

July 28, 1925.

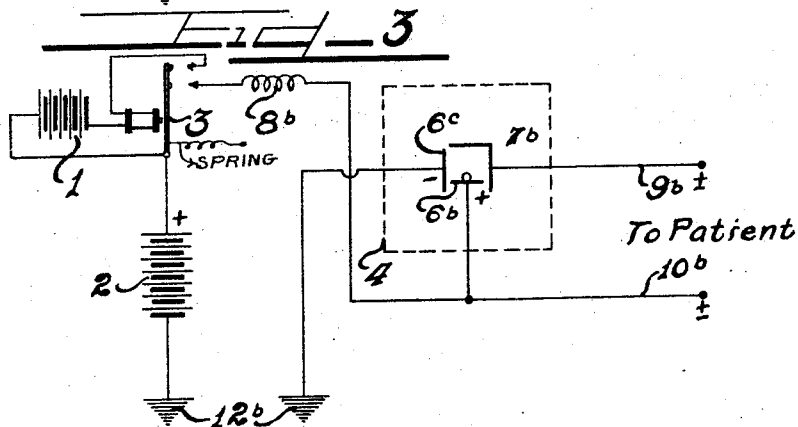
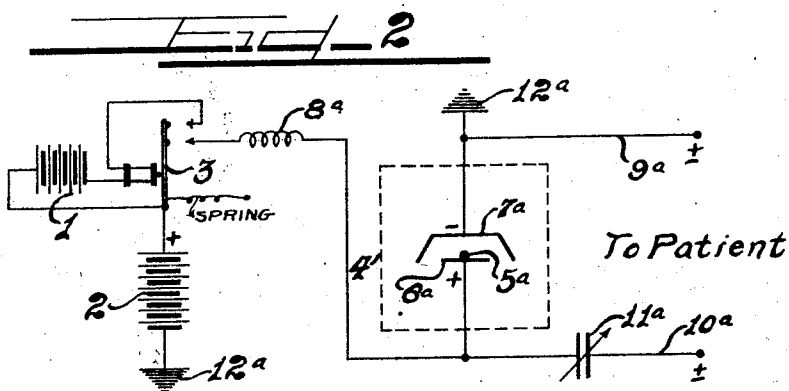
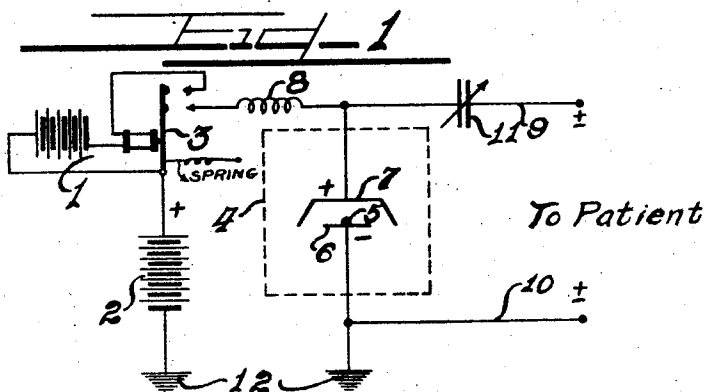
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C. M. PAGE

METHOD AND APPARATUS FOR GENERATING ELECTRONIC DISTURBANCES

Filed June 23, 1923

2 Sheets-Sheet 1



WITNESSES

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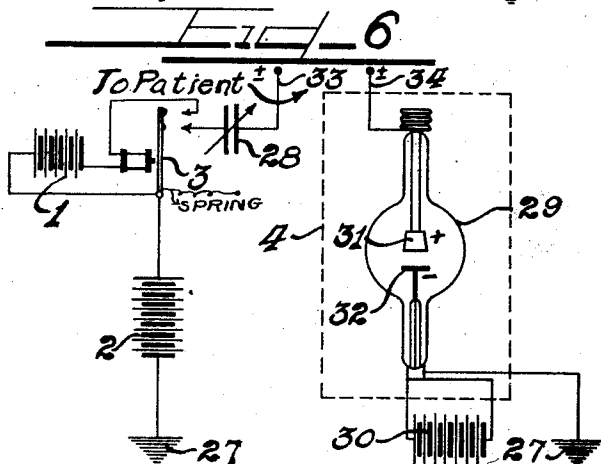
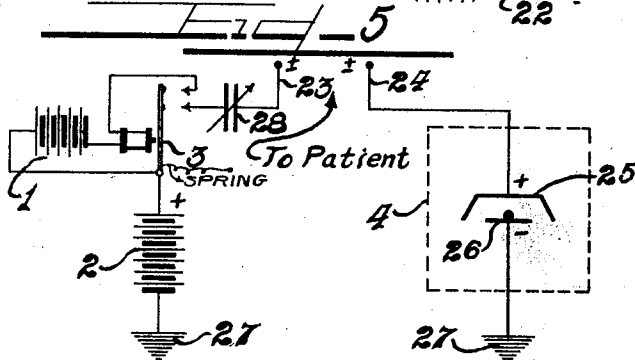
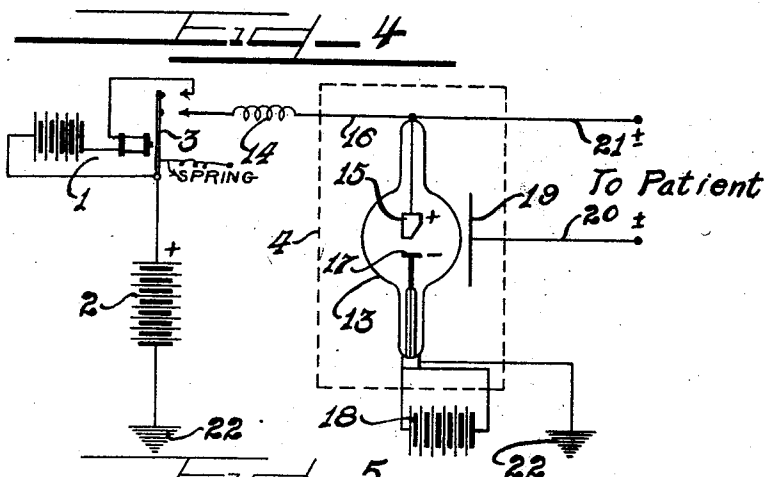
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METHOD AND APPARATUS FOR GENERATING ELECTRONIC DISTURBANCES

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2 Sheets-Sheet 2



Witnesses

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UNITED STATES PATENT OFFICE.

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METHOD AND APPARATUS FOR GENERATING ELECTRONIC DISTURBANCES.

Application filed June 23, 1923. Serial No. 647,226.

To all whom it may concern:

Be it known that I, CARL M. PAGE, a citizen of the United States, and a resident of the city of Geneva, in the county of Kane and State of Illinois, have invented certain new and useful Improvements in a Method and Apparatus for Generating Electronic Disturbances; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings, and to the numerals of reference marked thereon, which form a part of this specification.

This invention relates to a method and apparatus for generating electronic disturbances and particularly to a method whereby such disturbances may be generated and controlled for effective application and without danger to the operator.

It is now generally believed by those skilled in the art of X-rays and radio-active systems that the X-ray itself is ineffective and owes all its activity to the electrons or corpuscles which it produces when arrested. The same may be said of the active radiation from radium and all radio-active substances. In radiotherapy then it would appear that the only purpose served by the X-ray or the radio active rays is to plant the action deeper in the body. The lack of control of the depth of the penetration of the rays and the inability to regulate intelligently their amount or intensity is a great handicap in their therapeutic use. The danger of over-exposure of the patient to these rays is recognized by all workers and often the most elaborate precautions prove insufficient to obviate the same.

This invention presents a basic conception of a method and provides an apparatus whereby this desired corpuscular stimulus may be imparted to the living cells and tissues of the human body without exposing the body in any way to the rays themselves. In this manner danger to the patient under treatment and to the operator is removed. It is believed that the X-ray of a certain "hardness" or frequency or the rays from radio-active substances such as the gamma rays of radium which have a characteristic frequency or "hardness" when arrested by malignant cells have the effect of causing such cells to disappear. This marked activity is conceded to be due to the electronic disturbance produced at the time of

arrest of the ray by the cells or tissues of that area. The electronic disturbance produced by the arrest of the ray has a frequency of impulse or oscillation related to the frequency of the exciting electro-magnetic wave or ray. This disturbance may well be termed an oscillating electric current having a frequency related to the frequency of the exciting ray or wave as stated and it is to this that the extremely valuable properties of X-ray and rays from radio-active substances in the treatment of malignant disease, may be attributed. In many chemical and biological reactions a method of generating such electrical oscillation of varied frequency from a very slow frequency to an extremely high frequency, would be of great aid.

This invention provides a method and describes an apparatus by means of which such corpuscular disturbances may be generated and controlled and which may be used in radiotherapy for all purposes, where now rays or electro-magnetic waves themselves are used and without the danger of injury to the operator or patient from improper exposure to the rays as is the case in existing methods of treatment.

It is therefore broadly an object of this invention to provide a method and apparatus whereby an electrically-conductive circuit may be made electrically active and this electrical activity made controllable.

It is also an important object of this invention to provide a method and apparatus of the class described wherein an arrestment of generated electro-magnetic rays or waves is effected at a point separated from the point of application of the resulting disturbance.

I have illustrated in the accompanying drawings certain apparatus which is well adapted for the carrying out of the method of this invention but it will be apparent that many modifications and elaborations of this apparatus will be in accordance with the spirit and within the scope of this invention.

On the drawings—

Figure 1 illustrates a circuit and apparatus adapted for the generation from beta rays of radium.

Figure 2 illustrates a circuit and apparatus for generating desired electronic disturbances from gamma rays of radium.

Figure 3 illustrates a modified form of circuit and apparatus for generating desired electronic disturbances from gamma rays of radium.

5 Figure 4 illustrates a circuit and apparatus for generating desired electronic disturbances from X-rays and the cathode rays of a Coolidge tube.

10 Figures 5 and 6 illustrate circuits and apparatus for the purpose described, wherein the patient or object to be treated is included in the primary circuit.

As shown on the drawings—

15 In all of the apparatus illustrated I have broadly provided a source of electro-magnetic rays or waves such as a Coolidge tube or properly prepared radio-active substances such as radium, an inclosure for this source of electro-magnetic rays or waves, means
20 for arresting these waves to create an electronic disturbance and a circuit whereby this resulting electronic disturbance may be conducted to the patient or to the object to be treated.

25 I have ordinarily constructed the arresting means from a suitable metal of high atomic weight such as platinum and I purpose including the source of electro-magnetic rays or waves within a casing of material such as lead which will be impervious
30 thereto. More beneficial results are ordinarily obtained through intermittent surges at a desired low frequency, between surges and to this end I have included in the circuit shown, a low frequency vibrator connected
35 through a suitable circuit to the source or generator so that a desired electro-static tension or potential may be provided at said source. It is of course understood that this
40 vibrator may be dispensed with if desired and a direct connection utilized.

45 In all of the diagrams included in the drawings I have designated the closed vibrator circuit by the reference numeral 1; the constant potential source such as a storage battery or a static machine or high potential generator by the numeral 2; the vibrator, an armature or pendulum of which
50 is adapted to make and break a circuit through the battery by the reference numeral 3; and the lead container or housing for the electro-magnetic wave or ray generator, by the reference numeral 4.

55 It is of course understood that the potential applied from the storage battery 2 may be varied by means of changeable connectors, external resistance, or in any desired manner.

60 In Figure 1 the apparatus illustrated is particularly adapted for causing a generation of desired electronic disturbance from beta rays of radium or like substance. In this apparatus the radium or similar substances 5 is placed on a metallic plate 6
65 which is positioned opposite to a positively

charged target plate 7, said plate 7 in turn being connected through an inductance 8 to the vibrator. One purpose of the inductance 8 is to choke back the high frequency oscillations from the circuit just described, thus
70 causing it to flow through the circuit which includes the patient or object to be treated.

The electro-static state is indicated by the signs on the drawing and it will be apparent that beta rays discharged from the radium
75 or similar substances 5 will imping against the target plate 7 and colliding therewith and having their velocity suddenly altered, propagates X-rays in the general direction of plate 6. The arrestment thereon results
80 in the creation of electronic disturbances in the circuit formed through the conductors 9—10 leading to the patient or object to be treated, these electronic disturbances causing the desired therapeutic or other effect at
85 the point of application. Alterations in the natural period of the circuit may be conveniently achieved by means of variable condensers 11 and the battery circuit through the storage battery 2 is conveniently completed through ground connections 12.

In Figures 2 and 3 I have illustrated apparatus and circuits which are adapted for the utilization of the gamma rays of radium
95 or other radio-active substances, the radium 5^a being placed upon a positively charged plate 6^a. The target plate 7^a in this instance is negatively charged. In the case of the utilization of the gamma rays it is of course understood that the frequency thereof cannot be well controlled and for this reason the
100 utilization thereof, at their natural frequency is contemplated in the modified form of circuit illustrated in Figure 3. A target plate 7^b of somewhat different form than the target plate 7^a is provided in addition to the positively and negatively charged plates 6^a and 6^c said deflector plate 7^b being
105 connected in an external circuit 9^b—10^b; the variable condenser being omitted from this circuit.

In Figure 4 I have illustrated a circuit and apparatus wherein an X-ray tube such as a Coolidge tube 13, is utilized as a generator of the desired cathode and electro-magnetic disturbance. A connection from the vibrator 3, through an inductance 14 to a positively charged electrode 15 of the generator, is provided by a conductor 16.
115 Associated with the negatively charged electrode 17 of the generator is a heated filament which is supplied with energy from a storage battery or other suitable source, 18, as will be noted from Figure 4. The face of electrode 15 is positioned at an angle
120 so that rays emitted from the same will be repelled substantially at right angles against a target plate 19 constructed of suitable high atomic weight material; said target plate 19 being connected in a circuit
130

20—21 leading to a patient or object to be treated. The circuit through the battery 2 is completed through suitable ground connections 22.

5 In Figure 5 a circuit in which the patient or object to be treated is included in the primary circuit through conductors 23—24; the conductor 24 leading to a positively charged target plate 25 of the generator
10 which coacts with a negatively charged radium carrying plate 26 to produce a desired corpuscular disturbance in the manner above described.

15 In this circuit and in the circuit illustrated in Fig. 6 wherein the patient or object to be treated is also included in the primary circuit, return connection through the battery 2 is provided by grounds 27 and in both of these circuits a variable con-
20 denser 28 is provided in the circuit between the vibrator 3 and the patient or object to be treated.

25 In the circuit illustrated in Figure 6 a Coolidge tube 29 of the type above described is provided with a heated cathode deriving energy from a local battery circuit 30. It will be noted in this circuit that the face of the positively charged electrode or target
30 31 is parallel to the face of the negatively charged electrode 32. The circuit to the patient or the object to be treated in this case is completed through conductors 33 and 34. In connection with the circuits utilized in Figures 5 and 6 it will be noted that
35 the inductance or choke is eliminated and in these cases the primary circuit is reactive both to the static potential due to the battery and to the current or electronic effect due to the corpuscular reaction between the
40 cathode of the generator and the anode of the same. In the circuits illustrated in Figures 4 and 6, the patient is ordinarily placed on an insulated stool and the Coolidge tubes used are adapted for the production of "soft
45 rays" which nevertheless have the characteristics of and in fact are X-rays. With this arrangement the patient suffers no discomfort and is in no danger.

50 It is believed that the theory of operation of the foregoing apparatus and circuits will be understood from the foregoing description. If the velocity of an electron be suddenly altered an X-ray is generated. If the alteration of the speed of the electron is
55 very great the frequency of the generated X-ray will be high; if the alteration is slower the frequency will be lower. An X-ray is an electro-magnetic disturbance and if arrested by matter produces a corpuscular disturbance or electric current of a relative frequency. Under the conditions of circuit above illustrated and described making proper adjustment for given frequencies it becomes possible to transmit such
65 oscillations through an external circuit to

a patient or object to be treated. It is of course understood that the arresting of the electro-magnetic rays is effected at a point external to the desired point of application preferably within the impervious container
70 or within the Coolidge tube itself. In the Coolidge tube the cathode contains a heating element or other means for causing a corpuscular discharge and if desired a specially constructed container for any radio
75 active substance capable of discharging electrons may be substituted such as radium or metals under ultra-violet light.

It will be apparent from the foregoing description that this invention provides a
80 method and apparatus for permitting a proper application of effective electronic disturbances to a patient or object to be treated, the apparatus obviating the danger of injury to the patient or operator.

85 I am aware that numerous details in the methods of application and construction of circuits and apparatus used may be varied without departing from the spirit of my invention and I therefore do not purpose
90 limiting the patent granted otherwise than necessitated by the prior art.

I claim as my invention—

1. The method of producing a desired
95 electronic disturbance which consists in generating rays adapted to produce such a disturbance, arresting such rays at a point external to the desired point of applica-
100 tion thereof by the interposition of material of high atomic weight in the path of said rays, conducting the electronic disturbance created by such arrestment of the rays through a definite circuit to a desired point of application and controlling the
105 flow of such disturbance by the application of electrostatic pressure.

2. The method of producing a desired
110 electronic disturbance which consists in generating rays having the characteristics of X-rays or radium rays, arresting such rays to produce the desired electronic disturbance, applying a desired intermittent pressure to said disturbance and conducting the disturbance produced through a metallic
115 circuit to a desired point of application.

3. The method of producing a desired
120 electronic disturbance which consists in generating rays adapted to produce such a disturbance, definitely arresting such rays at a point external to a desired point of application by interposing an arresting plate
125 of high atomic weight material in the path thereof, conducting the electronic disturbance produced by such arrestment through a definite circuit to said desired point of application and applying a predetermined
130 impelling pressure to said disturbance to control its flow in the circuit.

4. An apparatus for the purpose described comprising a source of electromagnetic

waves or rays, an enclosure therefore substantially impervious to the waves or rays generated, means inside the enclosure for arresting said waves or rays, a circuit leading from the enclosure for conducting the resulting electronic disturbances to a point of application and means for varying the pressure applied to such disturbances.

5. An apparatus for the purpose described comprising a source of or generator for waves or rays adapted to produce a desired electronic disturbance, means for causing an intermittent increase of potential at said source, an enclosure at said source substantially impervious to rays or waves generated, means inside the enclosure for arresting said waves or rays and a circuit leading from the enclosure for conducting the resulting electronic disturbances to a point of application.

6. In an apparatus for the purpose described, a source of electromagnetic waves or rays, an enclosure therefore substantially impervious to the rays or waves generated at the source, means for varying the electrostatic potential at said source, means inside the enclosure for arresting said waves or rays and a circuit leading from the enclosure for conducting the resulting elec-

tronic disturbances to a point of application.

7. In an apparatus of the class described, a source of waves or rays, means for arresting the waves or rays generated at said source to produce a desired electrical disturbance, a definite circuit through which said disturbance is conducted to a desired point of application and means for applying a pressure to said circuit at the point of generation of the disturbance to control the flow of the disturbance therein.

8. In an apparatus for the purpose described, a source of potential, a vibrator connected thereto, a circuit including a generator of waves or rays adapted to produce a desired electronic disturbance adapted to be intermittently connected by the vibrator to said source of potential, means for arresting said rays external to a point of application thereof and a circuit for conducting the said electronic disturbances created by the arresting of said waves or rays.

In testimony whereof I have hereunto subscribed my name in the presence of two subscribing witnesses.

CARL M. PAGE.

Witnesses:

A. R. Dow,
Wm. C. Wood.