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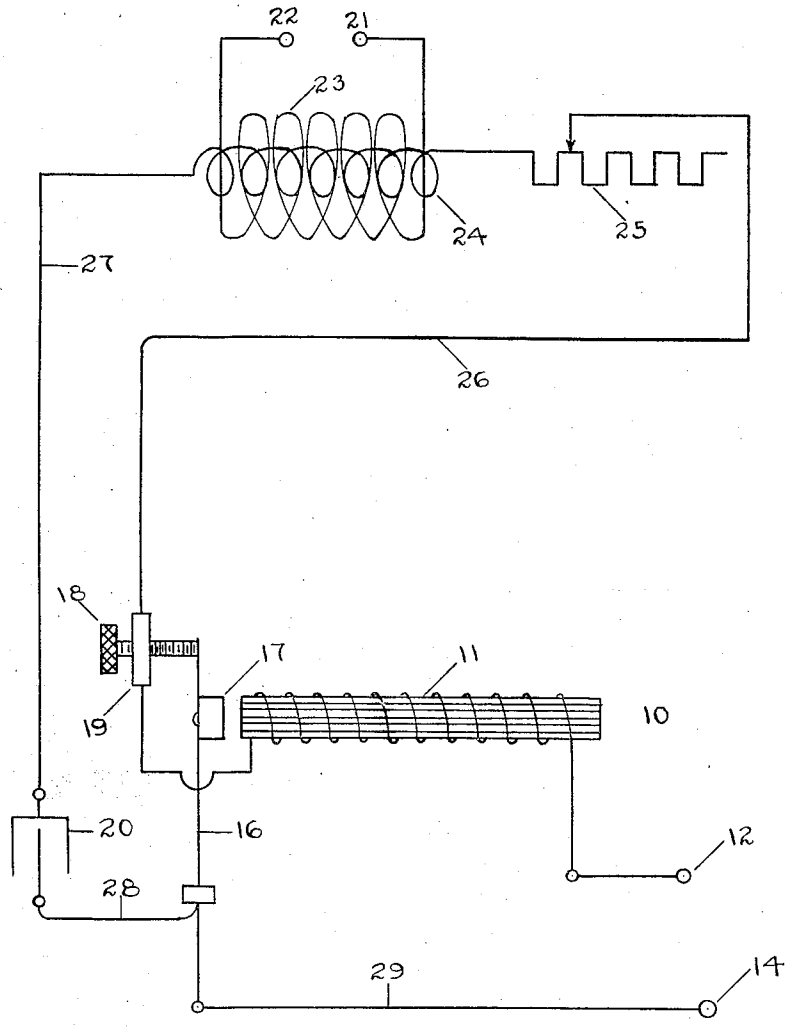
HIGH FREQUENCY DISCHARGE APPARATUS.

APPLICATION FILED JAN. 26, 1918.

1,323,472. Patented Dec. 2, 1919.



Inventor,

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UNITED STATES PATENT OFFICE.

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HIGH-FREQUENCY DISCHARGE APPARATUS.

1,323,472. Specification of Letters Patent. Patented Dec. 2, 1919.

Application filed January 26, 1918. Serial No. 213,982.

To all whom it may concern:

Be it known that I, WILLIAM J. HERDMAN, a citizen of the United States of America, and a resident of Toronto, county of York, and Province of Ontario, Canada, have invented a new and useful Improvement in High-Frequency Discharge Apparatus, of which the following is a specification.

My invention relates to apparatus for producing electric currents of high frequency and tension and pertains specifically to that class of such apparatus which finds its chief use in electrotherapeutics.

The principal object of my invention consists in producing a high frequency generator in which the intensity and pressure of the electrical discharge may be varied at will without varying the frequency or rate of oscillation of such discharge.

In my novel and improved device I employ means to render the operating current intermittent and thereafter transform the interrupted operating current into a high potential current oscillating at extremely high frequency. I further provide means for adjusting the pressure and intensity of this high frequency current without altering in any way its rate of oscillation. In this way the strength of the discharge at the electrodes may be adjusted to a value suitable to the sensitiveness of the patient or of the portion of the body to which it is to be applied and the frequency of the oscillation be maintained at a high value in order that the pathological effects of the current may be retained and the disagreeable physical effects of low frequency current, such as jarring of the muscles and sensory nerves, may be eliminated.

In the drawing which accompanies and forms a part of this specification I have illustrated diagrammatically the apparatus and electrical circuits of my complete device.

Referring now particularly to the drawing, I employ an electromagnet comprising a core of soft iron wires 10 and a winding 11 and provided with a rheotome comprising the vibrating member 16 (connected through conductor 29 with binding post 14), armature 17, fixed contact support 19 and adjustable contact screw 18. One terminal of the winding 11 is connected to the fixed contact support 19. The other terminal of the winding 11 is connected as shown to the binding post 12 and the action of the electromagnet 10—11 in rapidly vibrating the rheotome when the binding posts 12 and 14 are connected to any source of current supply is one well known in the art and needs no further explanation.

I provide a static transformer comprising the primary winding 24 and the secondary winding 23 and connect the primary 24 through conductor 27 with one terminal of a condenser 20, the other terminal of which is connected through conductor 28 with the movable member of the rheotome. The remaining terminal of the primary of the static transformer is connected to an adjustable non-inductive resistance 25, the movable member of which is connected through conductor 26 with the fixed element 19 of the rheotome. The condenser 20, primary of the static transformer and adjustable resistance 25 are therefore all connected in series and in a normally closed circuit including the two elements of the rheotome. The terminals of the secondary 23 of the static transformer are connected to suitable binding posts as 21 and 22 to which electrodes may be attached for utilizing the high frequency high tension current generated in the static transformer for medical purposes.

It will be observed that as the rheotome is vibrated by the electromagnet 10—11 the condenser 20 is alternately charged and discharged, for as the contact between the movable member 16 and the contact screw 18 is broken a rush of current at a very high pressure, due to the counter electromotive force of the electromagnet 10—11, surges through the non-inductive resistance 25, primary 24 of the static transformer and condenser 20, to charge the condenser to the potential of the counter electromotive force of the electromagnet 10—11, then as the contact between the contact screw 18 and movable member 16 is closed, the condenser 20 is discharged through the closed circuit containing the movable member 16, non-inductive resistance 25, primary 24 and condenser 20, and as this discharge path is of relatively low resistance and low reactance the condenser discharge is oscillatory and the discharge current alternates at an excessively high frequency, and thus a high frequency high tension current is obtained at the binding posts 21 and 22 from the secondary 23 of the static transformer. The discharge obtained is however of one predetermined strength or intensity and in the

therapeutic use of such devices it is imperative that the intensity of the discharge be varied through extremely wide limits to suit the patient or the various portions of the human body to which it is to be applied. It is to this end that my invention is directed, and my improvement resides in the adjustable non-inductive resistance 25, the total specific resistance of which is less than one ohm and is therefore insufficient to disturb the rate of discharge of the condenser, its particular location in the circuit, and co-functionality with the other associated apparatus, for as a small resistance is introduced into the circuit containing the condenser 20 and the primary 24 of the static transformer the peaks of the condenser discharge are flattened without appreciably diminishing the rate of oscillation of the condenser discharge and thus as resistance is introduced or abstracted by moving the movable member of the adjustable resistance 25 the intensity of the discharge is weakened or intensified to suit the subject being operated on without varying the frequency of the discharge current. Further, it will be noted that as the current passing through the electromagnet 10—11 is not changed in value by the operation of the adjustable resistance, the rheotome always operates at uniform speed and hence the condenser is charged and discharged at a substantially uniform rate at all times.

From the foregoing it will be readily observed that with my novel and improved device consisting of few and simple parts I am able to adjust through extremely wide limits the strength of the discharge current obtained from the binding posts 21 and 22 without in any way appreciably affecting the rate at which the condenser discharge takes place or the rate at which the rheotome is operated, and consequently I am able to proportion the strength of the discharge to the sensitiveness of that portion of the body being operated on without losing any of the beneficial effects of the discharge which are so largely dependent on maintaining the frequency at a high value.

Having thus fully and completely described my invention what I claim as new and desire to secure by United States Letters Patent is as follows:

1. In a device of the character described, an electromagnet, a rheotome operated thereby, and a normally closed circuit containing in series with each other, a static transformer, a condenser, an adjustable resistance and the elements of said rheotome.

2. In a device of the character described, an electromagnet, a rheotome having two elements operated thereby, and a static transformer, condenser, and an adjustable non-inductive resistance connected in series to each other and to the two elements of said rheotome.

3. In a device of the character described, a source of current, an electromagnet, a current interrupting device operated by said electromagnet, and a static transformer, adjustable resistance and condenser connected in series with each other and to the elements of said current interrupting device.

4. In a device of the character described, an electric switch comprising a movable member and a stationary member, an electromagnet for operating said switch, and a static transformer, adjustable non-inductive resistance and condenser connected in series with each other and to said movable member and said stationary member of said switch.

Signed by me at Toronto, county of York, and Province of Ontario, in the presence of two witnesses.

WILLIAM J. HERDMAN.

Witnesses:

S. B. CAMPBELL,

L. NEUSOME.