

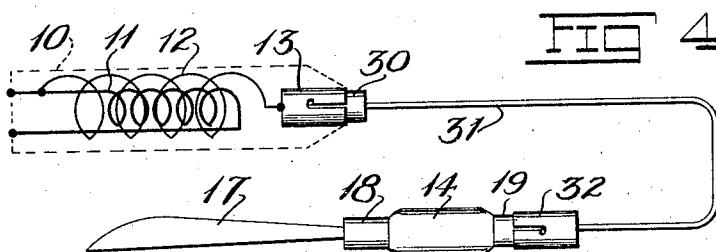
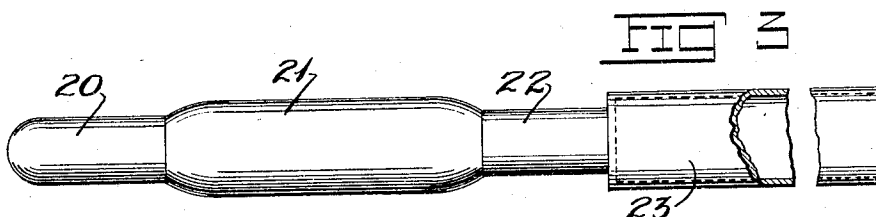
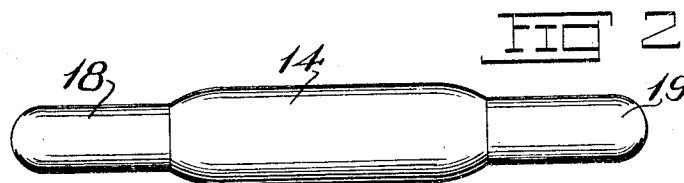
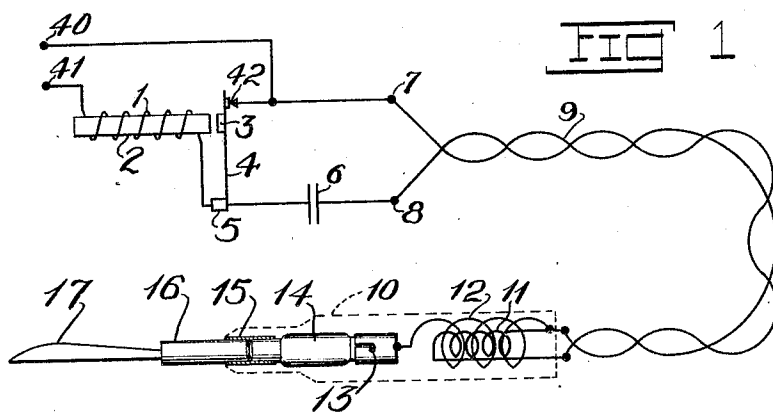
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ELECTROTHERAPEUTICAL DEVICE

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ELECTROTHERAPEUTICAL DEVICE

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My invention relates in general to electrotherapeutic devices and pertains specifically to that class of such devices which employ high frequency currents and the effects produced thereby as the curative agents.

My invention while applicable for use with any type of medical high frequency generator, as will hereinafter be pointed out, is perhaps more adapted for use with those types of high frequency generators which produce non-continuous or damped wave trains of oscillating electrical high frequency energy. In such devices the intermittent charging and discharging of the condenser produces a wide band of frequencies some of which have a periodicity so low as to cause extremely disagreeable physiological effects, such as involuntary contraction of the muscles and sensation of shock which, while not normally injurious, produce fear or other undesirable psychological reaction in the patient and militate against achieving the most beneficial results of the high frequency currents which do not in themselves cause such undesirable reactions. This prejudicial effect is of particular disadvantage when metallic electrodes or applicators are used or when, as contemplated by my invention, surgical instruments are attached to or connected with the high frequency source to obtain during surgical operations the advantages of the coagulation and antiseptic effects produced by the high frequency currents.

By my invention I provide simple and novel means for screening out these undesirable relatively low frequencies and thus permit of the use of metal electrodes or applicators to obtain most intimate contact with the body of the patient and thereby realize the benefits of such contact without producing shocks or involuntary contraction of the muscles and also permit of the use of the high frequency currents in connection with surgical instruments to obtain the benefits of such currents during surgical operations without the undesirable reactions.

One of the principal objects of my invention comprises introducing between the source of high frequency energy and the applicator or the surgical instrument as the

case may be a screening device comprising an envelope, preferably of vitreous insulating material and partially or wholly exhausted of gas or air, which effectively differentiates between the high and low frequencies by taking advantage of the fact that the low frequency currents are at low pressure or voltage while the high frequency currents are at very high voltage. The screen thus functions as a very high impedance, almost an insulator, to the passage of low frequency, low voltage currents, but as a negligible impedance to the passage therethrough of high frequency, high voltage currents. It further functions as a safety means preventing dangerous current surges due to accidents to the power transmission lines or transformers from reaching and injuring or possibly killing the patient as such currents are almost invariably of a lower frequency and voltage than the desired high frequency, high voltage currents.

A further object of my invention comprises providing a means whereby surgical instruments may be connected to such high frequency generators to obtain the advantages during surgical operations of the coagulating and antiseptic effect of high frequency currents without subjecting the patient to the undesirable and possibly injurious effects produced by the low frequency currents. In such use it will be obvious that any frequencies which produce involuntary contraction of the muscles or sensation of shock are particularly objectionable.

My invention will be more easily understood by referring to the drawings which accompany and form a part of this specification and in which like reference numerals designate corresponding parts throughout.

In the drawings:

Fig. 1 illustrates diagrammatically the circuits and apparatus of a common type of medical high frequency generator embodying my invention.

Fig. 2 is an elevation of the "screen" of my invention.

Fig. 3 is an elevation, partially sectioned, of another embodiment of my invention.

Fig. 4 illustrates diagrammatically a por-

tion of the high frequency circuit and an alternative embodiment of my invention used therewith.

Referring now particularly to Fig. 1, I employ an electromagnet comprising a core of soft iron wire 2 upon which is wound a winding of insulated wire 1. There is provided for this electromagnet a rheotome comprising the vibrating spring member 4 and armature 3. The vibrating member is secured to a fixed support 5 and adapted to make contact with an adjustable contact member 42. One terminal of the winding 1 is connected to the rheotome support 5, while the other terminal is connected to a binding post 41. The adjustable contact 42 is connected to a binding post 40. These binding posts are intended to be connected to any convenient source of commercial current supply either direct or alternating. The action of the electromagnet in rapidly vibrating the rheotome is well known and needs no further explanation.

There is provided also a static transformer comprising the primary winding 11 and secondary winding 12. The primary winding 11 is connected through a pair of flexible conductors 9 with binding posts 7—8. Binding post 7 is connected to adjustable contact 42, while binding post 8 is connected through condenser 6 with rheotome support 5. The secondary 12 is connected through one terminal with a terminal of the primary 11 while the remaining terminal of the secondary is connected to a metal socket 13 adapted to receive an electrode or applicator such as is commonly used with high frequency generators of this type. The static transformer 11—12 and electrode socket 13 are usually contained in an insulating handle 10 shown in dotted lines.

One form of my invention comprises inserting in the socket 13 a tubular glass member such as is shown in Fig. 2. This member which I term a screen, comprises a hollow tube of glass 14 or other vitreous insulating material from which the air or gas is exhausted or partially exhausted and provided with metal ferrules on each extremity as 18 and 19. One of these ferrules is adapted to fit in the socket 13, while the other ferrule is adapted to receive a collar 15 to form a connector or socket for a surgical instrument as 17. This surgical instrument may be a scalpel as indicated provided with a metal shank 16 to fit in the socket 15.

It will be observed that as electromagnet 1—2 rapidly vibrates the rheotome condenser 6 will be alternately charged and discharged at a high rate of speed. Further as the condenser discharge takes place through a path of low resistance and reactance the discharge is oscillatory at an extremely high frequency, and through the action of the static transformer 11—12 the voltage of the current is

enormously amplified and it is manifest at the socket 13 of the secondary 12 as an oscillatory current of extremely high voltage and one containing a wide band of frequencies varying from the relatively low frequencies produced by the action of the rheotome to the very high frequencies produced by the oscillatory discharge of the condenser. It has been common practice hitherto to screen out the lower undesired frequencies by introducing into the socket 13 a hollow applicator made of glass, the interior of which has been wholly or partially exhausted of gas. It is often, however, desired to employ a metal electrode inserted in socket 13 and have the patient hold this in his hand while the operator massages the affected portions of the patient's body to draw the current to the desired location. This method of treatment while very effective, permits the passage through the patient's body of the undesired low frequencies produced by the action of the rheotome because the patient is directly connected by metallic conductors therewith. My invention is directed toward the features of introducing always between the patient and the source of current a vacuum screen which functions as a very high impedance to the passage of the relatively low frequencies because of their relatively low voltage and as practically a negligible impedance to the passage of the high voltage and desirable high frequencies. It will be obvious therefore that by the use of the vacuum screen 14 either vacuum tube applicators or metallic applicators may be used and the undesirable low frequencies may be screened from the patient; further, metallic surgical instruments may be employed and the benefits derived from high frequency currents utilized in conjunction with surgical operations without occasioning discomfort or injury to the patient due to the presence of undesirable low frequencies.

In Fig. 3 I have illustrated my invention as applied to a common type of metallic electrode. In this embodiment of my invention the metallic electrode consists of a hollow metal handle 23, provided with a metal shank 22 which is united to the exhausted vitreous envelope 21, the other extremity of which is provided with a metal ferrule 20 for insertion in the socket 13.

In Fig. 4, I have illustrated a still further embodiment of my device in which there is provided an extension conductor 31 which may be heavily insulated and provided with a metal terminal 30 adapted to fit into and make contact with socket 13 contained in the handle 10. The other extremity of the conductor 31 is provided with an additional metal socket 32 adapted to receive a surgical instrument comprising the cutting edge 17 and the vitreous exhausted envelope 14

united through ferrule 18 with the surgical instrument and provided with a metal ferrule 19 adapted to fit in the socket 32.

From the foregoing it will be obvious that my invention is especially applicable to those
5 types of high frequency generators which generate a wide margin of variant frequencies because it affords a simple and effective way of screening out all but the desired high frequencies and further furnishes a safe
10 means to permit of the use of these beneficial high frequencies in conjunction with surgical operations. It will be further obvious that the screen 14 also acts as a safety gap of high impedance to the low frequency, relatively
15 low voltage surges which occur due to accident to the commercial transmission lines or transformers as the screen in effect breaks the direct metallic connection between the patient and the power supply lines when metallic electrodes or applicators are used, or
20 when surgical instruments are attached to the applicator handle.

While I have illustrated and described but two embodiments of my invention, it is to be
25 clearly and distinctly understood that I may vary the details thereof widely without departing from the spirit of the invention as defined in the appended claims.

Having thus completely described my invention, what I claim is as follows:

1. An electrotherapeutical device comprising, means for producing a plurality of alternating currents of variant high frequencies from a commercial current, a member comprising a partially exhausted envelope of
35 vitreous material, a surgical instrument connected to said source of variant high frequency currents and means whereby said exhausted envelope is interposed electrically
40 between said surgical instrument and said source of high frequency currents.

2. An electrotherapeutical device comprising, means for producing a plurality of alternating currents of variant high frequencies
45 from a commercial current, an applicator for applying said currents to the human body, a member comprising a partially exhausted envelope of insulating material, said envelope electrically interposed between said
50 applicator and said source of variant high frequency currents.

3. An electrotherapeutical device comprising, means for producing a plurality of alternating currents of variant high frequencies
55 from a commercial current, an applicator for applying said currents to the human body, said applicator comprising a metallic portion for contact with the body and a partially exhausted portion of vitreous material
60 attached thereto and interposed between said metallic portion and said source of variant high frequency currents.