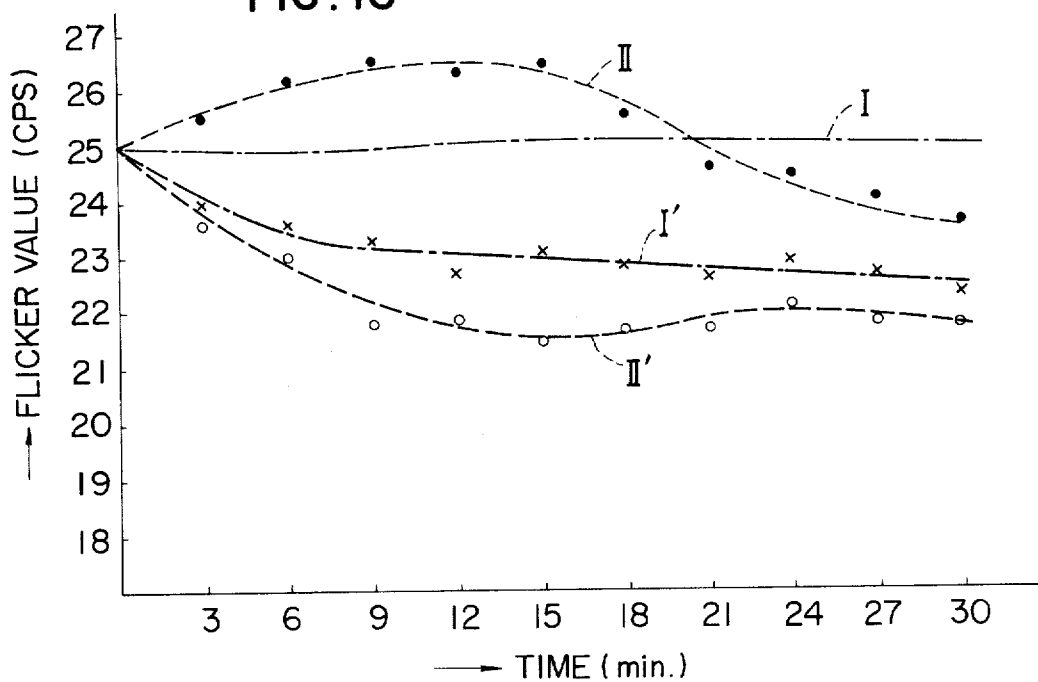


FIG. 16



THERAPEUTICAL APPARATUS APPLYING SUPERPOSED OUTPUT OF DC AND AC VOLTAGES

This invention relates to an electrical apparatus for therapeutically treating a human body, which comprises an output voltage generating part in which an AC voltage and a DC voltage can be superposed in a predetermined proportion and an electric field forming part including two sheets of opposite parallel electrodes, wherein the superposed output of DC and AC voltages which is fixed in polarity is applied to the human body entered into the electric field forming part to make effective electrical and therapeutical treatment of the human body.

BACKGROUND OF THE INVENTION

As is known for the therapeutical treatment of the human body by applying an electric voltage, the present inventor has proposed an apparatus which has previously been incorporated in Japanese Pat. No. 284,946 and Japanese Pat. No. 284,947.

These inventions are generally intended to provide an apparatus which can therapeutically treat the human body disposed above or beneath the insulated electrodes applying an AC high voltage of approximately 3,000 V to 1,000,000 V through a condenser of a capacitance as predetermined.

The therapeutical treatment by means of the described apparatus is primarily based on the known principle that the human body as the subject of the therapeutical treatment is charged with an electric current from an AC electric field of a high voltage and caused variation in the internal organs or systems of the body and in the blood of the human body calcium ions would increase and magnesium and phosphor decrease.

It is well known that unhealthy body is reduced in the amount of calcium ions and increased in that of magnesium and phosphor. The described known apparatus is provided to increase calcium ions and decrease magnesium and phosphor in the blood by charging a high AC voltage to the unhealthy body. Such unhealthy body is thereby favorably affected and whose cells of organs are reactivated so as to cause the sickness of the body to be remedied. However the apparatus in use of a high AC voltage of the type as described has involved the problem of reaction to occur during the treatment. Such reaction during the therapeutical treatment means a particular transient reactionary phenomenon which occurs in the course of recovery from sickness, that is, pains in sick portions or physical fatigue.

BRIEF SUMMARY OF THE INVENTION

The present invention provides a novel apparatus for therapeutical treatment which has overcome the problems involved in the conventional apparatus for therapeutical treatment such as caused from charging AC high voltage. The novel construction of the apparatus according to the invention comprises a voltage generating part producing a superposed output of DC and AC voltages, and two sheets of opposite electrodes to be applied such superposed output of DC and AC voltages. The human body entered said therapeutical electrical field is served electrical and therapeutical treatment by being applied with the superposed output of DC and AC voltages which is fixed in polarity by DC voltage.

Therefore, a primary object of the invention is to provide an apparatus which is directed to the effective therapeutical treatment of the human body by charging a superposed output of DC and AC voltages without a danger to the human body.

Another object of the invention is to provide an apparatus which can perform the effective electrical and therapeutical treatment most adapted to the human body by applying a superposed output of DC and AC voltages of a predetermined proportion.

Another object of the invention consists in an apparatus capable of providing the effective electrical and therapeutical treatment to the human body not rendering unpleasing reaction to the body during treatment by conventional use of an AC high voltage.

Another object of the invention is to provide an apparatus which by use of a low AC voltage enables an effective electrical and therapeutical treatment of the human body to obtain the same effect as desired by means of conventional AC high voltage.

These objects may be attained by utilizing various parts of the apparatus and operation thereof as illustrated in detail with reference to the accompanying drawings and in the description of the specification.

In accordance with a preferred embodiment thereof, a therapeutic treatment apparatus utilizing superimposed DC and AC voltages is provided which comprises therapeutic voltage generating means for generating an output comprising superimposed DC and AC voltages and means for producing a therapeutic electric field including first and second parallel, opposed electrodes, the electrodes, which preferably comprise spaced parallel plates, being connected to the output of the therapeutic voltage generating means. The therapeutic voltage generating means includes a transformer means which comprises a primary winding connected to an AC power source and first and second secondary windings, one of the secondary windings forming an AC generating circuit. A DC generating circuit is formed by the other of the secondary windings in combination with a rectifier circuit and the DC generating circuit and AC generating circuit are connected together in a mutually superimposed relationship to therapeutic voltage terminals so that an output comprising superimposed DC and AC voltages is presented at these terminals. The therapeutic voltage terminals are connected to the parallel, opposed electrodes and one of the electrodes is connected to the subject for therapeutic treatment.

In accordance with one embodiment, one of the electrodes is mounted by an insulator on a ceiling while the other of the electrodes is in contact with the subject. In another embodiment the electrode in contact with the subject is mounted on an insulated table which itself is insulatingly mounted. The other of the electrodes is grounded and is disposed above and in opposed relationship to the first mentioned electrode.

In a second embodiment of the therapeutic voltage generating means two transformers are used. An autotransformer is connected on the primary side of each of the transformers and one of the transformers includes, on the secondary side thereof, connected in the secondary circuit with the rectifier, a protective resistor, a condenser and a polarity reversing switch. The secondary side of the first transformer is connected in series with the secondary side of the second transformer.

Many variations and modifications of the construction of the apparatus may be understood all to be included in the scope and spirit of the claims and specification of the invention.

DESCRIPTION OF THE DRAWING

FIG. 1 is a circuitry diagram illustrating the essential principle of the therapeutical operation performed by means of the apparatus of the superposed DC-AC output type of the invention;

FIG. 2a, b, c, FIG. 3a, b, c and FIG. 4a, b, c are schematic diagrams of waveforms showing the therapeutical operation of the apparatus according to the invention;

FIG. 5 a-f are schematic diagrams of waveforms showing ratios of superposed output of DC and AC voltages;

FIG. 6a, b, c are schematic diagrams illustrating the vertical and horizontal orientation of cellular molecules of the human body;

FIG. 7 is a schematic diagram illustrating the orientation of cellular molecules of the human body which is solely applied an AC voltage;

FIG. 8 is a schematic diagram illustrating the orientation of cellular molecules of the human body which is applied a superposed output of DC and AC voltages;

FIG. 9 is a circuitry diagram illustrating a voltage generating part of the apparatus according to the invention;

FIG. 10 is a schematic diagram showing waveforms of outputs of DC and AC voltages as shown in FIG. 9;

FIG. 11 is an overall view of an embodiment of the apparatus according to the invention;

FIG. 12 is a view showing another embodiment of the apparatus of the invention;

FIG. 13 is a schematic diagram showing waveforms of an output of DC and AC voltages of the apparatus of FIG. 12;

FIG. 14 is a view showing an embodiment of a circuitry of the apparatus of the invention having DC and AC voltages variable with mixture ratios of voltages;

FIG. 15 is a schematic diagram illustrating the variation of polarity of a DC voltage during the application of superposed output of DC and AC voltages according to the invention; and

FIG. 16 is a schematic diagram illustrating the variation of mixture ratios of DC and AC voltages according to the invention.

DETAILED DESCRIPTION OF THE INVENTION

With reference to the drawings, an embodiment of the invention is now illustrated. The drawings show the basic principle of the therapeutical treatment which is applied superposed DC and AC voltages. As shown in FIG. 1, a human body M is positioned between electrodes Ea and Eb and these electrodes are connected to a power source Vo. In the figure, Eh designates a potential of the human body. When three kinds of waveforms of voltages, i.e., DC, AC and DC-AC, are applied there are produced waveforms of current as shown in FIG. 3a, b and c corresponding to waveforms of voltages as shown in FIG. 2a, b and c respectively, with the current flowing through the circuit including the human body. In the instant case, the waveforms of electric currents which would flow through the human body M are shown in FIG. 4a, b and c.

For the DC voltage, a transient current flows in one pass in the direction as shown in FIG. 4a and thereafter no more current flows. For the AC voltage, current flows both in the positive and negative directions as shown in FIG. 4b, while the voltage is applied to the human body, where a very slight potential Eh is provided in the human body as a bias potential. In this case the positive and negative currents are not set off with each other but a small differential of the positive and negative currents flows in one direction as shown in the drawing.

In the case where a DC voltage and an AC voltage are superposed as shown in FIG. 4c, the oriented current flowing in the human body is largest as compared with the case where a DC voltage and an AC voltage are used respectively singly. FIG. 5 shows that different types of waveforms are obtained as shown in FIG. 5a, b, c, d, e and f by varying the mixture ratios of DC voltage and AC voltage and further the polarity of DC voltage.

The cellular molecule of the human body essentially has in itself positive and negative polarities which provides the molecule with an orientation of orderly arrangement. As typically shown in FIG. 6a, when external stress F is imparted in the orientation as shown in FIG. 6b, the cellular molecule is disordered in the orientation, or, When intensity of polarization that the molecule internally has is decreased, the cellular molecule is disordered as shown in FIG. 6c and this movement would generate a stress. With superposed DC and AC voltages applied and thereby polarization intensified (inductive dipole), the cellular molecule can regain the normal orientation as shown in FIG. 6a.

If the stress is suppressed solely by AC electric field, where electrical bonding of the cellular molecules is weakened so that a large orientation is produced by influence of the AC high voltage field and then results a loss of large energy. Nearly same fatigue will appear in the human body as frequently seen after physical exercise of the body. The described fatigue is normally called the therapeutical reaction, which can be recovered to normal condition as shown in FIG. 6a, without giving fatigue to the human body by providing a DC voltage in a definite direction and an orientation by AC voltage to lessen the orientation angle of molecule. The DC voltage used at this time is required to have the same direction as the polarizing direction of the cellular molecule. FIGS. 7 and 8 illustrate in details the above condition. FIG. 7 shows further the instance in which AC voltage solely is applied and the angle of orientation of the cells is given by θ . FIG. 8 illustrates the case in which superposed DC and AC voltages are applied, where the angle of orientation is given by θ' . In the drawings, it is noted that θ is larger than θ' and therefore fatigue of the body due to orientation is decreased.

These therapeutical effects were obtained by experimental tests using DC and AC voltages respectively of 500 V with quite satisfactory result. Same effect may also be obtained by properly adjusting the charging time of voltages above or below the described DC and AC voltages.

Construction of the apparatus used for practicing the present invention according to the above principle will be illustrated below.

FIG. 9 shows a circuit for the therapeutical voltage generating part A according to the present invention.

In the circuit, AC power source E_0 is connected to terminals t_1 , t_2 of a primary winding L_1 of a transformer T. Secondary windings L_2 and L_3 are provided on the secondary side of the transformer T, which secondary windings are connected in series through rectifier S and protective resistor R. Condenser C is connected between terminals of the protective resistor R at a point P and terminal t_4 of the secondary winding L_2 .

In the circuit shown, the primary winding L_1 is connected to the AC power source E_0 . Thus, a DC voltage E_1 is produced between the point P and terminal t_4 and an AC voltage E_2 between the point P and terminal t_3 . Further between the terminal t_3 and terminal t_4 , there is produced superposed DC and AC voltages such as in the form of output voltage E_3 . Such voltages are shown in the waveforms of FIG. 10 and incorporated in the apparatus of FIG. 11 for practical treatment. In FIG. 11, one terminal t_3 of the therapeutical voltage generating part A as shown in FIG. 9 is connected to the electrode 1 depended by insulative material 2 from the ceiling 3 of the therapeutical electrical field forming part B with other terminal t_4 connected to a conducting plate 4 which is earthed 5.

The human body M which is applied the therapeutical treatment is laid on the conducting plate 4. A commercial power source is connected to the terminals t_1 and t_2 . The output voltage E_3 as shown in FIGS. 9 and 10 is applied between the electrode 1 and conducting plate 4 to apply electric field E_x to the human body M which is to be therapeutically treated.

FIG. 12 illustrates a modified embodiment of the apparatus, in which the electrode 1 is mounted on an insulated table 6 supported by the insulative material 2. The human body is directly laid on the insulating table 6. Above and in opposite to the electrode 1 is provided the conducting plate 4 which is earthed 5.

In this embodiment, it will be noted that the connection of the rectifier S is provided in opposite direction to that shown in the circuit of FIG. 9. In the same embodiment, the waveform of the voltage applied to the electrode 1 takes the waveform of the voltage E_3 as shown in FIG. 13. Thus, the electric field E_x may act on the human body M similarly as shown in FIG. 11. If the insulative material 2 is extended and the conductor plate 4 above the body is moved close to the electrode 1, the electric field E_x may act more effectively on the human body M, although there is produced an electric field beneath the insulating table 6.

FIG. 14 is an embodiment showing the circuit of the present invention. In the embodiment, the DC voltage and AC voltage are separately provided as being adjustable of output voltages. An autotransformer T_1 for adjusting DC output voltage and an autotransformer T_2 for adjusting AC output voltage are provided, these autotransformers having respectively switches SW_1 , SW_2 and pilot lamps PL_1 , PL_2 on the input side and transformers T_3 , T_4 on the output side. The rectifier S is of the full-wave rectifier type which is connected to terminals of a smoothing condenser C_s through a polarity changing switch SW_3 . R_1 , R_2 designate protective resistors and t_3 , t_4 output terminals.

In the construction as above described, the autotransformers T_1 , T_2 is preferably adjustable to select the mixture ratios of the DC voltage E_1 and AC voltage E_2 or otherwise the polarity of the DC voltage may be preferably determined so as to apply the most suitable

therapeutical treatment to the condition of sickness of the human body.

FIG. 15 shows the basic data obtained from experimental tests for the therapeutical treatment by changing polarity of DC voltage. In the instant case, a flicker value measuring device was used in order to affirm the effect of the therapeutical treatment. The flicker value measuring device is provided for the application of flicker light to the human body, which device would vary the frequency of flicker light so as to measure the frequency of threshold value ranging from sensing to non-sensing points of the flicker light to detect the degree of fatigue in the nerve center.

In FIG. 15, the Curve I shows the variation of the flicker value relative to time where a voltage is not applied when stimulation is not imparted to the human body. Curve II represents the variation of flicker values when superposed voltages of AC 500 V (peak value) and DC-500 V are applied and Curve III the variation of flicker values when superposed voltages of AC 500 V and DC +500 V are applied.

From these curves, it is seen that superposed voltages of AC voltage and negative DC voltage maintain the excitement of body organs and superposed voltages of AC and positive DC voltage rapidly lower the excitement of body organs to properly reduce the stress of organs. The same effect was available by applying a voltage between 100 V to 3,000 V in addition to the case of 500 V as above described.

Difference in the therapeutical effect due to variation in the mixture ratio of a DC voltage and an AC voltage is shown in FIG. 16.

In the diagram, variations of flicker values relative to time are respectively shown, in which Curve I represents a DC voltage -15KV containing AC voltage 8.3 %; Curve II a DC voltage -15KV containing AC voltage 64.2 %, and in the similar way, Curve I' represents a DC voltage +15KV containing an AC voltage 6.6 % and Curve II' a DC voltage +15KV containing an AC voltage 25.1 %.

These curves suggest that the DC voltage -15KV containing a relatively high percentage of AC voltage components can achieve a promotional effect in a very short period of time and enhance the excitement of visual organs of the human body, while the DC voltage +15KV containing a relatively high percentage of AC voltage components rapidly results the limitation of excitement.

Thus, according to the apparatus of the superposed DC-AC voltage system of the invention, the apparatus does not produce any danger to the human body as has been usual in the conventional therapeutical treatment in use of an AC high voltage nor producing electrostatic reaction but instead enables an effective therapeutical treatment by means of a very low voltage.

What is claimed is:

1. A therapeutic treatment apparatus utilizing superimposed DC and AC voltages, said apparatus comprising: therapeutic voltage generating means for generating an output comprising superimposed DC and AC voltages, means for producing a therapeutic electric field including first and second parallel opposed electrodes, and means for connecting the output of said therapeutic voltage generating means to said electrodes, said therapeutic voltage generating means including transformer means comprising a primary winding adapted to be connected to an AC power source,

and first and second secondary windings, one of said secondary windings forming an AC generating circuit, a rectifier means, means for connecting said rectifier means to the other of said secondary windings so as to form a DC generating circuit, and means for connecting said DC generating circuit to said AC generating circuit in a mutually superimposed relationship to therapeutic voltage terminals so that an output comprising superimposed DC and AC voltages is presented at said terminals, said therapeutic voltage terminals being connected respectively to said opposed electrodes of said therapeutic electric field producing means and one of said electrodes being adapted to be connected to the subject for therapeutic treatment, the AC voltage presented at said terminals being a low AC voltage as compared to the AC voltage used in conventional therapeutic treatment apparatus.

2. Apparatus as claimed in claim 1 wherein one of said electrodes is adapted to be mounted on an insulator on a ceiling and the other of said electrodes is adapted to be in contact with the subject for therapeutic treatment.

3. Apparatus as claimed in claim 1 wherein the electrode which is adapted to be in contact with the subject

is mounted on an insulated table, the other of said electrodes being disposed above and in opposed relationship to the first mentioned electrode, said apparatus further including means for grounding said further electrode and said voltage generating means.

4. Apparatus as claimed in claim 1 wherein said electrodes comprise spaced parallel plates.

5. Apparatus as claimed in claim 1 wherein said transformer means comprises first and second transformers, said primary winding and said first secondary winding forming the primary and secondary windings of said first transformer and a further primary winding and said secondary winding forming the primary and secondary windings of said second transformer, each of said transformers including an auto-transformer on the primary side thereof and one of said transformers including, on the secondary side thereof, connected in the secondary circuit with said rectifier means, a protective resistor, a condenser connected across said rectifier means, and a polarity reversing switch connected to the output of said rectifier means, the secondary side of said first transformer being connected in series with the secondary side of said second transformer.

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