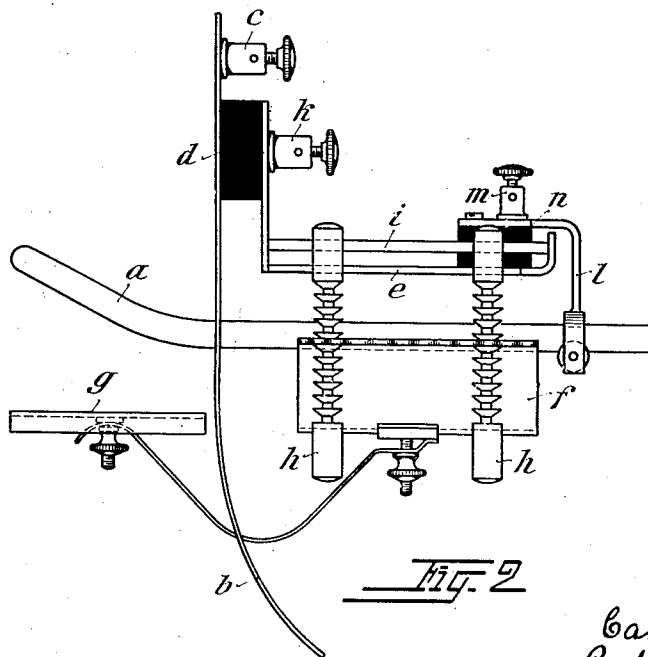
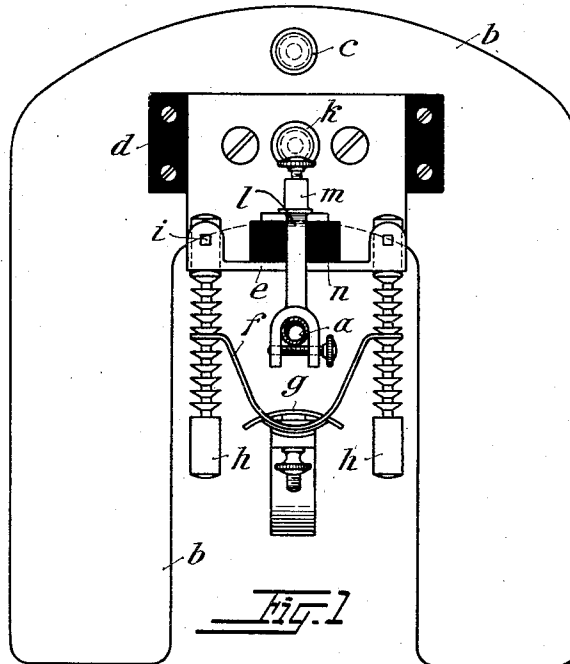


C. SANTOS & R. BOERNER.
ELECTROMEDICAL APPARATUS.
APPLICATION FILED APR. 24, 1914.

1,156,317.

Patented Oct. 12, 1915.
3 SHEETS—SHEET 1.



Witnesses
Marguerite Schauf
E. E. Swenson

Inventors:
Carlos Santos and
Rudolph Boerner
by *Amos W. M. O.*
Attorneys.

C. SANTOS & R. BOERNER.
ELECTROMEDICAL APPARATUS.
APPLICATION FILED APR. 24, 1914.

1,156,317.

Patented Oct. 12, 1915.
3 SHEETS—SHEET 2.

Fig. 2a

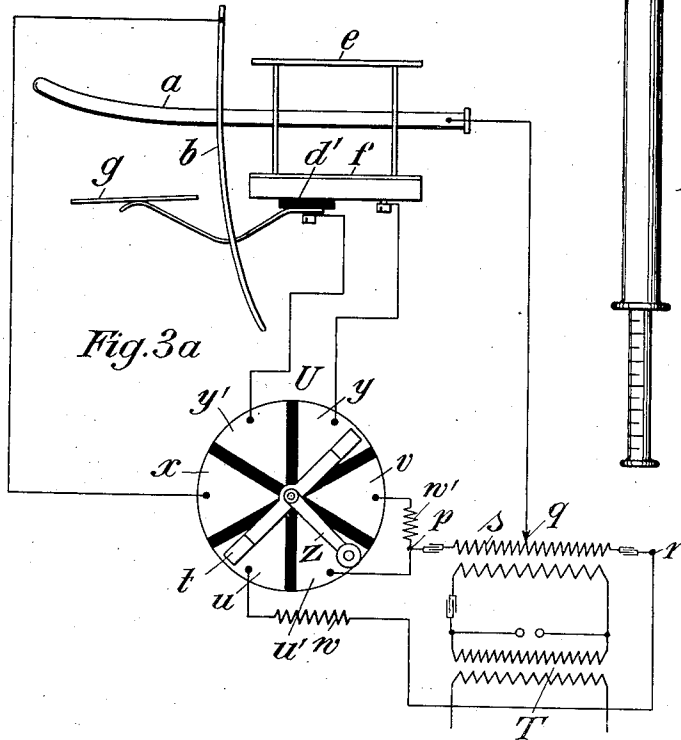
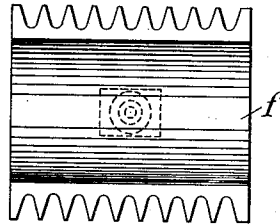
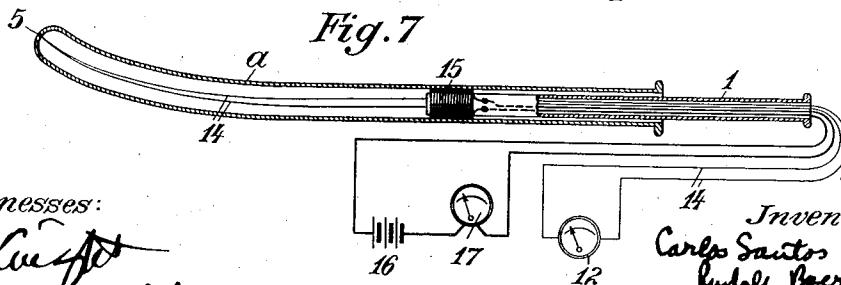


Fig. 6



Witnesses:
K. H. Kuebler
Marquerte Schaup

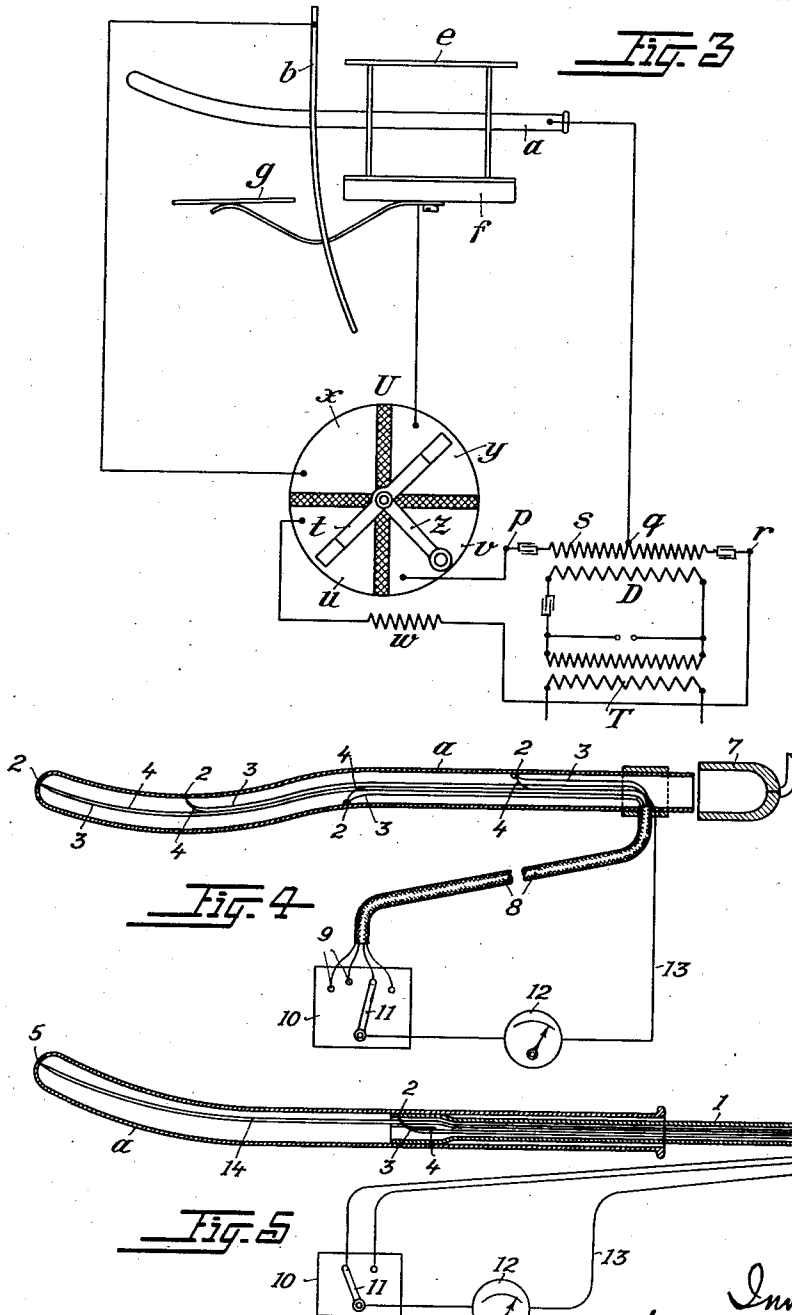
Inventors
Carlos Santos and
Rudolf Boerner
By their attorneys
Knight Bros

C. SANTOS & R. BOERNER.
ELECTROMEDICAL APPARATUS.
APPLICATION FILED APR. 24, 1914.

1,156,317.

Patented Oct. 12, 1915.

3 SHEETS—SHEET 3.



Witnesses:-
Marguerite Schauf
Olaf Swenson

Inventors
Carlos Santos & Rudolph
Boerner,
By *Frederick W. Brown*
Attorneys.

UNITED STATES PATENT OFFICE.

CARLOS SANTOS, OF LISSABON, PORTUGAL, AND RUDOLF BOERNER, OF BERLIN, GERMANY, ASSIGNORS TO SIEMENS & HALSKE A. G., OF SIEMENSSTADT, NEAR BERLIN, GERMANY, A CORPORATION OF GERMANY.

ELECTROMEDICAL APPARATUS.

1,156,317.

Specification of Letters Patent.

Patented Oct. 12, 1915.

Application filed April 24, 1914. Serial No. 834,279.

To all whom it may concern:

Be it known that we, CARLOS SANTOS, a Portuguese citizen, and resident of Lissabon, Portugal, and RUDOLF BOERNER, a German citizen, and resident of Berlin, Germany, have invented certain new and useful Improvements in Electromedical Apparatus, of which the following is a specification.

This invention relates to an electro-medical apparatus for treating diseases in cavities of the body by means of the diathermic method.

It is the principal object of our present invention to provide an apparatus for securing a uniform heating throughout the urethra or other cavities to be treated.

According to our invention, besides the effective electrode which is introduced into the cavity of the body, there are several indifferent electrodes employed. Preferably these electrodes are applied to two or more different oscillating circuits.

The electrode inserted into the cavity of the body and having a surface of such a size that the current flowing through it will heat the adjacent portions of the body, we will call "effective" electrode. The other electrodes having so large a surface that they do not effect any perceptible heating of the body portions adjacent to them, we will call "indifferent" electrodes. The indifferent electrodes only serve to give the currents passing the body certain directions. The different paths of current determined by the indifferent electrodes partly coincide with and partly cross each other. Thus, only certain portions of the inner surface of the cavity are heated.

In order to supervise the temperature at the different parts of the cavity and in order to regulate the current strength according to these temperatures, thermo-elements, resistance coils or the like are provided which are arranged at the proper places on or in the effective electrode and whose indications can be read individually. Also the arrangement may be made in such a manner that within the effective electrode a device for measuring the temperature is arranged in a manner to be displaceable, so that thereby the temperatures of the several parts of the cavity may be measured alone.

An apparatus for diathermic treatment according to our present invention is repre-

sented in the accompanying drawings, of which—

Figures 1 and 2 show such apparatus for the treatment of the urethra virilis, the two figures giving a front and a side view of the respective position of the several electrodes during the treatment. Fig. 2^a is a plan of one of the indifferent electrodes. Figs. 3 and 3^a are diagrams of two modes of the connections and Figs. 4 and 5 longitudinal sections of two forms of the effective electrode having an appliance for measuring the temperature. Fig. 6 shows a side view of the electrode according to Fig. 5. Fig. 7 is a longitudinal section of a modified form of the apparatus according to Fig. 5.

The effective electrode *a* which is introduced into the urethra may be of any desired catheter form and is made to coöperate with two indifferent electrodes. One of these electrodes *b* has the form of an apron and consists of a flexible metal sheet which during treatment is laid upon the thighs and the abdomen of the patient. The current of the diathermic apparatus is conveyed to the electrode *b* by means of a contact terminal *c*. Upon the electrode *b* a block *d* of hard rubber is mounted which carries the other indifferent electrode consisting of several metal sheets *e*, *f* and *g*, which are conductively connected with each other. The one of these electrode sheets *e* is rectangularly bent and fixed upon the block *d* in such a manner that it will present a plain surface facing the effective electrode *a*. The second sheet *f* is of a V-shaped cross-section and is carried by four bolts *h* which are adjustably mounted upon guide-rods *i*, said guide-rods being fixed upon the electrode sheet *e* and conductively connected herewith. As shown in Fig. 2^a the sheet *f* is provided at its rim with teeth adapted to fit into a number of notches at the bolts *h*, so that the sheet *f* may be adjusted in different distances to the sheet *e*. The two sheets *e* and *f* during treatment surround the organ and therewith the front part of the urethra.

For the rear part of the urethra a third metal sheet *g* is provided, which is resiliently fixed to the sheet *f*, said sheet *g* during treatment being laid against the perineum.

Current is conveyed to the three sheets *e*, *f* and *g*, which are conductively connected with each other, by means of a contact ter-

minal *k*. Furthermore at the electrode sheet *e* on a block *n* made from insulating material a holder *l* is provided for the effective electrode *a* which is positioned in the urethra, current being conveyed through said holder to said electrode *a* from the contact terminal *m*.

As can be seen from the diagram of Fig. 3, the secondary coil *s* of a diathermic apparatus D connected to a high voltage transformer T serve as a current source. The secondary coil *s* is connected in series with condensers, and these condensers are connected to the terminals *p* and *r*. The coil *s* is equipped with a tap leading to the terminal *q* serving to permanently connect the effective electrode *a*. The terminals *p* and *r*, however, are connected with two sectors *u* and *v* of a reversing switch U, a resistance *w* being inserted before said terminal *r*, while the sector *x* is connected to the indifferent electrode *b* and the sector *y* to the group of electrodes *e*, *f* and *g*. A contact clip *t*, which can be rotated by a crank *z*, permits to either connect the sectors *u*, *y* or *x*, *v* with each other, therewith inserting the electrode *b* or the group of electrodes *e*, *f* and *g* into the circuit of the parts of the coil belonging to these electrodes. If now, by means of the handle *z* the clip *t* is slowly rotated, the current of the effective electrode *a* will flow alternately to the indifferent electrode *b* or to the three other indifferent electrodes *e*, *f* and *g*. In this manner the current is caused to take its prescribed course with certainty in every case through the organ to be treated, thereby resulting in the desired uniform heating thereof.

The resistance *w* inserted into the circuit of the group of electrodes *e*, *f* and *g* serves for regulating the current strength in this circuit; in this manner one will be enabled to adjust on the one hand the current value in both circuits and consequently attain the desired temperatures by varying the coupling between primary and secondary coil of the diathermic apparatus and by regulating on the other hand said resistance *w*. The temperatures are measured at the several parts of the effective electrode *a*, for instance by means of thermo-elements as shown in Figs. 4 and 5 and more fully described below.

The apparatus may also be constructed in such a manner that more than two oscillating circuits are formed, for instance also the indifferent electrode *g* is advantageously arranged in an especial circuit in order to attain, if desired, a particularly intensive heating of the rear parts of the urethra.

Fig. 3^a diagrammatically shows the connections of such an apparatus. In this case the indifferent electrode *g* is fastened to a block *d'*, of insulating material, for instance hard rubber, which is provided on the un-

der side of the electrode *f*. The electrode *g* is conductively connected with a further sector *y'* of the reversing switch U. The corresponding sector *u'* is connected with the terminal *p* without inserting of a special resistance. If the contact clip *t* is connecting the two sectors *y'* and *u'* the indifferent electrode *g* will carry full current through the perineum and thereby heat the rear portion of the urethra. In the connections between the secondary coil *s* and the sectors *v* and *u* resistances *w*, *w'* are arranged. The resistance *w'* is of higher degree than the resistance *w*, the purpose being that the smallest current shall flow through the indifferent electrodes *e* and *f* and through the electrode *f* somewhat more current but less than through the electrode *g*.

As shown in Fig. 4 at the exterior surface of the tube-shaped electrode *a* to which the high frequency current of the diathermic apparatus is supplied over a plug switch, the soldered junctions 2 of four thermo-elements 3, 4 are arranged in even distance along a helical line. The one shank 3 of the thermo-elements which are united into a cable 8 leads to the contact points 9 of a switch 10, whose movable arm 11 at its fulcrum is connected to the one terminal of a measuring instrument 12 which is calibrated to directly indicate temperature. The other shank 4 of the thermo-elements are connected to a common line 13 which is connected with the other terminal of said measuring instrument 12. By throwing the arm 11 of the switch 10 upon the several contacts 9, the temperature at the corresponding points of the electrode and therewith of the cavity of the body to be treated may be ascertained.

Fig. 5 shows another form of the effective electrode *a*. Within the tube-like electrode *a* a second tube 1 is mounted to be adjustable therein in longitudinal direction, said tube 1 being preferably made of a material which is a poor conductor of heat and arranged to be rotatable therein. The end of the tube 1 which is directed toward the interior of the electrode *a* carries a slot to which the soldered junction 2 of a thermo-element consisting of the wires 3, 4 is connected. The tube is preferably flexible or pliable, so that it may also be introduced into the bent part of the electrode *a*. The two wires 3, 4 are carried through said tube 1 and connected to a temperature indicating device. Through the slot at the end of the tube 1 the soldered junction of the thermo-element is resiliently placed against the interior wall of the outer tube or electrode *a*.

As shown in Fig. 6 the tube 1 is graduated in order to indicate at which point in the interior of the effective electrode the device for measuring the temperature is positioned.

Fig. 7 shows an effective electrode in

which instead of the thermo-elements a small resistance coil 15 is employed. It can, for instance, be wound upon the slotted end of the interior tube 1, so that it can quickly assume the temperature of the exterior tube by contact throughout its length. Corresponding to the various temperatures the electrical resistance of this coil 15 will be different. The resistance coil 15 being connected in series with a battery 16 and an ammeter 17 the indications of the measuring instrument will give a measure for the temperature at the observed point of the effective electrode. In addition to the movable device for measuring the temperature, one or more measuring devices may also be fixedly provided within the bent part of the electrode *a*. In the construction as represented in Figs. 5 and 7, for instance at the point of the electrode *a* the thermo-element 5 is provided and connected by special wires 14 with voltmeter 12.

Having thus described our invention, we claim as new and desire to secure by Letters Patent of the United States:—

1. In an electro-medical apparatus for diathermic treatment the combination of a tube-shaped effective electrode adapted to be introduced into a cavity of the body, and a plurality of indifferent electrodes arranged in different positions on the outer surface of the body for leading the current in different ways and heating definite parts of said cavity.

2. In an electro-medical apparatus for diathermic treatment the combination of a tube-shaped effective electrode adapted to be introduced into a cavity of the body, a plurality of indifferent electrodes, and oscillating circuits including some of said indifferent electrodes and commonly said effective electrode.

3. In an electro-medical apparatus for treatment of the urethra virilis, the combination of a tube-shaped effective electrode adapted to be introduced into the urethra, a multi-part indifferent electrode adapted to surround the organ in longitudinal direction, a second electrode adapted to be laid to the perineum, which second electrode may be conductively connected to the former, and a third indifferent electrode in the form of an apron adapted to be laid to the thighs and the abdomen.

4. In an electro-medical apparatus for diathermic treatment the combination of a tube-shaped effective electrode adapted to be introduced into a cavity of the body, a plurality of indifferent electrodes positioned to lead the current through different parts of said body, and regulating means for controlling the heat imparted to said different parts.

5. In an electro-medical apparatus for diathermic treatment the combination of a tube-shaped effective electrode adapted to be introduced into a cavity of the body, a plurality of indifferent electrodes, oscillating circuits commonly including said tube-shaped electrode and some of said indifferent electrodes, and means for regulating the current strength in said oscillating circuits.

6. In an electro-medical apparatus for diathermic treatment the combination of a tube-shaped effective electrode adapted to be introduced into a cavity of the body, a plurality of indifferent electrodes for individually heating different parts of said cavity, and devices for measuring the temperature of said different points of said tube-shaped electrode.

7. In an electro-medical apparatus for diathermic treatment the combination of a tube-shaped electrode adapted to be introduced into a cavity of the body, a plurality of indifferent electrodes for individually heating different parts of said cavity, and thermo-electric means for measuring the temperature at different points of said effective electrode.

8. In an electro-medical apparatus for diathermic treatment the combination of a tube-shaped effective electrode adapted to be introduced into a cavity of the body, a plurality of indifferent electrodes for individually heating different parts of said cavity, and a temperature measuring device in the form of a tube mounted movably within said tube-shaped electrode for measuring the temperature at different points of said tube-shaped electrode.

9. In an electro-medical apparatus for diathermic treatment the combination of an effective electrode having the form of a curved tube adapted to be introduced into a cavity of the body, a plurality of indifferent electrodes for individually heating different parts surrounding said cavity, a temperature measuring device consisting of a flexible tube mounted movably within said electrode, said flexible tube having a slotted end and carrying a temperature measuring device therein which is in resilient contact with the interior of said effective electrode.

In witness whereof we have hereunto set our signatures in the presence of two subscribing witnesses.

CARLOS SANTOS.
RUDOLF BOERNER

Witnesses for Santos:

ERNST G. HUPT,
VASCO DE F. REGO.

Witnesses for Boerner:

WOLDEMAR HAUPT,
HENRY HASPER.