This invention relates to electric high-tension apparatus, particularly for medical purposes.

The present invention has for one of its objects to enable current impulses of high tension to be used under circumstances which enable the desired results to be obtained painlessly and without danger.

According to the invention there is provided electric high-tension apparatus, particularly for medical purposes comprising in combination means for supplying unidirectional high-tension current impulses, an electrode for application to the object, e.g. a person, to be treated, and means for preventing dangerous current strengths, which apparatus is characterized by the provision of means for preventing the appearance of irregular parasitic discharge phenomena, for the purpose of enabling the current impulses to be used safely and painlessly.

Preferably, a safety capacity is connected between the high-tension current-impulse generator and the said electrode, in which capacity irregular discharges are avoided by means of oil insulation.

Conveniently, the application surface of said electrode consists of insulating material.

When said safety capacity is provided, according to a feature of the invention the said electrode may be in the form of a vacuum electrode

Conveniently, the said electrode is of extended form for treating cavities and ducts of the body.

According to another feature of the invention a counter-electrode may be connected to earth or to the opposite pole of the apparatus.

For varying the effect of the electrode a variable capacity may be used, or, alternatively, its degree of vacuum may be varied.

According to yet another feature of the invention, the high-tension current-impulse generator may comprise a high-tension alternating-current transformer and a rectifying device in its secondary circuit, which generator is so arranged that the secondary current of the transformer can not exceed or reach a value that would be dangerous to the human organism.

Preferably, the generator aforesaid is adapted to supply current impulses of relatively low frequency.

Various embodiments of the invention which have proved to be satisfactory in practice are diagrammatically illustrated by way of example in the accompanying drawing, wherein:

Figure 1 is a diagram showing one form of apparatus according to the invention, in which the impulse generator is an induction coil.

Figure 2 shows a similar apparatus, but without the valve shown in Figure 1, and further a modified form of apparatus designed to ensure the safety of the patient.

Like reference characters designate like parts throughout the several views.

Referring first to Figure 1, the numeral 1 denotes a so-called turbine interrupter, 2 is the primary winding of an induction coil, 3 the secondary winding, 4 a glass plate condenser with oil insulation and of high capacity, 5 a like condenser of lower capacity (a few 100 cm.), 6 a thermionic rectifying valve, and 7 a so-called vacuum electrode.

An earth is indicated at 8, and 9 designates a protective spark-gap. The numeral 10 denotes an electrostatic indicating instrument, while 11 and 12 are the terminals for connection to a source of current. In Figure 3, the numeral 13 denotes a regulator, e.g. a variable resistance.

When employing an apparatus of the described combination of parts, in which there were about 50 interruptions per second and the spark-gap was set to about 3 cm. and did not operate, the electrostatic indicating instrument 10 showed about 30,000 volts, and this has been found to be a suitable operating condition for one type of treatment. In some instances, such treatments have met with success in reduction of gouty nodes and tumors.

The treatment with such an electrode can also be used e.g. for general disinfecting purposes, particularly in connection with a counter-electrode connected to the opposite pole.

The apparatus in Figure 2 comprises a metallic electrode 1 having a glass covering.

When using the apparatus shown in Figure 3 the safety of the patient is assured in that the maximum value of the primary current is limited; the unidirectional action is obtained in this embodiment of the invention by means of a diode rectifying valve 6.

For varying the effect of the apparatus variable capacities may be employed in the high-tension current-impulse circuit, or in the case of a vacuum electrode for application to the patient a variable degree of vacuum may be used.

In the above described high-tension apparatus there may be inserted between the high-tension current-impulse generator and the electrode 1 to be applied to the patient a safety capacitance 5, in which irregular discharges are avoided by means of oil insulation.

The electrode 1 may have various shapes according to its use, and its outer surface may be made of insulating material. Further, it may be a so-called vacuum electrode.

Moreover, a counter-electrode connected to earth or to the opposite pole may be arranged in the secondary circuit. For varying the action of the electrodes themselves a variable capacity may be connected to them, or the vacuum of the electrodes themselves may be varied.

The high-tension current-impulse generator may comprise an alternating current transformer for supplying high tension current and a rectifying device in its secondary circuit, the entire apparatus then being of the vacuum type.
apparatus being so arranged that the secondary current of the transformer can not exceed a predetermined value that is safe for the human organism.

Tests have shown that when operating the apparatus described above with reference to Figure 1 under the circumstances referred to, an alternating current measuring instrument in the lead of the glass electrode showed a couple of milliampere, and a direct current measuring instrument showed a couple of microamperes. It is possible that the therapeutic results obtained depend on the frequency and on these intensities of current or on their relation to one another.

The high-tension current-impulse source or generator may be arranged to supply current impulses of relatively lower frequency.

Various modifications may be made in the details of construction and arrangement of parts described above without departing from the scope of the invention as defined by the claims.

1. Electric high-tension apparatus for medical purposes, comprising a generator of high tension low to medium frequency current impulses, an electrode connected to said generator for application to a person to be treated, means also in circuit for preventing irregular parasitic electrical discharges from the electrode, said generator comprising a transformer for supplying a high-tension alternating current and a rectifying device in the secondary circuit of said transformer for producing a rectified alternating current which is impressed across said electrode, and means for preventing the current in the transformer secondary circuit from exceeding a predetermined value that is safe to the person undergoing treatment.

2. Electric high-tension apparatus of the character described comprising in combination a generator of high-tension current-impulses of relatively low frequency, an electrode connected to said generator, for application to a person, means for rectifying the output from said generator, for producing rectified alternating current, means for impressing said rectified current on said electrode, means also in circuit for preventing impulses of dangerous intensity, and means for preventing irregular parasitic electrical discharges from said electrode.

3. Electric high-tension apparatus of the character described, comprising in combination, a generator of low to medium frequency current impulses of a tension of several thousand volts, an electrode connected to said generator for application to a person connected therewith, and means also in the circuit for preventing the occurrence of irregular parasitic electrical discharges from the electrode, said generator comprising a transformer for supplying a high-tension alternating current, a rectifying device in the secondary circuit of the transformer for producing partially rectified alternating current which is impressed on said electrode, and means for preventing secondary current impulses exceeding a predetermined value which is safe for the human organism.

ALFRED SCHMID.