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METHOD AND APPARATUS FOR TREATMENT OF THE DEAFNESS. CAUSED
BY DISEASES OF THE MIDDLE AND INTERNAL EAR
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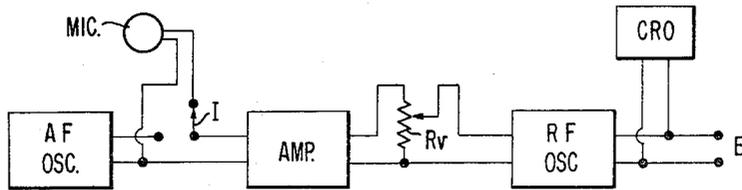


FIG. 1

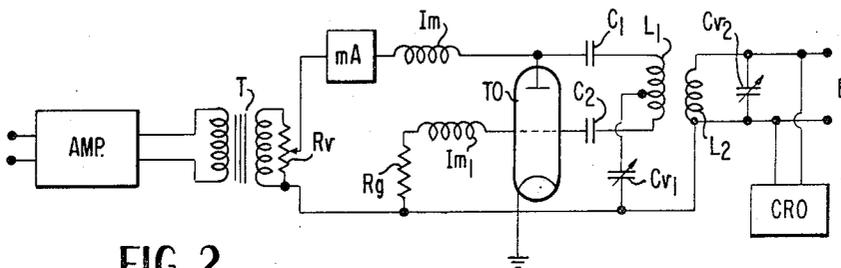


FIG. 2

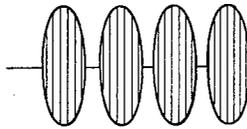


FIG. 3

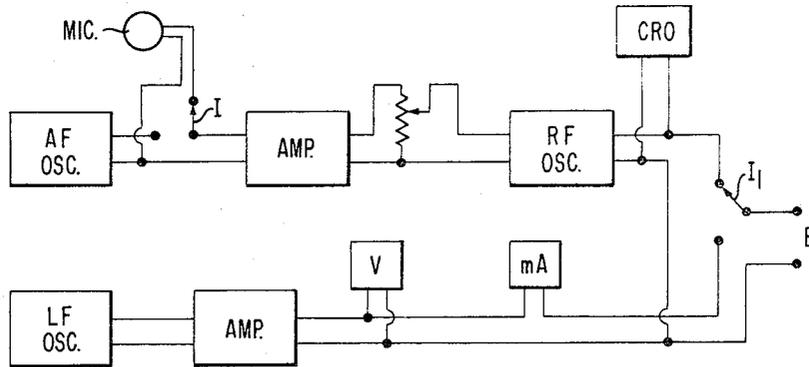


FIG. 4

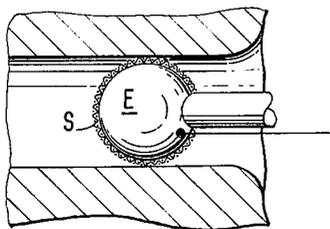


FIG. 5

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METHOD AND APPARATUS FOR TREATMENT OF THE DEAFNESS, CAUSED BY DISEASES OF THE MIDDLE AND INTERNAL EAR

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8 Claims. (Cl. 128-422)

The present invention relates to method and apparatus for generating pulsating waves of particular characteristics, said waves permitting treatment of the deafness caused by diseases of the middle and internal ear and which produce a total or partial lack of sensitivity of the auditory nerve.

In a modification of the invention, the apparatus is associated with a low-frequency wave generator in order to permit completing or alternating the treatment based on the aforesaid pulsating waves, by a treatment carried out by using low frequency alternating current, more particularly adapted to cure neuroses or neuritides of the auditory nerve which often accompany or cause deafness.

It is well known that until now, no means were known for the treatment of such deafness when it results from an inactivity of the sensorial receptors or of the auditory nerve. A slight gain in auditory sensitivity has been attained by the application of medical treatment on the administration of vitamin preparations. In other forms of deafness, due to alterations of the middle ear, improvements were obtained through treatments, based on tubal insufflations, with air passages and, in the specific case of otosclerosis, through surgical operations, such as those of Lempert, of Rosen, etc.

On the contrary, in the case of diseases affecting the sensorial receptors and auditory nerve, no practical result has so far been obtained by other clinical procedures, nor has anyone thought of possible cures based on physical treatments. By a number of tests I have ascertained that pulsating currents consisting in pulse type, special shape radio waves have a high therapeutic activity on the sensorial receptors and nerve terminals, wherefore, by applying such currents daily for a short time, the auditory sensitivity of the patient is improved and very often even a complete recovery reached.

The apparatus according to this invention permits obtaining said particular type of current.

The accompanying drawing represents merely by way of example, an embodiment of my invention.

In the drawing:

FIG. 1 shows a block diagram of the apparatus according to my invention;

FIG. 2 shows, on a larger scale, the detail of the radio-frequency oscillator forming the main part of the apparatus;

FIG. 3 shows the form of the radio waves at the output end of the apparatus;

FIG. 4 diagrammatically shows the circuit of the apparatus when associated with a device for generating low frequency waves; and

FIG. 5 is an enlarged fragmentary cross-sectional view of one of the electrodes in place in the ear.

Referring now to FIG. 1, the apparatus comprises an audio-frequency oscillator AF OSC., which could also consist in a common microphone MIC., capable of supplying in an equivalent manner an audio frequency modulation, the two-position switch I permitting connecting to the modulation amplifier AMP. to either said microphone MIC. or the oscillator AF OSC., the latter not being further illustrated since it is of a conventional type. The amplifier AMP. is a known type power amplifier as-

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sociated with an impedance transformer T provided for the control of the impedance (FIG. 2).

Between the modulation amplifier AMP, and an oscillator RF OSC. is arranged a variable resistor R_v , which permits modifying the output of the apparatus according to the sensory characteristics of the patient.

The device RF OSC. consists of a radio frequency oscillator comprising a radio frequency thermionic oscillator TO, whose anode is fed by an audio-frequency alternating current derived from the secondary winding of the transformer T, while into the feeding circuit a radio frequency or blocking impedance I_m is inserted.

Another blocking impedance I_m , and a resistor R_g are inserted into the grid circuit. At C_1 and C_2 are indicated two feedback coupling capacitors, at CV_1 a variable balancing capacitor, and at L_1 and L_2 the coils of a second radio frequency transformer. Across the circuit connected to the secondary coil L_2 is inserted a variable or tuning condenser CV_2 and a cathode ray oscilloscope CRO. Therefore, as the anode of the apparatus RE OSC. is fed with audio frequency alternating current, at the output electrodes E a pulse type wave is formed having the form indicated in FIG. 3. In this wave the positive half waves are equal and symmetric with respect to the negative half waves and each wave is spaced apart from the successive wave by a value not surpassing the maximum breadth of the wave, as measured along the horizontal, while the amplitude in the vertical direction is such as to yield an output power of say the order of 50 watts.

It is obvious that any other equivalent electronic device capable of producing waves of the aforesaid characteristics may identically be used for the said purpose. The present apparatus operates as follows: when switch L is placed in the position indicated in FIG. 1, the apparatus AF OSC. drives the amplifier AMP. which in turn feeds the apparatus RF OSC. which produces at the electrodes E pulsating waves of the above mentioned characteristics.

These electrodes E are applied correspondingly to the external auditory canal, as shown in FIG. 5, or to such parts of the head that the electric field generated encompasses the cochlea. The wave form is displayed by the oscilloscope CRO which is of the conventional type.

The electrodes E consist in spherical metal heads of approximately 8-14 mm. diameter and may be placed directly in contact with the skin surface or may be insulated therefrom by means of an electrically insulating sheet S. In the embodiment shown in FIG. 4, the aforesaid apparatus is associated with a conventional device adapted to produce low frequency alternating currents. Said second apparatus comprises a low frequency oscillator LI OSC. connected to an amplifier AMP.

Said second apparatus is controlled manually by the operator in response to the readings which the operator obtains visually from a voltmeter V and a milliammeter ma. The switch II permits connecting the electrodes I with either apparatus.

By means of this assembly, in addition to the treatment based on the application of pulsating radio wave and forming the subject matter of the present invention also an auxiliary or collateral treatment may be carried out using low frequency alternating current. In order to perform these auxiliary treatments, the electrodes E will be applied to appropriate areas of the head, and thus cures of neuroses and neuritides of the auditory nerve can be effected. Since such forms of neuroses and neuritides are very frequent causes of deafness, it is advantageous to be able to have a centralized assembly available, which permits carrying out both treatments.

What I claim is:

1. An apparatus for generating pulsating radio fre

quency waves for the improvement of the hearing capability of human patients having afflictions of the middle and internal ear, comprising: an audio frequency oscillator; a power amplifier electrically connected to said oscillator; a transformer, said transformer having a primary coil and a secondary coil, said primary coil electrically connected to said amplifier; a radio frequency oscillator, said radio frequency oscillator including a radio frequency thermionic oscillator and said secondary coil electrically connected to said radio frequency oscillator; a cathode ray oscilloscope electrically connected to the output of said radio frequency oscillator to give a visual indication of the wave form of the output of said radio frequency oscillator; two electrodes electrically connected to said output of said radio frequency oscillator, said electrodes having a spherical configuration and a diameter adapted to fit the external auditory canal of human patients; and, said audio frequency oscillator, said power amplifier, said transformer, and said radio frequency oscillator so correlated as to produce at said electrodes pulsating radio frequency waves having positive half waves equal and symmetrical to the corresponding negative half waves and each wave is substantially spaced from the successive wave by a breadth not greater than the breadth of each individual wave.

2. An apparatus for generating pulsating radio frequency waves for the improvement of the hearing capability of human patients having afflictions of the middle and internal ear, comprising: a microphone; a power amplifier electrically connected to said microphone; a transformer, said transformer having a primary coil and a secondary coil, said primary coil electrically connected to said amplifier; a radio frequency oscillator, said radio frequency oscillator including a radio frequency thermionic oscillator and said secondary coil electrically connected to said radio frequency oscillator; a cathode ray oscilloscope electrically connected to the output of said radio frequency oscillator to give a visual indication of the wave form of the output of said radio frequency oscillator; two electrodes electrically connected to said output of said radio frequency oscillator, said electrodes having a spherical configuration and a diameter adapted to fit the external auditory canal of human patients; and, said microphone, said power amplifier, said transformer, and said radio frequency oscillator so correlated as to produce at said electrodes pulsating radio frequency waves having positive half waves equal and symmetrical to the corresponding negative half waves and each wave is substantially spaced from the successive wave by a breadth not greater than the breadth of each individual wave.

3. An apparatus for generating pulsating radio frequency waves for the improvement of the hearing capability of human patients having afflictions of the middle and internal ear, comprising: an audio frequency oscillator; a power amplifier electrically connected to said oscillator; a transformer, said transformer having a primary coil and a secondary coil, said primary coil electrically connected to said amplifier; a variable resistor, said resistor electrically connected to said secondary coil to permit the variance of the power output thereof; a radio frequency oscillator, said radio frequency oscillator including a radio frequency thermionic oscillator, and said variable resistor electrically connected to said radio frequency oscillator; a cathode ray oscilloscope electrically connected to the output of said radio frequency oscillator to give a visual indication of the wave form of the output of said radio frequency oscillator; two electrodes electrically connected to said output of said radio frequency oscillator, said electrodes having a spherical configuration and a diameter adapted to fit the external auditory canal of human patients; said audio frequency oscillator, said power amplifier, said transformer, said resistor, and said radio frequency oscillator so correlated to produce at said electrodes pulsating radio frequency

waves having positive half waves equal and symmetrical to the corresponding negative half waves and each wave is substantially spaced from the successive wave by a breadth not greater than the breadth of each individual wave; and wherein said variable resistor permits an operator of said apparatus to watch said oscilloscope and to adjust the power of said pulsating radio waves at said electrodes to the auditory sensory characteristics of a human patient.

4. An apparatus for generating pulsating radio frequency waves for the improvement of the hearing capability of human patients having afflictions of the middle and internal ear, comprising: a microphone; a power amplifier electrically connected to said microphone; a transformer, said transformer having a primary coil and a secondary coil, said primary coil electrically connected to said amplifier; a variable resistor, said resistor electrically connected to said secondary coil to permit the variance of the power output thereof; a radio frequency oscillator, said radio frequency oscillator including a radio frequency thermionic oscillator, and said variable resistor electrically connected to said radio frequency oscillator; a cathode ray oscilloscope electrically connected to the output of said radio frequency oscillator to give a visual indication of the wave form of the output of said radio frequency oscillator; two electrodes electrically connected to said output of said radio frequency oscillator, said electrodes having a spherical configuration and a diameter adapted to fit the external auditory canal of human patients; said microphone, said power amplifier, said transformer, said resistor, and said radio frequency oscillator so correlated as to produce at said electrodes pulsating radio frequency waves having positive half waves equal and symmetrical to the corresponding negative half waves and each wave is substantially spaced from the successive wave by a breadth not greater than the breadth of each individual wave; and wherein said variable resistor permits an operator of said apparatus to watch said oscilloscope and to adjust the power of said pulsating radio waves at said electrodes to the auditory sensory characteristics of a human patient.

5. The method of the treatment of human patients having afflictions of the middle and internal ear, comprising: providing an electronic circuit capable of producing pulsating radio frequency waves having positive half waves equal and symmetrical to the corresponding negative half waves and each wave is substantially spaced from the successive wave by a breadth not greater than the breadth of each individual wave; connecting said electronic circuit to two conducting electrodes having dimensions and configurations adapted for direct placement on the external auditory canal of human patients; placing said electrodes in direct contact with each of the two external auditory canals of a human patient, and administering said pulsating waves for a short period at daily intervals, whereby the acoustic sensitivity of said patient is improved.

6. The method for the treatment of human patients having afflictions of the middle and internal ear, comprising: providing an electronic circuit capable of producing pulsating radio frequency waves having positive half waves equal and symmetrical to the corresponding negative half waves and each wave is substantially spaced from the successive wave by a breadth not greater than the breadth of each individual wave; connecting said electronic circuit to two conducting electrodes having dimensions and configurations adapted for direct placement on the external auditory canal of human patients; providing electrically insulating sheet material; placing said insulating sheet material in direct contact with each of the two external auditory canals of a human patient; placing said electrodes in direct contact with a portion of said insulating sheet material that is in said direct contact with the patient, and administering said pulsating waves for a short period at daily intervals, whereby the acoustic sensitivity of said patient is improved,

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7. The method for the treatment of human patients having afflictions of the middle and internal ear, comprising: providing an electronic circuit capable of producing pulsating radio frequency waves having positive half waves equal and symmetrical to the corresponding negative half waves and each wave is substantially spaced from the successive wave by a breadth not greater than the breadth of each individual wave; connecting said electronic circuit to two conducting electrodes having dimensions and configurations adapted for direct placement on the external auditory canal of human patients; providing an oscilloscope connected to give a visual indication of said pulsating waves at said electrodes and a variable power control resistor in said circuit; placing said electrodes in direct contact with each of the two external auditory canals of a human patient; administering said pulsating waves for a short period at daily intervals, and at all times controlling the power of said pulsating waves at said electrodes by said variable resistor to correlate the power of said waves to the auditory sensory characteristics of said patient, whereby the acoustic sensitivity of said patient is improved.

8. The method for the treatment of human patients having afflictions of the middle and internal ear, comprising: providing an electronic circuit capable of producing pulsating radio frequency waves having positive half waves equal and symmetrical to the corresponding negative half waves and each wave is substantially spaced from the successive wave by a breadth not greater than

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that breadth of each individual wave; connecting said electronic circuit to two conducting electrodes having dimensions and configurations adapted for direct placement on the external auditory canal of human patients providing an oscilloscope connected to give a visual indication of said pulsating waves at said electrodes and a variable power control resistor in said circuit; providing electrically insulating sheet material; placing said insulating sheet material in direct contact with each of the two external auditory canals of a human patient; placing said electrodes in direct contact with a portion of said insulating sheet material that is in said direct contact with the patient; administering said pulsating waves for a short period at daily intervals, and at all times controlling the power of said pulsating waves at said electrodes by said variable resistor to correlate the power of said waves to the auditory sensory characteristics of said patient, where by the acoustic sensitivity of said patient is improved.

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