Oct. 19, 1926. 1,603,339

H. HERRMANN

SYSTEM FOR UNIPOLAR HIGH FREQUENCY TREATMENT

Filed May 26, 1924

FIG. 1.

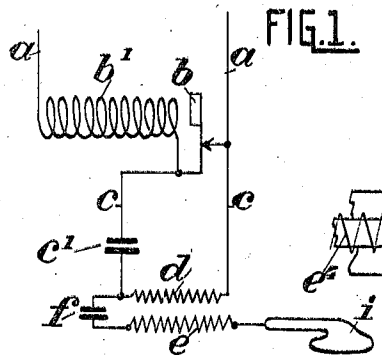
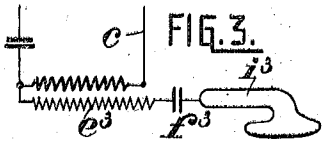


FIG. 3.



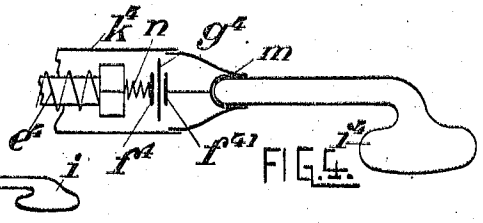
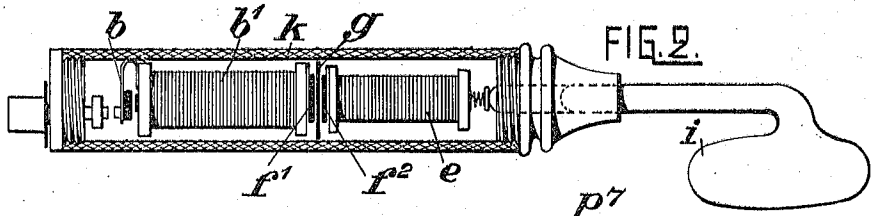


FIG. 4.

FIG. 2.



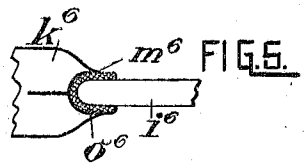


FIG. 5.

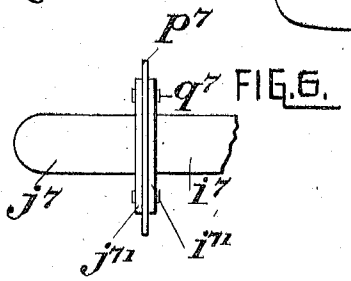


FIG. 6.

FIG. 7.

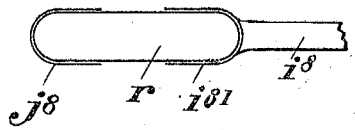


FIG. 8.

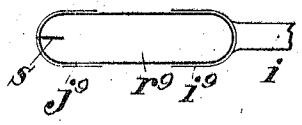


FIG. 9.

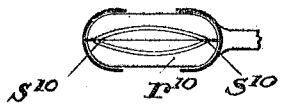


FIG. 10.

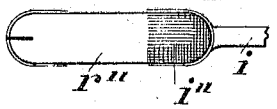
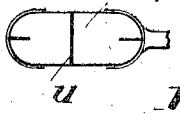


FIG. 11.

FIG. 12.



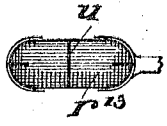


FIG. 13.

Inventor:
H. Herrmann
By
Marks & Clark
Attys.

Patented Oct. 19, 1926. 1,603,339

UNITED STATES PATENT OFFICE.

HEINRICH HERRMANN, OF BERLIN, GERMANY, ASSIGNOR TO ELECTRICITÄTSGESELLSCHAFT, "SANITAS" M. B. H., OF FRIEDRICHSTRASSE, BERLIN, GERMANY.

SYSTEM FOR UNIPOLAR HIGH-FREQUENCY TREATMENT.

Application filed May 26, 1924, Serial No. 716,057, and in Germany June 6, 1923.

My invention relates to improvements in unipolar high frequency electric therapeutical apparatus, and the object of the improvements is to provide an apparatus having means for protecting the patient against injury by electric current of the supply wires or primary circuit also when using a metallic electrode. With this object in view I provide a protective condenser intermediate the electrode and the primary circuit, which does not interfere with the transmission of the high frequency current, but reduces the primary current to zero or so far that it does not endanger the patient.

For the purpose of explaining the invention several examples embodying the same have been shown in the accompanying drawing in which the same reference characters have been used in all the views to indicate corresponding parts. In said drawing,

Fig. 1 is a diagrammatical view showing the electrical connections of the system,

Fig. 2 is an elevation partly in section showing the apparatus comprising the system shown in Fig. 1,

Fig. 3 is a diagrammatical view showing a modification of the system,

Fig. 4 is a diagrammatical view showing an apparatus comprising the system shown in Fig. 3,

Figs. 5 to 13 are diagrammatical views showing further modifications of the apparatus.

In the example shown in Figs. 1 and 2 to the supply wires a, a magnetic hammer interrupter comprising a coil b^1 and a spring contact b and a primary oscillation circuit c are connected. The circuit c includes the primary d of a transformer d, e and a condenser c^1. The electrode i is connected with the secondary or Tesla coil e of the transformer. So far the system is known in the art. In my improved system a condenser f is provided at the part where ordinarily the Telsa coil e connected to the free terminal of the electrode i is connected to the oscillation circuit, which condenser interrupts the conductor connecting the electrode and the oscillation circuit c or the net a, but brings the terminal of the Tesla coil to earth potential in the same way as is done by the conductive connection heretofore provided, so that the effect is in no way impaired.

In the construction of the apparatus including my improved system the transformer d and the magnetic hammer interrupter b, b^1 are disposed within a tubular member k providing a handle for operating the instrument, and the condenser g, f_1, f_2 is disposed between the magnet coil b^1 of the hammer break and the Tesla coil e. As shown the condenser comprises an insulating disk g and metal disks f^1 and f^2.

In the modification shown in Fig. 3 the general arrangement of the system is the same as has been described with reference to Figs. 1 and 2, but the condenser f^3 is disposed between the high potential terminal of the Tesla coil e^3 and the electrode i^3. Also in this case the condenser breaks the conductor connecting the electrode i^3 and the oscillation circuit c or the net, but it does not interfere with the transmission of the high frequency oscillations.

Fig. 4 shows an instrument including the system shown in Fig. 3. As shown one of the metal disks f^4 of the condenser provides the terminal of the Tesla coil e^4 and it is acted upon by a spring n forcing the same against a loosely mounted insulating plate g^4 and the latter against a metal disk f^{41} connected with a cap m providing a seat for the electrode i^4. The tubular casing or handle carrying the said parts has received the character k^4.

In the modification shown in Fig. 5 a metallic electrode i^6 is provided, and the terminal of the electrode seated in the cap m^6 of the handle k^6 is equipped with a cap o^6 of insulating material, which cap cooperates with the metal electrode provided thereon and the metal of the cap m^6 to form the condenser.

In the construction shown in Fig. 6 the condenser is provided between the electrode i^7 and a part j^7 designed to be passed into the cap of the handle. The parts i^7 and j^7 both consist of metal and they are made integral with flanges i^{71} and j^{71} respectively, which are separated from each other by an insulating disk p^7 of mica and are connected by dielectric parts q^7.

Fig. 7 shows a modification in which the electrode i^8 is equipped with a cap i^{81} receiving a vacuum tube r provided at its opposite end with a cap j^8. The tube r, its gas filling, and the caps i^{81} and j^8 act as a double condenser, the gas filling having the function of one of the metallic disks

of both condensers, and the other disks being provided by the caps i^{81} and j^8. The cap j^8 is seated in the cap of the handle, which is electrically connected with the high potential terminal of the Tesla coil enclosed within the handle.

If it is desired to dispense with one of the sections of the condenser, an electrode s is passed into the tube r^9 at one end thereof, as is shown in Fig. 8. In this case there is no material condenser action at this end of the tube, though there is a certain condenser action particularly if the electrode s is provided with a blunt end. Therefore in some cases both ends of the tube r^{10} may be provided with an electrode s^9, as is shown in Fig. 10. In this case the main action of the tube is not a condenser action but a spark discharge through the gas within the tube r^{10} which discharge, however, takes place through a high resistance depending on the relative distance and condition of the electrodes and the character and other conditions of the gas confined within the tube, so that the high pressure high frequency oscillations of the Tesla current can pass through the tube, while there is no passage of the current of the net a.

The effect of a condenser constructed according to Figs. 7 and 8 is improved by coating the tube internally with metal, which metal covers either the whole inner surface of the tube, or only the part of the surface corresponding to the caps i^{81} and j^7 of Fig. 8, or the part of the surface corresponding to the cap i^9 in Fig. 8. The coating may be in the form of a metal deposit, or of a filling of mercury, metal cuttings, or graphite.

Fig. 10 shows a tube r^{11} in which the metal deposit is provided only at the part of the inner surface which corresponds to the cap i^{11}, while in Fig. 11 the metal deposit covers the whole inner surface of the tube r^{12}, or the tube is entirely filled with mercury, graphite, or the like.

In Fig. 12 I have shown a modification which is similar to the one shown in Fig. 9, which, however, shows pure condenser action, a glass partition u being provided within the tube r^{13} at the middle thereof so that no current can pass through the tube, the partition providing the insulator of the condenser the metallic parts of which are represented by the gas confined within the chambers of the tube. Also in this case the walls of the chambers may be internally coated with metal, or the chambers may be filled with electric material such as mercury, metal cuttings, graphite, or the like as shown in Fig. 13.

When filling the tube shown in Fig. 9 with powdered graphite or the like, as has been indicated in Fig. 11 almost pure resistance action is produced. The same is the case, if instead of the tube a rod of a material of high ohmic resistance such as silit is provided in the system. In both cases the high frequency current has free passage through the resistance, probably by reason of condenser action of the parts composing the resistance.

While in describing the invention reference has been made to particular examples embodying the same I wish it to be understood that my invention is not limited to the construction shown in the drawing, and that various changes may be made in the general arrangement of the apparatus and the construction of its parts without departing from the invention.

I claim:

1. A system for unipolar high frequency treatment, comprising a primary oscillation circuit, a secondary oscillation circuit, a Tesla transformer having its primary and secondary respectively included in said circuits, a device connected with the high potential terminal of said secondary for receiving an electrode, and a protective condenser disposed between said device and the primary oscillation circuit.

2. A system for unipolar high frequency treatment, comprising a primary oscillation circuit, a secondary oscillation circuit, a Tesla transformer having its primary and secondary respectively included in said circuits, an electrode electrically connected to the high potential terminal of said secondary, and a protective condenser disposed between the electrode and the secondary of the transformer.

3. A system for unipolar high frequency treatment, comprising a primary oscillation circuit, a secondary oscillation circuit, a Tesla transformer having its primary and secondary respectively included in said circuits, a device connected to the high potential terminal of the secondary for receiving an electrode, and a protective condenser between said device and the secondary.

4. A system for unipolar high frequency treatment, comprising a primary oscillation circuit, a secondary oscillation circuit, a Tesla transformer having its primary and secondary respectively included in said circuits, a disk connected with the high potential terminal of the secondary, a disk connected with a member adapted to receive an electrode, and an insulating plate disposed between said disks, said disks and insulating plate forming a condenser.

5. A system for unipolar high frequency treatment, comprising a primary oscillation circuit, a secondary oscillation circuit, a Tesla transformer having its primary and secondary respectively included in said circuits, a disk connected with the high potential terminal of the secondary, a disk connected with a member adapted to receive an electrode, an insulating plate disposed be-

tween said disks, said disks and plate forming a condenser and a spring acting on one of said disks in a direction for forcing the same against said insulating plate.

6. A system for unipolar high frequency treatment, comprising a primary oscillation circuit, a secondary oscillation circuit, a Tesla transformer having its primary and secondary respectively included in said circuits, a disk connected with the high potential terminal of the secondary, a disk connected with a member adapted to receive an electrode, an insulating plate loosely disposed between said disks, said disks and plate forming a condenser and a spring acting on one of said disks in a direction for forcing the same against said insulating plate.

In testimony whereof I affix my signature.

HEINRICH HERRMANN.